EMBL Australia Partner Laboratory Network

2022 Highlights

EMBL Australia

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Foreword by EMBL Director General

> Australia, as an associate member of the European Molecular Biology Laboratory (EMBL), is a key partner in the new scientific era that EMBL has launched, thanks to its new *Molecules to Ecosystems* five-year scientific programme.

Professor Edith Heard FRS
EMBL Director General

Building on our strengths in fundamental molecular biology research, the programme applies EMBL's expertise to study the molecular basis of life in the context of the natural world, with a view to rising up to human and planetary health challenges.

As part of this programme, EMBL has launched its 'Traversing European Coastlines' (TREC) project. As Australia is well aware, coastal ecosystems are the sites of the greatest biodiversity on Earth. The goal of this scientific expedition, which takes place between 2023-2024, is to study land-water interfaces and the responses of ecosystems to changing environments; sharing findings with all member states and the global scientific community, and ultimately helping address global environmental challenges. In August 2022, EMBL scientists visited Iceland for the final pilot expedition of this project and, since then, the TREC project was launched.

On 30 June 2022, EMBL also celebrated the opening of its new Imaging Centre. Through this global resource, members of the international scientific community, including Australia, can access cutting-edge technologies – in some cases, before they become commercially available – both on-site and remotely. The Imaging Centre's expert staff ensure users from across industry and academia are ably supported to make best use of the latest imaging technologies.

EMBL Australia continues to create tremendous opportunities to strengthen international research links and deepen complementary knowledge. In September 2022, we were delighted to host senior leadership from EMBL Australia, Professors Ian Smith and James Whisstock, at EMBL's headquarters, to discuss further opportunities to link EMBL's European research infrastructures with Australia's, particularly in the context of EMBL's new programme and the services and training that EMBL can provide.

The value of international scientific networks created through Australia's associate membership was also highlighted at EMBL's fourth Partnership Conference, taking place at EMBL Heidelberg in September 2022, where researchers from the EMBL Australia Partner Laboratory Network joined researchers from EMBL and its partner institutes to explore new collaborations and foster research connections.

EMBL's broad-reaching scientific agenda continues to enrich the world's understanding of molecular biology. EMBL Australia strengthens Australia's national association to EMBL, and in turn, to the broader scientific community, ensuring the most impactful use of scientific resources to address national and global priorities.

I look forward to seeing this impact realised further in 2023.

Report of EMBL Australia Scientific Head

> The past year marked a significant period of reconnection and scientific advancement within our research community.

Professor James Whisstock
EMBL Australia
Scientific Head

Scientific summits held in Canberra and Adelaide brought together members of our Partner Laboratory Network (PLN) from across Australia, providing invaluable opportunities for sharing scientific excellence, fostering new connections, and reaffirming existing ones. As did the revival of our suite of student programs, including our much-loved PhD Course, which was a resounding success, thanks to the generous contributions of some of the country's foremost scientists.

It was a year of scientific success for many in our PLN, with members involved in securing $66.7 million in competitive grants to support their groundbreaking and collaborative research. Additionally, group leaders Dr Michelle Boyle and Associate Professor Robert Weatheritt were respectively awarded the prestigious CSL Centenary Fellowship and Viertel Senior Medical Research Fellowship, recognising the potential impacts of their innovative research in the fields of malaria and cancer.

This injection of additional funding will help shape the future of healthcare, not just in Australia but worldwide, by supporting the varied and cutting-edge research happening across the PLN, including: the development of next-generation RNA vaccines, therapeutics, and diagnostics; the exploration of novel pathways to enhance chemotherapy success; the improvement of malaria vaccines, particularly for children in high-malaria regions; the creation of innovative therapies for muscular dystrophies; the establishment of a rapid and reliable diagnosis for Parkinson's disease; and the development of targeted drugs to combat diet-induced obesity.

Our group leaders continue to build Australia's scientific infrastructure capabilities, setting up spatial transcriptomics facilities at the Australian National University, enabling fundamental research in 3D environments that mimic lifelike conditions via the bioprinting of model organs and tissues at the University of New South Wales, and overseeing the introduction of the first ultra-high throughput sequencer in Australia, and other world-leading technologies, at the South Australian Genomics Centre.

In 2022, EMBL Australia group leaders produced close to 80 high-impact research publications, many in leading scientific journals. The remarkable array of scientific discoveries that emerged included the mechanical processes used by specialised immune cells to kill cancer cells more efficiently, novel approaches to treating bacterial infections and antibiotic resistance, a hypothesis on the emergence of life on Earth and the discovery of a jumping gene vital to the immune response to viral infection.

Demonstrating their commitment to the local and global scientific community, our group leaders actively shared their expertise at more than 60 events across 18 countries in North America, Europe, and Asia in 2022, including several EMBL courses and conferences. Additionally, they played pivotal roles in organising various conferences and symposia, further enriching scientific discourse and collaboration, and continued to train the next generation of scientific leaders.

I reflect on the remarkable achievements and scientific breakthroughs of the past year with optimism for the future of fundamental scientific research.

The accomplishments and advancements showcased in this Highlights Report serve as a testament to the exceptional talent and dedication within our scientific community. We eagerly anticipate the continued collaborations, discoveries, and breakthroughs that lie ahead, propelling us further towards a future where scientific excellence and innovation thrive.

Welcome from the Council Chair

It is with great pleasure that I welcome you to the 2022 EMBL Australia Partner Laboratory Network Highlights Report.

Emeritus Professor Ian Smith
Chair of the EMBL Australia Council

As the Council Chair, I am thrilled to share with you the progress and achievements made by the EMBL Australia Partner Laboratory Network (PLN) over the past year.

As part of our ongoing efforts to strengthen collaborations and partnerships with international research institutions, last year Professor James Whisstock, the Scientific Head of EMBL Australia, and I visited EMBL Heidelberg in Germany. During our visit, we had the opportunity to meet the EMBL Director General Edith Heard and other leading scientists, and learn more about the new 2022 - 2026 EMBL research program, 'Molecules to Ecosystems', as well as have a guided tour around EMBL's world-class imaging facilities. We also took advantage of this fantastic opportunity to explore potential collaborations and discuss ways to further strengthen the partnership between EMBL and EMBL Australia.

One of the major initiatives that the EMBL Australia Council focused on in 2022 was developing a Gender Equity, Diversity and Inclusion (GEDI) Action Plan.

We formed a working group comprising members of the Council and other stakeholders to develop a comprehensive plan that addresses the gender imbalance in the research sector. The plan includes a range of measures aimed at improving gender equity, including increasing support for women researchers, providing opportunities for career development and mentoring, and implementing family-friendly policies. We look forward to formally implementing the actions outlined in the gender equity action plan and the positive results it will yield, most importantly, improving the gender balance in leadership positions across our Partner Laboratory Network.

In addition to our efforts to promote gender equity, the EMBL Australia PLN has made significant progress in advancing scientific research. Our partner laboratories have continued to produce groundbreaking research in a range of areas, including genomics, proteomics, and structural biology, as well as secure competitive grants that will enable their teams to realise their ambitious research projects in coming years and continue to successfully collaborate with researchers from leading institutions worldwide.

Finally, I would like to take this opportunity to express my gratitude to my fellow council members, the EMBL Australia secretariat and, of course, all the members of the EMBL Australia PLN for their dedication and hard work. It is through their tireless efforts and commitment to scientific research that we have achieved such remarkable progress over the past year.

I look forward to continuing to work with you all in the coming years to further advance our understanding of the biological world and make a positive impact on society.

About EMBL Australia

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

Australia is an associate member of the European Molecular Biology Laboratory (EMBL) – Europe's flagship life sciences 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, with Europe and Asia.

Supported by the National Collaborative Research Infrastructure Strategy (NCRIS) program, an Australian Government initiative, EMBL Australia is at the cutting edge of life sciences research in Australia.

EMBL Australia has:

- a Partner Laboratory Network (PLN) consisting of 14 research groups led by outstanding early-career researchers at nodes in Victoria, South Australia, New South Wales, Queensland and the ACT
- a nationwide reach through student training programs, including a PhD course, postgraduate symposium, travel grants and PhD program
- access to international linkages through EMBL and the European Bioinformatics Institute (EMBL-EBI).

Australia became the first associate member of the 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.

The EMBL Australia PLN is hosted at the South Australian Health and Medical Research Institute (SAHMRI), University of New South Wales (UNSW), Australian National University (ANU), the Garvan Institute of Medical Research, QIMR Berghofer Medical Research Institute (QIMR Berghofer) and Monash University. The EMBL Australia Secretariat is hosted by the Monash Biomedicine Discovery Institute.

The EMBL Australia Council oversees and guides the activities of EMBL Australia. The Partner Laboratory Network also has a Steering Committee, which is composed of senior representatives of each institution that form part of the network and is chaired by EMBL Australia's Scientific Head, Professor James Whisstock.

Members of the EMBL Australia Council in 2022

- Emeritus Professor Ian Smith (Chair)
- Professor Edith Heard (EMBL)
- Professor Ewan Birney (EMBL-EBI)
- Ms Plamena Markova-Anderson (EMBL)
- Professor John Carroll (Universities Australia)
- Professor Sarah Russell (Universities Australia)
- Professor Andrew Sinclair (Association of Australian Medical Research Institutes)
- Professor Elizabeth Hartland (Association of Australian Medical Research Institutes)
- Dr David Hansen (CSIRO)
- Professor Susie Nilsson (CSIRO)
- Mr Andrew Gilbert (Bioplatforms Australia)
- Representative from the Australian Government's Department of Education, Skills & Employment

Research Groups

In 2022, EMBL Australia consisted of 14 research groups at six institutes across Australia.

With the freedom to drive their own ambitious research projects, EMBL Australia group leaders are exceptional and innovative researchers who apply novel approaches and techniques to complex scientific problems.

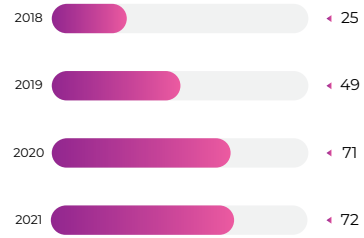
They ask challenging research questions and publish in high-impact journals.

$50.4M

External funding grants*

65

Students
(PhD, Master & Hons)



14

Group leaders

6

Research institutions

68

Researchers

* Includes the entire amount of individual and collaborating grants for projects active in 2022

Partner Laboratory Network

Brisbane

QIMR Berghofer Medical Research Institute

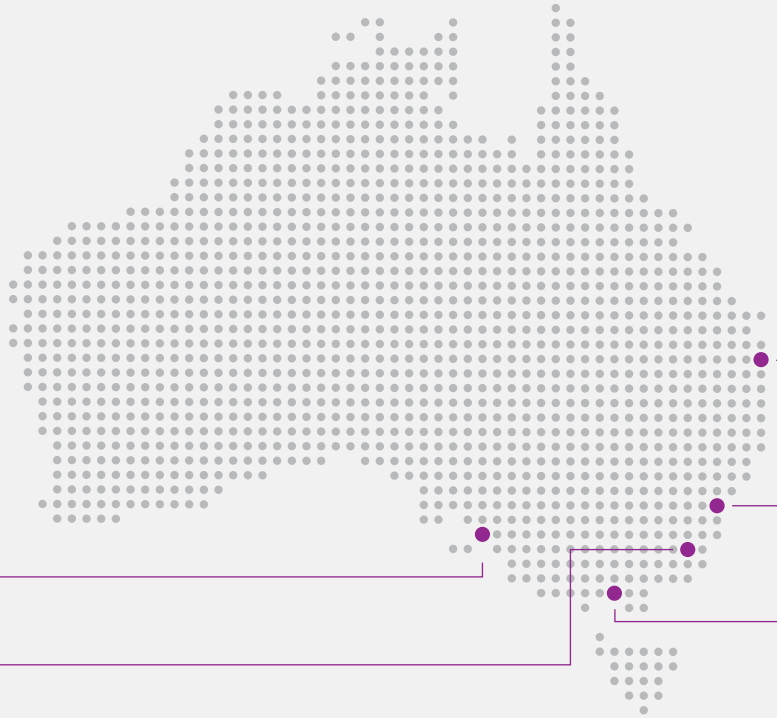
Michelle Boyle
Malaria immunology

Adelaide

SAHMRI · Flinders University · The University of Adelaide

David Lynn
Systems immunology

Ville-Petteri Mäkinen
Systems epidemiology



Sydney

UNSW The University of New South Wales

Yann Gambin
Single molecule science

Maté Biro
Immune response

Richard Morris
Theoretical biophysics

Vaishnavi Ananthanarayanan
Cytoskeleton and molecular motors

Garvan Institute of Medical Research

Robert Weatheritt
RNA biology

Canberra

Australian National University

Barry Thompson
Epithelial biology

Eduardo Eyras
Computational RNA biology

Melbourne

MONASH University

Prof James Whisstock
Scientific Head

Max Cryle
Antibiotics and bacterial infections

Mikaël Martino
Bone regeneration

Chen Davidovich
Chromatin biology

Senthil Arumugam
Cellular physiology

Partner Laboratory Network (cont.)

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 PLN mentors and nurtures outstanding young scientists selected from an international pool by offering up to nine years of secure funding.

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 PLN is hosted at Monash University and, in 2022, consisted of four research groups:

- The Arumugam Group, based at the Monash Biomedicine Discovery Institute (Monash BDI), researches how complex properties arise out of molecules and their interactions, with a primary focus on endosomal trafficking.
- The Cryle Group (also based at Monash BDI) uses 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, as well as developing novel approaches to treat bacterial infections.
- The Davidovich Group, based at Monash BDI, studies the key proteins involved in the maintenance of stem cell fate, which play an important role in multiple cancers.
- The Martino Group, based at the Australian Regenerative Medicine Institute (ARMI), focuses on the immune regulation of stem cells and regeneration, seeking to design regenerative medicine strategies integrating a control of the immune system.

The Australian EMBL Partnership Laboratory Head for Monash BDI is Professor John Carroll and for ARMI is Professor Peter Currie.

Partner Laboratory Network (cont.)

South Australian node

The South Australian node of the PLN is hosted at SAHMRI and comprises three groups, supported by the University of Adelaide, the University of South Australia and Flinders University.

- The Lynn Group is based at the SAHMRI Infection and Immunity theme and investigates how microbes (pathogenic and commensal) modulate the immune system in a range of contexts, from infection (including COVID-19) to immunisation and immunotherapy.
- The Mäkinen Group is based at the Heart Health research theme at SAHMRI, where members use big data to better understand pathologic phenomena at the intersection of ageing, obesity, diabetes and cardiovascular disease.

The Australian EMBL Partnership Laboratory Head for SAHMRI is Professor Steve Wesselingh.

New South Wales node

The New South Wales node of the PLN is hosted at the UNSW Centre in Single Molecule Science and the Garvan Institute of Medical Research (Garvan Institute), Sydney.

- The Ananthanarayanan Group is based at UNSW and investigates how stochastic and rare events, such as motor protein binding to cytoskeletal tracks or cargo, give rise to complex cellular organisation across scales.
- The Biro Group, also based at UNSW, investigates the cell biology and mechanics of the actin cytoskeleton and how immune cells locate and kill cancer cells.
- The Gambin Group, based at UNSW, combines single-molecule detection and microfluidics to develop a microscopy-based pipeline to readily study protein-protein interactions at high resolution.
- The Morris Group, based at UNSW, applies and develops concepts from statistical and theoretical soft-condensed matter physics, as well as applied mathematics, in order to describe biological systems.
- The Weatheritt Group is based at the Garvan Institute and aims to understand how post-transcriptional regulation contributes to proteomic diversity and cell signalling.

The Australian EMBL Partnership Laboratory Head for UNSW is Associate Professor Till Böcking.

In 2022, Professor Robert Brink replaced Professor Chris Goodnow as the Australian EMBL Partnership Laboratory Head for the Garvan Institute.

Partner Laboratory Network (cont.)

Australian Capital Territory node

The ACT node of the PLN is hosted at the ANU, Canberra. The Australian EMBL Partnership Laboratory Head for ANU is Professor Ross Hannan.

— The Eyras Group, is based at the John Curtin School of Medical Research (JCSMR) at ANU and is working on understanding the biology of RNA and cancer using computational methods.

— The Thompson Group, also based at JCSMR, aims to understand the control of tissue growth and form using Drosophila and mice as models.

Queensland node

The Queensland node of the PLN is hosted at QIMR Berghofer. The Australian EMBL Partnership Laboratory Head for QIMR Berghofer is Professor Fabienne Mackay.

— The Boyle Group is based at QIMR Berghofer and aims to inform the development of effective malaria vaccines by defining functional mechanisms of antibodies that target the parasite, and the development of protective antibodies in humans.

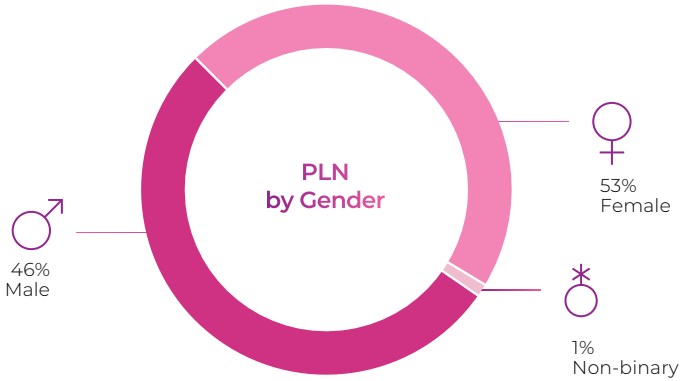
Recruiting the best and brightest from around the world

Our generous and unique funding model, combined with the internationally renowned EMBL brand, enables our group leaders to attract the best and brightest students and postdoctoral fellows from around the world, ensuring our Partner Laboratory Network is bursting with high-calibre staff with diverse talents.

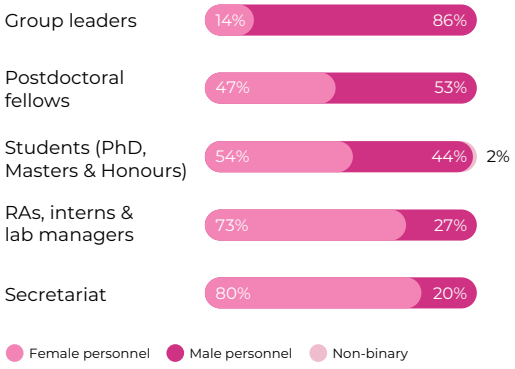
Data collected from 156 PLN members shows that our people come from 38 countries, spanning six continents (with the majority of members originating from Australia, Asia and Europe).

Gender distribution at EMBL Australia

EMBL Australia aims to be transparent about its gender distribution. More than half of the 148 members who provided gender identity information identified as female. While gender distribution is relatively balanced across the Partner Laboratory Network as a whole, the EMBL Australia GEDI Action Plan aims to balance the inequalities seen in some staff categories.



PLN gender distribution by job position

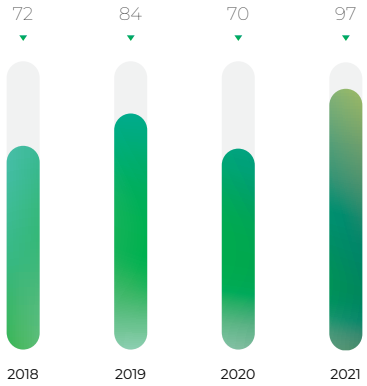


Research Excellence Snapshot

79

Publications by group leaders in 2022, including journal articles, pre-prints, reports, reviews, letters and book chapters.

View all 2022 publications



Rapid and reliable diagnosis for Parkinson's disease within reach

Much-needed rapid and reliable diagnosis for Parkinson's disease is within reach thanks to a powerful 3D-printed microscope developed by EMBL Australia group leader Dr Yann Gambin, Dr Emma Sierecki and their team at UNSW Medicine and Health's Single Molecule Science.

To enhance sensitivity and reliability of detection, the researchers coupled single-molecule spectroscopy with a single-step assay they developed to detect biomarkers for Parkinson's disease (alpha-synuclein) in spinal fluid.

Parkinson's disease is currently very difficult to diagnose and usually occurs when the disease is advanced (ie. patient experiencing tremors and impaired mobility); the only definitive way to diagnose the disease at present is at autopsy.

This new diagnostic assay takes mere hours and - with the support of a $1.37m grant from the Michael J. Fox and Shake It Up Australia Foundations - is currently being adapted to detect the biomarker in a simple blood test, avoiding the need for invasive spinal tap procedures.

Early and accurate diagnosis allows more time for therapeutic intervention and even prevention of signs and symptoms.

Being able to monitor disease progression with this assay has the potential to facilitate discovery and testing of new drugs to treat, or even cure, Parkinson's disease.

Turning Kat Gaus' vision into reality: Infrastructure for bioprinting 3D model systems

A $1 million Australian Research Council (ARC) Linkage Infrastructure, Equipment and Facilities grant is enabling fundamental research in 3D environments that closely mimic lifelike conditions via the bioprinting of 3D models of organs and tissues.

Group Leader Dr Vaishnavi Ananthanarayanan is part of a team of experienced imaging experts who are bringing to life the vision of late world-leading immunologist Katharina Gaus, who was also a key driver of the EMBL Australia initiative and head of the EMBL Australia Node in Single Molecule Science at UNSW.

The team is developing infrastructure, using Australian-made bioprinting machinery, to create miniature replicas of organs and tissues, and a new microscope to study the cells within these 3D structures, minimising the use of animals in research and enabling the study of cell and tissue function under more lifelike conditions.

UNSW Associate Professor Kate Poole, who is leading the project, said the "grant will help extend Professor Gaus' vision to obtain unprecedented insight into how cells function through cutting-edge imaging" and further enhance the state-of-the-art infrastructure within the Katharina Gaus Light Microscopy Unit (formerly the Biomedical Imaging Facility and renamed in honour of Scientia Professor Gaus).

Scientia Professor Katharina Gaus (1972 - 2021). Image: UNSW.

Research Excellence Snapshot (cont.)

Biotech startup to develop new treatments for muscular dystrophies

Associate Professor Mikaël Martino and Professor Peter Currie have created a new biotech company, Myostellar, to develop much-needed new therapies for the treatment of debilitating muscular dystrophies.

The startup received more than half a million dollars from Australia's national biotechnology incubator, CUREator, and approximately $200,000 from Monash University to assist the company in growing and attracting further investment.

The funds will allow them to develop a game-changing, first-in-class therapy for stimulating skeletal muscle regeneration with minimal fibrosis.

The company stems from an exciting discovery made by Prof Currie, A/Prof Martino and colleagues, and published in *Nature* in 2021.

Prof Currie is an Australian EMBL Partnership laboratory head and A/Prof Martino is an EMBL Australia group leader, both based at the Australian Regenerative Medicine Institute at Monash University.

Growing genomics through world-leading infrastructure

Group leader Professor David Lynn was re-appointed as the Scientific Director of the South Australian Genomics Centre (SAGC) and oversaw the introduction of more than $3 million worth of new infrastructure, greatly expanding the centre's capabilities.

This included the acquisition of the first ultra-high-throughput sequencer in Australia (the T7 MGI sequencer) and the only complete set of single-cell RNA sequencing and spatial transcriptomics infrastructure from 10x Genomics across the globe, including the CytAssist and Xenium systems.

This expansion greatly increases the facility's capacity to cope with the ever-growing demands for sequencing depth and affordability.

SAGC was established in July 2020 as an NCRIS-funded, state-wide genomics facility to support research in South Australia, as well as nationally and internationally.

More information can be found in the SAGC Annual Report 2021/22.

Boosting the immune response to malaria

Group leader Dr Michelle Boyle was awarded a $1.25 million CSL Centenary Fellowship to continue her ground-breaking work to improve vaccines for malaria, particularly for children in high-malaria regions.

Dr Boyle and her team at QIMR Berghofer discovered how the immune response to malaria can be disrupted by the malaria parasite, reducing the effectiveness of vaccination.

Investigating single cells in the tonsils and spleens from malaria-infected people using multiple omnics approaches and then working with tonsil and spleen organoids to elicit a strong immune response, they will work to bypass the parasite's suppression of certain T cells critical to the body's defences and boost the immune response to malaria.

The research may also improve vaccines for other chronic diseases.

In papers published in *Nature Communications* and *eBioMedicine* in 2022, Dr Boyle and colleagues presented major findings on the impact of age on T-follicular helper cell function during malaria. These cells are essential for the development of protective antibodies during infection or vaccination.

The results of these studies have major implications for the design of vaccines which drive robust protection in at-risk children.

Watch this video for more information about the Boyle Group's research.

Research Excellence Snapshot (cont.)

New pathways to boost chemotherapy success

Associate Professor Robert Weatheritt will receive funding of $1.375 million over five years to support his vital work in cancer research after being selected as a Viertel Senior Medical Research Fellow in 2022.

The EMBL Australia group leader and head of the Garvan Institute's Neurotranscriptomics Lab, is researching new pathways to boost chemotherapy success.

A/Prof Weatheritt identified a new biological pathway implicated in chemotherapy resistance, a P-body formation.

'P-bodies' – or processing bodies – are granules of mRNAs and proteins found in the cell that help prevent tumour cells from converting to cancer stem cells, which then develop into pro-metastatic and chemotherapy-resistant cancer stem cells.

By working out what drug types and combinations can support P-bodies to do their work, A/Prof Weatheritt aims to boost the effectiveness of other cancer treatments.

Group leaders compute life in new maths Centre of Excellence

Group leaders Professor Eduardo Eyras and Dr Richard Morris are chief investigators in the new Australian Research Council (ARC) Centre of Excellence for the Mathematical Analysis of Cellular Systems.

The $35 million centre aims to deliver the mathematics required to compute life by bringing together experts from mathematics, physics, computational biology and experimental biology to model life in unicellular and multicellular systems.

Administered by the University of Melbourne under the leadership of Professor Michael Stumpf, it will deliver advanced mathematics to study biological processes through whole-cell modelling and develop methods for engineering biotechnological applications.

Prof Eyras, based at ANU, said the centre will work towards its research goals (separated into four themes: mathematical modelling; machine learning and multiscale modelling; data-driven approaches; and applications to life-science research) and provide plenty of training activities.

Prof Eyras will be in charge of the research training portfolio and high-performance computing lead and Dr Richard Morris (based at UNSW) will take on the role of summer school coordinator.

"We will plan training activities in interdisciplinary and transferable skills, and in the topics developed by the network, among other things," Prof Eyras said.

Emergence of life: from RNA to proteins

A unique project hypothesising on the origin of life on Earth that Associate Professor Chen Davidovich initiated as a PhD student 15 years earlier was completed and published, with his co-authorship, in *Nucleic Acids Research* journal.

The researchers - Nobel-Prize winning structural biologist Ada Yonath and her team at the Weizmann Institute of Science in Israel - proposed that the 'protoribosome' was the mechanism that enabled the transition between the RNA-dominated world and the contemporary nucleic acids/proteins world during the emergence of life.

Unsurprisingly, the research has garnered much attention - including being featured in a news article in respected journal *Nature* - due to the broad appeal of origin-of-life theories.

Also in 2022, A/Prof Davidovich and his former PhD student, Brady Owen, published an interesting critical review on the DNA-binding activity of polycomb repressive complexes, also in the journal *Nucleic Acids Research*.

Research Excellence Snapshot (cont.)

T cells use force to destroy cancer cells

New research reveals the mechanical processes used by specialised immune cells - called cytotoxic (or killer) T cells - to kill cancer cells more efficiently.

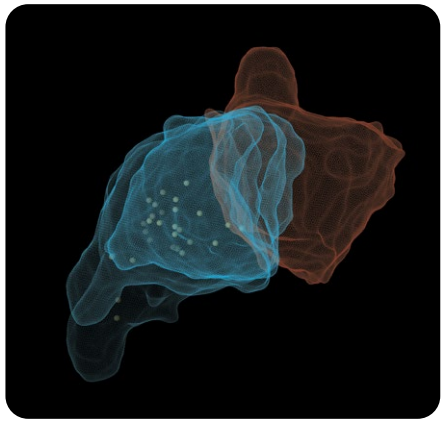
Led by Associate Professor Maté Biro, the research group based at the EMBL Australia Node in Single Molecule Science at UNSW found that mechanical forces generated by T cells influence how effectively perforin can punch through tumour cell membranes.

In a *Developmental Cell* paper, they described the cell interactions and the integration of forces at both the front and rear of the cell.

"It was very exciting to discover that, in addition to its mechanical tension and biochemical configuration, the shape of the target cell membrane plays an important role in T cell mediated cancer cell killing," said Dr Daryan Kempe, who co-led the research.

This study adds to the understanding of fundamental mechanisms involved in how T cells destroy disease-causing or compromised cells in our bodies.

The research garnered coverage in a number of publications, including *Cosmos Magazine*, *The Science Times*, *News Medical Life Sciences* and *Bioengineering*.



T cells (blue) use physical forces to stretch and bend the membranes of cancer cells (orange). Image: James Cremasco, Daryan Kempe and Maté Biro

Bringing MERSCOPE technology to Australia

Group leader Professor Barry Thompson and his colleagues are setting up spatial transcriptomics capabilities at ANU with the recent purchase of a MERSCOPE.

MERSCOPE uses MERFISH technology to directly map and quantify the spatial distribution of hundreds to tens of thousands of RNA species in individual cells, without the need for downstream sequencing.

MERFISH technology is applied to single-cell genomics and has broad applications in both fundamental biology and medicine, ranging from basic science to drug discovery, to clinical pathology.

Given its ability to quantify RNAs across a wide range of abundances while preserving native context, MERFISH enables many applications of in situ transcriptomic analyses of individual cells in culture or complex.

MERSCOPE is incredibly versatile across applications and sample types, revolutionising life sciences research, including neuroscience, cancer research, infectious diseases, developmental biology, drug development and cell and gene technology.

Prof Thompson will work collaboratively in this space with other EMBL Australia group leaders, including Professor David Lynn, who has been reappointed as the Scientific Director of the South Australian Genomics Centre.

Research Excellence Snapshot (cont.)

Novel approaches to treating bacterial infections and antibiotic resistance

Group leader Associate Professor Max Cryle and his team continue their battle against superbugs (or antibiotic-resistant bacteria), making headway in understanding how antibiotics are made in nature, how we can re-engineer these natural systems to produce new antibiotics and developing novel approaches to treat bacterial infections.

The Cryle Group has progressed its exciting research, which was published in *Nature Communications* and found that using an immunotherapeutic approach could make current antibiotics more effective.

The publication detailed the development of a new class of immune-active antibiotics, which stem from the recognition that the cell wall-binding propensity of vancomycin - an antibiotic commonly used to treat resistant strains of bacteria - be decoupled from antibiotic activity in resistant pathogen strains.

Using synthetic and peptide chemistry, the researchers designed a series of vancomycin peptide conjugates that target neutrophil recruitment through conjugation with formyl peptide chemoattractants.

These immune antibiotics display a novel mode of action and the Cryle Group is now developing modified versions as a prophylactic therapy for high-risk hospital environments.

In a study published in *Angewandte Chemie, International Edition*, the Cryle Group reported that the Cytochrome P450 enzymatic peptide cyclisation system is a unique example of a ribosomally encoded peptide that is cyclised with a minimum of extraneous residues, making it an appealing system to develop for biocatalytic purposes, and further for engineering to produce a range of alternate crosslinked tripeptide building blocks that are gaining interest with industry.

Discovering a jumping gene vital to immune response

Group leader Associate Professor Robert Weatheritt and his team worked with Associate Professor Cecile King's research group at UNSW to reveal a mystery gene that has a profound effect on the immune response to virus infection.

Published in prestigious journal *Nature*, the researchers discovered that a transposable - or 'jumping' - gene in the genome is vital for quickly suppressing an immune response to infection after a virus clears the body.

The findings in mice provide new information about how the immune system is regulated and have potential ramifications for the treatment of viral infections that can lead to an overactive immune response.

"It shows very clearly that a transposable element can control the immune system to favour host survival following virus infection and it's probably been selected to remain in the genome for this very reason," Dr King said.

She said the finding illustrates how the immune system is under tight regulation; a person needs a strong immune response to infection, but this needs to be suppressed quickly after the pathogen clears the body to avoid the risk of continued tissue damage.

The team next plans to conduct genome-wide analysis to identify and determine the role of other transposable elements to pinpoint if there are others that are acting in similar ways.

Research Excellence Snapshot (cont.)

An innovative centre for RNA-based healthcare

Group leader Professor Eduardo Eyras contributed to the creation of the Shine-Dalgarno Centre for RNA Innovation, which aspires to build partnerships and capabilities to collaborate and innovate in ribonucleic acid (RNA) therapeutics and diagnostics.

Bringing his expertise in developing computational tools to study RNA biology, he is one of the centre's many world-leading experts aiming to deliver innovative research for RNA-based healthcare.

In 2022, Prof Eyras also obtained more than $3 million in competitive funding to enable his research group to accelerate mRNA therapeutics, published 10 articles and established connections with industry partners for research collaborations.

With a $1.55 million National Health and Medical Research Council (NHMRC) Ideas Grant, the Eyras Group will attempt to overcome the challenges that hinder the widespread implementation of therapeutic mRNA by deciphering biochemical modifications of the RNA in a cell to enable efficient and precise therapeutic mRNA.

He also filed a provisional patent related to his work on epitranscriptomics, a highly specialised field that deals with investigating post-transcriptional RNA chemical modifications present across the life forms that change structural, functional and biological characters of RNA.

Metabolic ageing and machine learning tools

Group leader Associate Professor Ville-Petteri Mäkinen had the first of a trilogy of studies about metabolic ageing in human populations accepted in the prestigious *International Journal of Epidemiology*.

This important work laid the methodological basis for the researchers' future work on ageing and presented novel metabolomics data.

The second paper, subsequently accepted by the *Journal of Clinical Endocrinology and Metabolism*, debunks the popular notion that cross-sectional models of ageing can be applied as predictors of ageing rates in humans.

A/Prof Mäkinen and his group also published two important machine learning studies.

The first used a method developed by the group (Numero R library) to dissect the metabolic diversity in the UK Biobank.

Importantly, they linked the metabolic profiles of individuals with both prevalent and incident cardiometabolic end-points and all-cause mortality.

In the second study, they developed a new tool for the automated classification of acute lymphoblastic leukaemia patients based on their RNA-seq profiles (Allspice R library).

The tool is already widely used across the globe.

Strengthening International Linkages

Australian and EMBL researchers continued to collaborate closely in 2022, with 45 co-authored papers spanning agriculture, antimicrobial resistance and climate topics – among many others – and including research conducted using EMBL's specialist facilities. There were also four active research and infrastructure grant collaborations between Australian and EMBL researchers.

EMBL's commitment to open access is increasing the impact of these international collaborations. In 2022, EMBL signed a memorandum of understanding with UNESCO, laying the foundation for further initiatives focused on shared global priorities, such as open science.

Data resources managed by EMBL-EBI are critical to research and development. In 2022, Australia ranked third among EMBL member states accessing EMBL-EBI websites, with almost one million unique users.

Australian scientists also engaged in online and in-person training opportunities, including milestone participation in the first on-site course fully developed and delivered through the EMBL Imaging Centre in its first year of operation.

More than 120 Australian researchers attended EMBL courses and conferences, including at EMBL sites in Heidelberg, Barcelona, Hamburg and EMBL-EBI in the UK.

EMBL Australia group leaders also contributed to the success of these events. For example:

- Associate Professor Chen Davidovichwas a speaker at the EMBL Transcription and Chromatin Meeting in Heidelberg in August 2022;
- Professor David Lynn represented EMBL Australia at an EMBL conference titled 'The next generation in infection biology' in January;
- Dr Michelle Boyle was co-chair of the organising committee for an EMBL conference, 'BioMalPar XIX: biology and pathology of the malaria parasite'; and
- many EMBL Australia delegates presented at the EMBL Partnership Conference in Heidelberg, with alumna Associate Professor Edwina McGlinn helping to organise and chair the event.

With international travel back on the agenda, EMBL Australia researchers continued to share their science globally. In 2022, EMBL Australia group leaders shared their cutting-edge research and expertise at more than 60 conferences and symposia, hosted in 36 cities across 18 countries in North America, Europe and Asia.

Image via Twitter @EMBLHeidelberg

International collaboration begins at the top

Delegates from EMBL Australia's leadership team and secretariat visited EMBL's headquarters in Heidelberg throughout 2022 to strengthen connections, share knowledge and gain new insight from our European colleagues.

EMBL Australia Scientific Head Professor James Whisstock and Council Chair Ian Smith met with EMBL Director General Professor Edith Heard and other EMBL representatives in September to discuss the collaborative opportunities under the new EMBL Programme and the different transversal themes.

Professors Whisstock and Smith also toured the new EMBL Imaging Centre to view the latest imaging technologies that will enable ground-breaking research within the global scientific community.

Ian Smith and James Whisstock meet with EMBL Director General Edith Heard and members of EMBL's international relations team, Agata Pernus Voigt and Plamena Markova.

Image via Twitter @EMBLHeidelberg

EMBL Australia Interim Chief Operating Officer Penny Rowlett attended EMBL Heidelberg in June 2022 to meet with EMBL's Head of International Relations, Plamena Markova, and other members of the international relations team.

Ms Rowlett also attended the summer meeting of the EMBL Council.

Penny Rowlett met with members of EMBL's international relations team. L-R: Agata Pernus Voigt, Plamena Markova, Penny Rowlett and Hana Jurina.

EMBL Australia Student Programs Coordinator Ricki Mailloux attended EMBL Heidelberg in December to meet with EMBL colleagues, including members of the Courses and Conferences team and the International PhD Program Manager, and to observe the EMBL PhD Symposium.

Mx Mailloux said the visit gave them an in-depth understanding of how EMBL operates its various programs, and fresh perspective and new ideas about how EMBL Australia could enhance its offerings to PhD students and other early career researchers.

"I also met with the EMBL PhD Symposium organising committee and witnessed firsthand how this program operates, including their engagement with students throughout their PhD journey," Mx Mailloux said.

"These insights are something I hope to incorporate into the student programs in Australia."

Mx Mailloux said meeting with recipients of EMBL Australia travel grants in Heidelberg also made them appreciate how significant these unique opportunities are for Australian students.

Building new collaborations at the EMBL Partnership Conference

An EMBL Australia delegation joined more than 300 other researchers from around the world at EMBL Heidelberg for the 4th EMBL Partnership Conference in September.

The conference brings together EMBL and its partner institutes to enable the exchanging of expertise and building of new collaborations and research networks.

Representing EMBL Australia, group leaders Professor Eduardo Eyras and Professor Barry Thompson, as well as Dr Avnika Ruparelia, Dr Jan Manent and Dr Derrick Lau, presented on a range of topics, including genomics and disease, stem cells and development and neurobiology.

EMBL Australia alumna Associate Professor Edwina McGlinn helped organise the event and chaired the 'Cell to organ development' session.

Dr Lau, a postdoctoral researcher from the Gambin Group at UNSW's EMBL Australia node in Single Molecule Science, said the conference was a fantastic opportunity to present his work on using single-molecule strategies to diagnose Parkinson's disease.

"There's a lot of different talks from very different fields," Dr Lau said.

"I think it opens up a lot of opportunities to explore something beyond my discipline."

The 4th EMBL Partnership Conference, open to staff at EMBL and EMBL Partner institutes, was held on 21 – 23 September 2022.

(L-R): Dr Avnika Ruparelia, Professor Barry Thompson, Associate Professor Edwina McGlinn (EMBL Australia alumni), Dr Derrick Lau, Dr Jan Manent and Professor Eduardo Eyras were amongst the EMBL Australia cohort to attend the EMBL Partnership Conference.

Inspiring women in biomedicine

EMBL Australia was pleased to sponsor an International Women in Biomedicine event featuring EMBL Director General Professor Edith Heard FRS in March.

Organised by the Convergence Science Network, Professor Heard appeared virtually from Paris to share inspiring stories about her research and career, and discuss the current state of science in Europe, with Dr Clare Fedele from the Centre for Cancer Research at the University of Melbourne.

EMBL Australia Outreach

In an unwavering commitment to strengthen ties and foster collaboration, EMBL Australia researchers dedicated themselves to rekindling connections and making impactful contributions within the local and international scientific community.

Webinar series enables sharing of international expertise in living systems

The Theory of Living Systems webinar series - co-organised by EMBL Australia group leader Dr Richard Morris - continued connecting local audiences with the most compelling experts in the study of living systems from all around the world in 2022.

Speakers included Professor Corina Tarnita (Princeton University), Dr Davide Michieletto (University of Edinburgh), Professor Jessica Flack (Santa Fe Institute) and Professor Marino Arroyo (Universitat Politècnica de Catalunya).

The webinars, which began in late 2020, are hosted online to lower the barriers for international researchers to share cutting-edge research at the interface of theory, computation and life science with Australian audiences.

Selected past webinars can be viewed on a dedicated YouTube channel.

Martino Group opens lab to the public

The Martino Group shared its amazing regenerative medicine and stem cell science with members of the public during the return of the ARMI and the Convergence Science Network's popular 'Opening the Vault' event in October 2022, hosted at Monash University, Clayton.

More than 40 people - ranging from primary-school students to retirees in their 70s - attended the sold-out event, which included displays of ARMI's high-tech facilities, including a tour of AquaCore to understand the importance of animal models in regenerative medicine research and a live imaging station to illustrate the institute's powerful imaging capabilities.

Professor Peter Currie, ARMI Director of Research and Australian EMBL Partnership Laboratory Head, said maintaining a relationship with the general public was critical.

"With the COVID-19 pandemic, awareness of biomedical research and its impacts on our community's health has never been higher. But so has misinformation," Prof Currie said.

"As such, we have to inform people of our research activities and how their contribution, whether through tax and public funding or philanthropy, is helping us achieve our goals of better understanding the human body and how to harness that to improve the lives of patients."

Postdoctoral research fellow Dr Jean Tan (left) explains some of the Martino Group's innovative work in developing safe and effective regenerative therapies.

EMBL Australia Outreach (cont.)

Science Week NCRIS video campaign

As part of a coordinated effort to promote NCRIS and its constituent organisations to the general public via social media, EMBL Australia produced a one-minute video about the organisation and shared it during science National Science Week in August 2022.

A handful of EMBL Australia representatives - including group leaders, a postdoctoral fellow and the Scientific Head - participated in the snappy video, which aimed to give the audience a brief insight into what the organisation does to enhance research innovation across Australia.

The EMBL Australia video was shared on our social media channels, linked to an explanatory post by NCRIS, and was viewed by hundreds of people.

In the Media:

Talking mRNA with the PM

Group leader Chen Davidovich and fellow researchers from the Monash RNA innovation hub discussed RNA research with Prime Minister Anthony Albanese and Victorian Premier Daniel Andrews during their visit to Monash University in August.

As captured by *7NEWS*, the politicians were announcing the establishment of a state-of-the-art Moderna facility at the university.

As part of Monash RNA, Associate Professor Davidovich will use his expertise in RNA biology and biochemistry to help develop next-generation mRNA vaccines and therapeutics.

Monash RNA is part of the Victorian mRNA Innovation Hub, a collaboration of mRNA experts from Monash University and the University of Melbourne established in 2022 with a $5.4 million investment by the Victorian Government to develop next-generation mRNA vaccines and therapeutics to treat a range of diseases.

Expert commentary on malaria vaccines

Dr Michelle Boyle spoke on *The Health Report* on ABC Radio National as a national expert commenting on developments in malaria vaccines.

Listen now

EMBL Australia Outreach (cont.)

Training the next generation of scientific leaders

EMBL Australia group leaders are committed to training, mentoring and inspiring the next generation of Australian scientists.

As well as supervising PhD candidates within their own research groups and contributing to EMBL Australia's student programs by organising and participating in events, such as the annual PhD Course, many group leaders play a significant role in training students within their host institutions and other associated organisations.

For example, as leader of the training and mentoring portfolio for the ARC Centre of Excellence for Innovations in Peptide and Protein Science, Associate Professor Max Cryle creates opportunities for students and early career researchers (ECRs) within the centre and has established a new grant scheme to provide funding for seed projects lead by ECRs.

A/Prof Cryle is also the ECR coordinator for the Monash BDI, where he supports the mentoring, training, development, engagement and outreach portfolios of the BDI ECR committee for a group of more than 200 early career scientists.

He is also a member of the research leadership team of the Monash Warwick Alliance AMR Training Program in Emerging Superbug Threats, an interfaculty and multi-institutional training program launched in January 2022 and designed to support the most promising future leaders in interdisciplinary science through the recruitment and supervision of a team of six early career researchers.

The program aims to produce a future-ready workforce to tackle antimicrobial resistance and develop promising approaches for the treatment of the most worrying bacterial and fungal infections.

PhD student Paulina Rudolffi was cheered on by fellow Gambin Group members as she submitted her thesis in December 2022.

Image via Twitter @SingMolSci

EMBL Australia Outreach (cont.)

Giving back to the research community

As well as being involved in various committees and leadership roles within their own institutions, EMBL Australia group leaders were involved in organising many scientific conferences, symposia and events in 2022.

These events benefit the scientific community by encouraging the exchange of knowledge, fostering collaboration through networking, promoting the professional development of early career researchers and advancing scientific understanding.

For example:

— Associate Professor Maté Biro was the scientific program co-chair for the 4th International Symposium on Mechanobiology (6-9 November 2022, Sydney), which featured mechanobiology experts from all around the world, including a Nobel laureate. More than 200 delegates attended to discuss advances in the field of mechanobiology. A/Prof Biro was also on the scientific advisory panel for the NSW Cancer Conference 2022.

— Associate Professor Max Cryle was the lead organiser of the inaugural Australian-New Zealand Natural Products Chemistry and Biology Symposium, which focused on the future of natural product research in Australasia. Held on 7-8 November at the Doherty Institute, Melbourne, the keynote speakers included Professor Emily Parker (Victoria University of Wellington, New Zealand), Professor Brett Neilan (University of Newcastle) and Associate Professor Lara Malins (ANU). A/Prof Cryle was also on the organising committee for the 14th Australian Peptide Conference, held in Queensland in May 2022.

— Associate Professor Mikaël Martino organised the 4th Monash University - Osaka University Joint Symposium on Advanced Biomedical Sciences, the fourth in an annual series of joint symposiums designed to exchange ideas about cutting-edge research in medicine and life sciences and promote collaboration between the two universities. The scientific topics were organoids, tissue engineering and regenerative medicine.

— Professor David Lynn was an organising committee member for the 2nd Australasian COVID-19 Conference, which was themed 'Taking stock of our COVID toolkit' and co-convened by director of the Peter Doherty Institute Professor Sharon Lewin, AO. Prof Lynn is also a Steering Committee member of the Commission on Excellence and Innovation in Health - Clinical Genomics.

Sharing scientific excellence

In 2022, EMBL Australia group leaders gave more than 60 presentations in 36 cities across 18 countries in North America, Europe and Asia.

Highlights include:

— Professor David Lynn presented at the 'COVID-19 Immunology, Vaccines and Lessons for the Future' conference in Dublin, and gave several seminars at institutions across Ireland, as well as presenting at the Optimmunize conference in Odense, Denmark.

— Professor Eduardo Eyras was an invited speaker at conferences and symposiums in Germany, Japan, Singapore, Spare, the UK, USA and Australia. He also enjoyed co-organising the Computational Biology Seminar Series at the John Curtin School of Medical Research (JCSMR).

— Associate Professor Mikaël Martino spoke at Tissue Engineering and Regenerative Medicine International Society conferences in Poland, Korea and Canada.

— Dr Richard Morris was an invited speaker at the International Symposium for Mechanobiology 2022, Sydney, where he jointly headlined a session demonstrating modern applications of theory in biology.

— Professor Barry Thompson spoke at the 4th International Symposium on Mechanobiology in Sydney. He also presented on YAP and TAZ in skin cancer using stunning MERSCOPE data at the Melbourne Immunotherapy Network Symposium in Marysville, Victoria, in November 2022.

EMBL Australia Outreach

Re-connecting our Partner Lab Network

After enduring two years of limited in-person events due to the COVID-19 pandemic, we seized the opportunity to make up for lost time by holding two EMBL Australia Scientific Summits in 2022.

These summits, traditionally held annually, encourage the strengthening of existing connections and the forging of new relationships between members of our PLN.

Members from EMBL Australia research groups hosted at various institutions across the country came together to share their science in a supportive, cross-disciplinary environment, with the aim of being inspired by new ideas and promoting scientific collaborations across the network.

In addition to learning about the impressive, cutting-edge science happening across the PLN, the summits featured engaging events, such as PhD student poster presentations, enlightening chalk talks by postdoctoral fellows and an informative evening hosted by the Australian Wine Research Institute at the National Wine Centre of Australia in Adelaide.

The first summit of the year was hosted by the John Curtin School of Medical Research at ANU, Canberra, on 23-24 March. It provided a great platform for PLN members to connect and engage with each other in an intellectually stimulating environment.

Following the success of the first summit, the second gathering took place at SAHMRI in Adelaide on 6-7 October and further enhanced the collaborative spirit across the network.

The scientific programs for these events were crafted by Professor James Whisstock, Professor David Lynn and Associate Professor Max Cryle.

Image top: Members of the Martino Group - postdoc Dr Julien Legrand and PhD students Parik and Richard - at the October Summit.

Image wia Twitter @Martino_Lab

Image below: Attendees at the October Summit in Adelaide.

Awards and Achievements

Viertel Senior Medical Research Fellowship

Associate Professor Robert Weatheritt

A/Prof Robert Weatheritt was awarded a coveted Viertel Fellowship of $1.375 million over five years to support his vital cancer research - finding new pathways to boost chemotherapy success.

He is the fourth EMBL Australia group leader to be awarded the prestigious fellowship.

CSL Centenary Fellowship

Dr Michelle Boyle

Dr Michelle Boyle was awarded a $1.25 million CSL Centenary Fellowship to advance her work in boosting the immune response to malaria, with the aim of improving vaccines for malaria and other chronic diseases.

Tregear Award by the Australian Peptide Association

Associate Professor Max Cryle

A/Prof Max Cryle received the Tregear Award for outstanding research in the field of peptide chemistry at the biennial Australian Peptide Conference in May 2022.

The award was presented by Geoff Tregear, widely considered the 'father' of peptide chemistry in Australia.

Flinders University Senior Research and Outstanding Supervision awards

Professor David Lynn

Prof David Lynn was awarded the 2022 Flinders University College of Medicine and Public Health Senior Research Award (awarded to a distinguished senior researcher who has demonstrated excellence in research funding, publication output, service to their discipline, student supervision and research translation) and the Vice President and Executive Dean Award for Outstanding Student Supervision.

Member of the ARC College of Experts

Professor Eduardo Eyras

Prof Eduardo Eyras was appointed to the Australian Research Council (ARC) College of Experts (2023 - 2026).

Members play an important role in assessing research proposals for funding under the National Competitive Grants Program, identifying research excellence, moderating external assessments of research grant proposals and recommending projects to be funded.

Grant Success for Group Leaders

As well as continuing work on innovative research projects enabled by more than $50 million in external funding, EMBL Australia group leaders won more than $66.7 million in competitive and collaborative grants in 2022.

Dr Vaishnavi Ananthanarayanan

University of New South Wales

A chief investigator for a $1 million Australian Research Council (ARC) Linkage Infrastructure, Equipment and Facilities Grant to enable the bioprinting and study of 3D models of tissues and organs, facilitating the study of cell and tissue function under lifelike conditions and minimising the use of animals in research.

Dr Senthil Arumugam

Monash University

Part of a collaboration that was awarded a $1.4 million Wellcome Trust India Alliance Team Science Grant to further investigate cell size regulation.

Dr Michelle Boyle

QIMR Berghofer/Burnet Institute

Awarded a $1.25 million CSL Centenary Fellowship to advance her work in boosting the immune response to malaria, with the aim of improving vaccines for malaria and other chronic diseases.

Co-investigator on a project titled 'COVID transmission and morbidity in Malawi', which received more than US$3.33 million in funding via a US National Institutes of Health Research Project Grant (R01).

A/Prof Max Cryle

Monash University

Awarded a National Health and Medical Research Council (NHMRC) Ideas Grant, as a chief investigator on the project led by **Associate Professor Mireille Lahoud**, to dissect the regulatory mechanisms controlling antigen processing and presentation in dendritic cells, with the aim of finding new approaches for vaccines and immunotherapies.

A/Prof Chen Davidovich

Monash University

Awarded an NHMRC Ideas Grant to investigate the RNA-mediated regulation of chromatin compaction in development and disease.

Awarded an mRNA Victoria Activation Program Grant, as co-chief investigator of a project titled 'mRNA Victoria: A universal platform for affinity purification of RNA' and led by Davidovich Group member **Dr Qi Zhang**.

Grant Success for Group Leaders (cont.)

Prof Eduardo Eyras

Australian National University

Awarded an NHMRC Ideas Grant of more than $1.55 million to accelerate mRNA exploration and design for therapeutic development by cracking the epitranscriptomic code.

A chief investigator in the new ARC Centre of Excellence for the Mathematical Analysis of Cellular Systems, which will receive **$35 million** in funding over seven years.

A chief investigator in a Genomics Health Futures Mission Grant of close to $3 million to develop a nationally accessible pipeline of clinical RNA diagnostics to enable diagnosis and personalised healthcare for those living with rare genetic diseases or inherited cancer predisposition.

A/Prof Yann Gambin

University of New South Wales

Awarded, as part of a UNSW Sydney-led consortium, a $1.37 million grant from the Michael J. Fox Foundation for Parkinson's Research and the Shake it Up Australia Foundation to assess the potential of an early diagnostic test for Parkinson's disease that uses single-molecule technologies to detect biomarkers in the biofluids of patients.

Prof David Lynn

South Australian Health and Medical Research Institute

Awarded an NHMRC Ideas Grant of almost $1.6 million to develop a human experimental model to assess whether the gut microbiota regulates specific and non-specific immune responses to vaccination.

Awarded a Medical Research Future Fund (MRFF) Genomics Health Futures Mission Grant Opportunity of almost $5 million as co-chief investigator of a project led by **Prof Alex Brown** and titled 'Pathways to benefit for Indigenous Australians in Genomic Medicine', which will establish a National Indigenous Genomics Network.

Awarded, as a chief investigator for a project led by **Prof Lisa Butler**, an ARC Discovery Project Grant to investigate how male sex hormones, androgens, affect fat metabolism.

Dr Stephen Blake, a postdoctoral fellow in the Lynn Group, was also awarded an NHMRC Ideas Grant to investigate engineered tumour-homing bacteria that safely turn up the heat on immunologically cold colorectal cancer.

Dr Feargal Ryan, also a postdoctoral fellow in the Lynn Group, was awarded a $655,000 NHMRC Investigator Grant to understand how gut bacteria modulate activity of the immune system in response to vaccination.

Grant Success for Group Leaders (cont.)

A/Prof Mikaël Martino

Monash University

Awarded more than half a million dollars (with **Prof Peter Currie**) to investigate the potential of novel cellular therapies and tissue engineering to prevent heart damage following ischemic injury, to reduce scarring and prevent the onset of heart failure, as part of the Federal Government's $10 million commitment to the Australian Stroke and Heart Research Accelerator.

Awarded an $857,000 ARC Linkage Grant to enable critical research into developing macrophage-based technologies for tissue regeneration. The project - a collaboration between ARMI and AstraZeneca - will be led by **Prof Peter Currie**, **A/Prof Mikaël Martino** and **Dr Ryan Hicks**.

Awarded an NHMRC Ideas Grant - with postdoctoral research fellow **Dr Julien Legrand** - to investigate engineered amphiregulin as a novel growth factor to promote tissue regeneration.

A chief investigator in an MRFF Stem Cell Therapies Mission project titled 'Gene-modified pluripotent stem cells to generate and empower innate immune cells against poor-prognosis cancers'.

A/Prof Richard Morris

University of New South Wales

A chief investigator in the new ARC Centre of Excellence for the Mathematical Analysis of Cellular Systems, which will receive **$35 million** in funding over seven years.

Prof Barry Thompson

Australian National University

Awarded an Ian Potter Foundation Medical Research Grant of $150,000 to bring MERSCOPE technology to Australia.

A/Prof Robert Weatheritt

Garvan Institute of Medical Research

Awarded a Viertel Senior Medical Research Fellowship of $1.375 million over five years to support his cancer research in finding new pathways to boost chemotherapy success.

Awarded a NSW Health early-mid career RNA Future Leaders Grant to harness the latest advances in RNA technology to develop targeted drugs to fight diet-induced obesity.

People Highlights

A/Prof Rob Weatheritt

Successful review

Associate Professor Robert Weatheritt, hosted at the Garvan Institute, successfully passed his mid-term review in November 2022, receiving unanimous support from the review panel, which included local scientists and EMBL group leader Dr Oliver Duss.

The panel praised A/Prof Weatheritt's competitive grant success (including his award of a prestigious Viertel Fellowship) and quality of publications in leading journals, stating that he was clearly an emerging leader in the field of RNA in Australia

Professor Robert Brink

Australian EMBL Partnership Laboratory Head

We welcomed Professor Robert Brink as the Australian EMBL Partnership Laboratory Head for the Garvan Institute.

He succeeds Professor Chris Goodnow, who stepped down from the role of Executive Director of the Garvan Institute in July 2022.

Dr Michelle Boyle

Relocation to the Burnet Institute

Dr Michelle Boyle, a group leader who has been hosted at QIMR Berghofer since late 2018, moved her cutting-edge work in boosting protection against malaria to the Burnet Institute, where she originally completed her PhD.

We are thrilled to welcome the Burnet Institute to our Partner Laboratory Network.

Dr Boyle will remain an honorary group leader at QIMR Berghofer during 2023.

Working towards an equal, diverse and inclusive workplace

EMBL Australia and the Partner Laboratory Network host institutes are committed to supporting a gender-diverse and inclusive work environment, ensuring equal employment opportunity to attract and retain the best researchers in their field.

In 2022, the EMBL Australia Gender Equity, Diversity & Inclusion (GEDI) Action Plan 2023 - 2028 was developed in conjunction with a specifically formed working group consisting of members of our various partner institutes and the EMBL.

The objective of the GEDI Action Plan is to achieve equal representation and recognition of group leaders in the recruitment and review processes, irrespective of gender, sexuality, race, ethnicity, disability or cultural background.

The document, which sets out the actions we're taking to achieve our vision of a gender-diverse and fully inclusive Partner Laboratory Network, was endorsed by the EMBL Australia Council in December 2022.

Student Programs

To identify and develop future scientific leaders, EMBL Australia attracts Australia's best students by offering a number of highly sought-after programs.

The 7th EMBL Australia PhD Course

Modelled on EMBL's predoc course, the two-week annual program offers sixty first or second-year PhD students symposium-style presentations and workshops from Australian and international speakers.

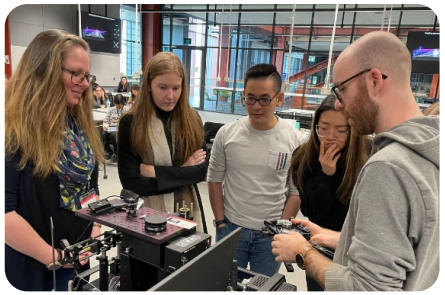
A tour of the Australian Synchrotron was a highlight of the 2022 PhD Course.

After two years of COVID-related cancellations, the much-anticipated EMBL Australia PhD Course returned in 2022, this time hosted at Monash University, Clayton on 10-15 July.

Despite the course being shortened to six days, instead of the usual two weeks, it was packed with amazing learning opportunities from some of the best scientists in Australia.

The course covered a wide range of scientific topics - including structural and synthetic biology, drug discovery and delivery, development and regeneration, biomedical engineering, bioinformatics/omics and artificial intelligence - and non-scientific topics, including scientific integrity, career progression and social media in science.

The approximately 50 PhD student attendees participated in a range of workshops and tours, including a tour of the Australian Synchrotron and the Monash Institute of Pharmaceutical Sciences.



Interactive workshop on the anatomy of a fluorescence single-molecule microscope.

Students shared their own research with peers via a poster session and Three-Minute Thesis (3MT) presentation.

Feedback about the course was overwhelmingly positive, with participants saying they felt "very inspired" and would "definitely be recommending it to every other PhD student".

Group leaders who contributed to the organisation of the course included Mikaël Martino, Rob Weatheritt, Senthil Arumugam and Harald Janovjak (alumni).

Student Programs (cont.)

The 9th EMBL Australia Postgraduate Symposium: Breaking Barriers, Building Bridges

An annual student-developed symposium for honours, masters and PhD students provides an opportunity for students to learn from world-leading researchers, network and present their work.

We welcomed back our in-person format for the 9th annual EMBL Australia Postgraduate Symposium (EAPS), held at the Bio21 Institute in Melbourne on 9-11 November 2022.

Themed 'Breaking Barriers, Building Bridges', the event provided a unique opportunity for 55 emerging young researchers from across Australia to network, share their own science and be inspired by leading local scientists.

Organised by a dedicated committee of PhD students - many of whom have been previously involved in EMBL Australia programs - the symposium brought together a variety of plenary speakers, including: Prof Melissa Southey, Dr Sebastian Furness, Prof Marnie Blewitt, Dr Jazmina Gonzalez Cruz, Dr Anai Gonzalez Cordero, Prof Alan Cowman and Dr Fernando Fonseca Guimaraes.

Themes covered during the three-day event included genomics and computational biology, proteins and structural biology, epigenetics and development, cancer biology, molecular and cell biology and infection and immunity.

EAPS also provides students with opportunities to present their work to peers in a supportive environment via oral presentations, lightning talks and poster sessions.

The EAPS 2022 committee members (L-R): Bhavana Nayer, Samuel Widodo, Nick Dooley, Laura Rodriguez, Shoaib Anwaar, Pragya Gupta, Eva Apostolov, Clelia Timpone, Nutpakal Ketprasit, Christine Goy and Akriti Varshney. (Not pictured: Abhishek Patil.)

Student Programs (cont.)

Travel grants

Supporting PhD students to take a short course, attend a conference or work collaboratively alongside some of the world's best researchers at EMBL's facilities in Germany, Italy, France, Spain or the UK.

EMBL Australia's travel grant program returned in mid-2022 as international travel increased following the easing of COVID-19 travel restrictions.

Twelve Australian PhD students had the opportunity to train at one of EMBL's six European facilities, go to a conference or take a short course thanks to a $2,000 EMBL Australia travel grant.

Six of those students elected to attend the EMBL PhD Symposium - ' The Spectra of Life: Dimensional Breadth in Biological Research' - in Heidelberg in December, while another six students attended courses hosted at EMBL in topics that would advance their current or future scientific endeavours.

Bec Degnan, a PhD student from the University of Queensland and travel grant recipient, used the opportunity to meet with several labs in pursuit of her goal of a postdoctoral fellowship at EMBL, tour EMBL's imaging and sequencing facilities and attend a course on RNAi experimentation, a multi-day seminar on electron microscopy and the EMBL PhD Symposium, where she presented her current research and was awarded the first place poster prize.

Ms Degnan said a highlight of her trip was establishing new professional relationships and discussing how to join her preferred lab with the group leader.

"Before my visit to EMBL, I had already considered that I would like to move in a new direction with molecular biology after my PhD," she said.

"My visit gave me further clarity on what I would like this new research direction to be, and deeply inspired me to work towards this."

Bonnie Werner, a PhD student at UNSW, said presenting her research as a poster at the EMBL PhD Symposium enhanced her skills in communicating to a broad audience, as well as her confidence in her own research.

"As a personal objective of my PhD training is to develop my skills in science communication, this was an invaluable opportunity," Ms Werner said.

PhD students Bonnie Werner (left) and Kate Gunther (right) used EMBL Australia travel grants to network and extend their scientific knowledge at the EMBL PhD Symposium in Heidelberg.

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