

# Garvan Institute of Medical Research

Annual Report 2021



## 2021: Resilience through research

While 2021 continued to challenge us as a community and a country, we rallied behind innovative research to protect ourselves, and our loved ones. Our dedicated scientists and professional staff continued to adapt to our new normal, to make significant discoveries and invaluable contributions to global COVID-19 research, and existing research portfolios.



## Our vision

We see a future where everyone lives a longer, healthier life.

## Our mission

We will harness all the information encoded in the genome to better diagnose, predict, treat and prevent diseases that have the deepest impact on society.

## Our values

Excellence  
Innovation  
Collaboration  
Community  
Integrity  
Respect

## Who we are, what we do

The Garvan Institute of Medical Research brings together world-leading medical researchers with clinicians and the best technology. We are patient focused. Our researchers break down barriers between traditional scientific disciplines to find solutions to disease.

Founded in 1963, Garvan's researchers have made significant advances in genome, epigenome, protein and cell analysis technology. We have revealed causes and developed treatments for diseases including diabetes, osteoporosis, cancer, immune deficiency and autoimmunity.

Today, Garvan's mission builds on those advances, harnessing all the information encoded in our genome, from DNA to complex organ systems, to better diagnose, treat, predict and prevent disease.

Garvan's research has global impact. World-leading people pioneer discoveries across four intersecting research themes. We lead the field in medical genomics, epigenetics, and cellular genomics; cancer; diseases of immunity and inflammation; and diseases of ageing affecting bone, brain and metabolism.

Our goal is to translate discovery into meaningful health benefits for those living with disease and their families. Patients, clinical trial cohorts and population cohorts are at the centre of Garvan's research.

We are focused on addressing the unmet needs of those living with disease – where better understanding, new treatments and more effective diagnosis can have the biggest impact.

Through cutting-edge technology, facilities, local and international collaborations, Garvan researchers strive, every day, to create a future where everyone lives longer, healthier lives.

Garvan's research is funded through a crucial combination of peer-reviewed government grants and generous philanthropic investment from the community.

Garvan is affiliated with St Vincent's Hospital Sydney and UNSW Sydney.

# Organisation structure

As at 31 December 2021

## Garvan Institute of Medical Research

### Board of Directors

**Chair:** Dr John Schubert AO

### Executive

**Executive Director:** Prof Chris Goodnow FAA FRS

**Deputy Director:** Prof Peter Croucher

**Chief Operations Officer:** Nat McGregor

## Garvan Research Foundation

### Board of Directors

**Chair:** Dr Russell Scrimshaw

### Executive

**Director:** Mara-Jean Tilley

**Deputy Director:** Brad Timms

## Research themes and Centres

### Cancer

**Acting Head:** Prof Paul Timpson

**Faculty:** Prof Chris Ormandy, A/Prof Alex Swarbrick, A/Prof Elgene Lim, A/Prof Marina Pajic, Prof Joseph Powell, A/Prof Christine Chaffer, A/Prof David Croucher

### Healthy Ageing

**Acting Head:** Prof Katherine Samaras

**Faculty:** Prof Jacqueline Center, Prof Peter Croucher, Prof Jerry Greenfield, Prof Herbert Herzog, Prof Mike Rogers, Prof David Ryugo, A/Prof Paul Baldock, A/Prof Carsten Schmitz-Peiffer

*Emeritus Fellow:* Prof Trevor Biden,

Prof Lesley Campbell AM,

Prof Don Chisholm AO, Prof John Eisman AO,

Prof Ted Kraegen AO

### Immunity and Inflammation

**Head:** Prof Stuart Tangye

**Faculty:** Prof Robert Brink, Prof Daniel Christ, Prof Christopher Goodnow FAA FRS, Prof Shane Grey, Prof Tri Phan, Prof Jonathan Sprent FAA FRS, A/Prof Elissa Deenick, A/Prof Cindy Ma, Dr Tatyana Chtanova

*Emeritus Fellow:* Prof Antony Basten AO FAA

### Genomics and Epigenetics

**Head:** Prof Susan Clark FAA

**Faculty:** Prof Vanessa Hayes, Prof Sean O'Donoghue, A/Prof Ozren Bogdanovic, Dr Robert Weatheritt

*Emeritus Fellow:* Prof John Shine FRS AC FAA

### The Kinghorn Cancer Centre

**Director:** Prof David Thomas

### Kinghorn Centre for Clinical Genomics

**Clinical Head:** Mary-Anne Young

**Scientific Head:** A/Prof Sarah Kummerfeld

### Garvan-Weizmann Centre for Cellular Genomics

**Head:** A/Prof Joseph Powell

### Centre for Population Genomics

**Head:** Prof Daniel MacArthur

## Development and Support

**People and Culture:** Cleo Rowley

**Australian BioResources:** Dr Jenny Kingham

**Business Development & Innovation:** David Barda

**Finance & Accounting:** Samantha Malone

**Risk & Assurance Services:** Michelle Jarvie

**Information Technology:** Esteve Mayolas

**Legal Office:** Nancy Campisi

**Building Operations:** Andrew Humphries

**Facilities:** Amanda Brindley

**Research & Development Office:** Louise Fleck

**Grants Administration:** Sonja Bates & Mariëtte Le Roux

**Human Research Governance:** Therese Yim

**Animal Ethics:** Dr Rayson Tan

**Animal Welfare:** Dr Vivian Song

**Student Programs:** Dr Tracy Anderson

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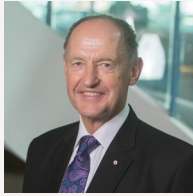


We acknowledge the Gadigal and Gundangara peoples, the traditional owners and custodians of the lands on which the Garvan Institute and the ABR are located. We pay respects to Elders, past, present and future, and recognise the continuing connection and contribution to this land.

A digital version of this report is available at [garvan.org.au/annual-reports](https://garvan.org.au/annual-reports)

# Garvan Institute of Medical Research Report 2021

2021 was another challenging year for people across the globe. With thanks to the Garvan family, our scientists were able to continue their critical research.



**Dr John Schubert AO**  
*Chairman*



**Professor Chris Goodnow FAA FRS**  
*Executive Director*

As we entered the second year of a pandemic, Garvan researchers and professional support staff continued working with the same dedication and passion that is a defining trait of our people. Through our rigorous safety protocols and by prioritising staff-on-site for those undertaking experimental, time-sensitive or COVID-specific research, we were able to avoid a Garvan-wide lockdown, ensuring the pace of Garvan's research could be largely maintained. We are immensely grateful for the perseverance of our people through what was a particularly difficult time for individuals, families and the community at large.

Excitingly, Garvan researchers continued to drive and collaborate on local and international projects to better understand COVID-19 and develop a strategy for next-generation COVID-19 vaccines. As you'll read on page 31, a Garvan-led breakthrough has identified a key site of vulnerability on the virus surface that is unlikely to change over time, offering hope for future-proofed COVID-19 vaccines that can resist emergent new viral strains.

While COVID-19 has been an urgent area of focus, our critical research into cancers, diseases of immunity and inflammation, and diseases of ageing affecting bone, brain and metabolism has continued at pace, with Garvan scientists publishing 463 research breakthroughs in high-impact scientific journals in 2021.

Garvan's expertise in genome sequencing and analysis was further strengthened by the establishment of the Centre for Population Genomics (CPG), a partnership between the Garvan Institute and the Murdoch Children's Research Institute in Melbourne, led by Professor Daniel MacArthur. The CPG aims to establish an equitable genomics infrastructure to enable comprehensive disease prediction, accurate diagnosis and effective therapeutics for all the diverse peoples of Australia.

In 2021 Garvan galvanised its direction and focus around key scientific strengths in data, genomics, cellular, translational and clinical science to catalyse research from fundamental discovery to transformational impact. From the individual patient with rare disease, to the many thousands affected by complex, widespread illness, we are pioneering discoveries across diseases that have the deepest impact on our community.

This year we would especially like to acknowledge the scientific and strategic leadership of outgoing members of Garvan's Executive Leadership Team: Professor Susan Clark, Professor Paul Timpson, Professor Katherine Samaras and Professor Stuart Tangye, all of whom continue to lead major research initiatives within the Institute. Meanwhile, we warmly welcomed new members to Garvan's Leadership Team: Professor Rob Brink, Associate Professor Sarah Kummerfeld, Professor Joseph Powell, Ms Nancy Campisi and Ms Samantha Malone, and acknowledge the ongoing leadership of Professor Daniel MacArthur, Professor Peter Croucher, Mr Nat McGregor, Ms Cleo Rowley and Ms Mara-Jean Tilley.

We also extend our thanks to Professor David Thomas for his leadership as inaugural Director of The Kinghorn Cancer Centre. Professor Thomas has stepped down from this responsibility to focus on his role as CEO leading the spectacular national expansion of his Garvan-founded Australian Genomic Cancer Medicine Centre (Omico) and his Garvan Cancer Medicine research laboratory.

We are immensely grateful to our Board of Directors, who offer their extensive expertise and knowledge to Garvan, and whose guidance over the past two years of the pandemic have proved invaluable. We also acknowledge and sincerely thank our many supporters in the community, who make up our Garvan family. We are privileged to have your enduring support in difficult times.

# Garvan Research Foundation Report 2021

In 2021 we proved just how resilient we are as a community; it has been exhilarating and heart-warming to see the Garvan family rally around our breakthrough medical research.



**Dr Russell Scrimshaw**  
*Chairman*



**Mara-Jean Tilley**  
*Director*

We are absolutely humbled that even with the ever-mounting challenges faced by the community due to new COVID-19 variants, vaccine delays and seemingly endless lockdowns, the support of the Garvan family remained steadfast. Through donations large and small, philanthropic investment underpins and inspires our researchers in their pursuit of improving human health for all. Collectively, in 2021, our Garvan family raised and donated more than \$48m to accelerate our innovative research. What an incredible act of generosity, thank you!

Our dedicated and resilient Foundation team worked with great passion and enthusiasm to promote Garvan's researchers and the importance of medical research for the future of human health. In March 2021, we launched our internationally award-winning 'Disease Dilemmas' campaign, posing an impossible question to Australians – to choose to support one disease over another (you can read more about the campaign on page 53). As you know, by supporting Garvan you are supporting breakthroughs to better predict, diagnose, treat and prevent not just one, but many devastating diseases. We extend our sincere thanks to BWM Isobar (formerly BWM Dentsu), the creative agency who worked with us on a pro-bono basis to create this campaign, and their advertising partners who donated their channels and networks free of charge. We also extend our deepest gratitude to our campaign heroes who so generously shared their personal stories for the campaign.

We sincerely thank our Board of Directors for their generous commitment, enduring passion and expert guidance throughout 2021. Your leadership and advocacy of Garvan's research is deeply appreciated by everyone at the Institute. We also warmly welcomed Mr John Meacock and Ms Isabella Rich, who joined the Board in February and August 2021 respectively.

We truly could not do what we do without the support of you – our Garvan family. To each of you, we extend our deepest gratitude and thanks. Every donation catalyses and accelerates Garvan's research – individuals and corporate partners, our *Partners for the Future* who have included a gift in their Will to Garvan, our *Partners for Discovery* who make a donation every month, our volunteers and advocates, and those of you who make a gift in memory or in celebration of loved ones, thank you!

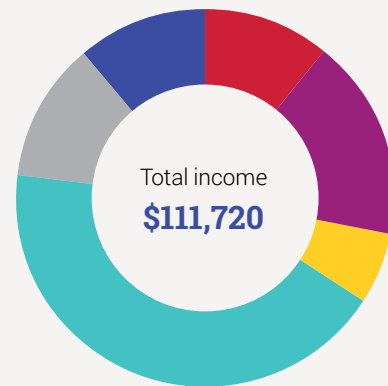
# The year at a glance

As at 31 December 2021

All figures are A\$'000

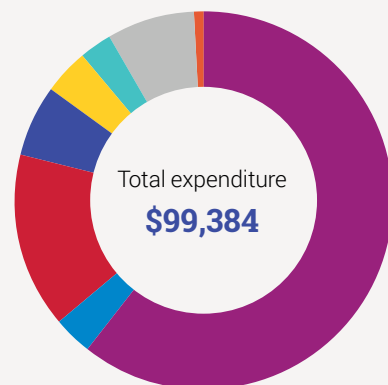
## Garvan income

- NHMRC fellowships, scholarships and other grants **\$12,144**
- Peer-reviewed and other research grants **\$19,491**
- NSW government grants **\$ 6,818**
- Donations received **\$47,728**
- Revenue from contracts with customers **\$13,127**
- Other Income **\$12,412**



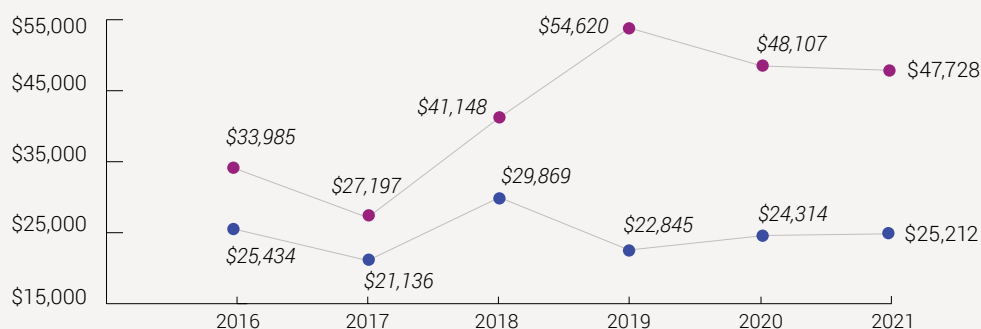
## Total expenditure

- Employee benefits expense **\$60,192**
- Sequencing consumable expense **\$3,519**
- Other Research expenses **\$14,783**
- Depreciation and amortisation expense **\$5,991**
- Administration expense **\$4,029**
- Fundraising expenses **\$2,709**
- Building and scientific expenses **\$7,607**
- Finance costs **\$554**



## Philanthropic income

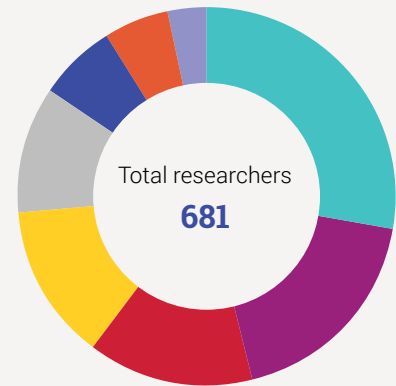
- Philanthropic income with bequests
- Philanthropic income without bequests





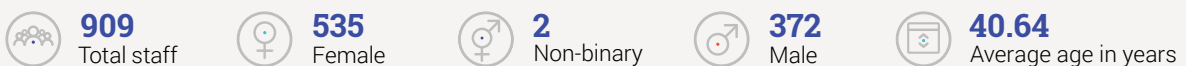
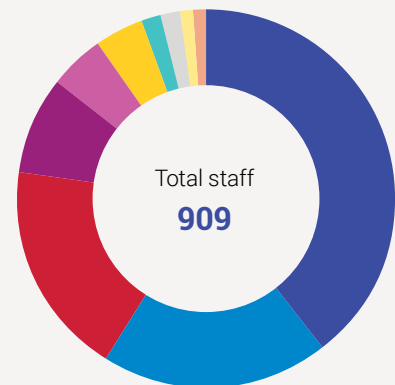
## Garvan researchers

- Healthy Ageing **125**
- Immunity & Inflammation **96**
- Genomics & Epigenetics **91**
- Cancer **190**
- Kinghorn Centre for Clinical Genomics **74**
- Garvan-Weizmann Centre for Cellular Genomics **45**
- Centre for Population Genomics **39**
- Emeritus, Fellow and Staff **21**



## Total staff

- Honours and Masters students **17**
- PhD students **77**
- Visiting scientists **166**
- Visiting students **36**
- Visiting professionals **15**
- Emeritus Fellows **8**
- Scientists **360**
- Foundation staff **44**
- The Services Team **176**
- Executive leadership team **10**



## Public community engagement and education

**Bite Size science seminars:**  
2,957 attended 3 virtual public seminars

**Other virtual events:**  
40 people attended 1 event

**Scientific showcase seminars:**  
1,920 attended 4 virtual seminars

**In-person showcases:**  
545 people attended 3 events

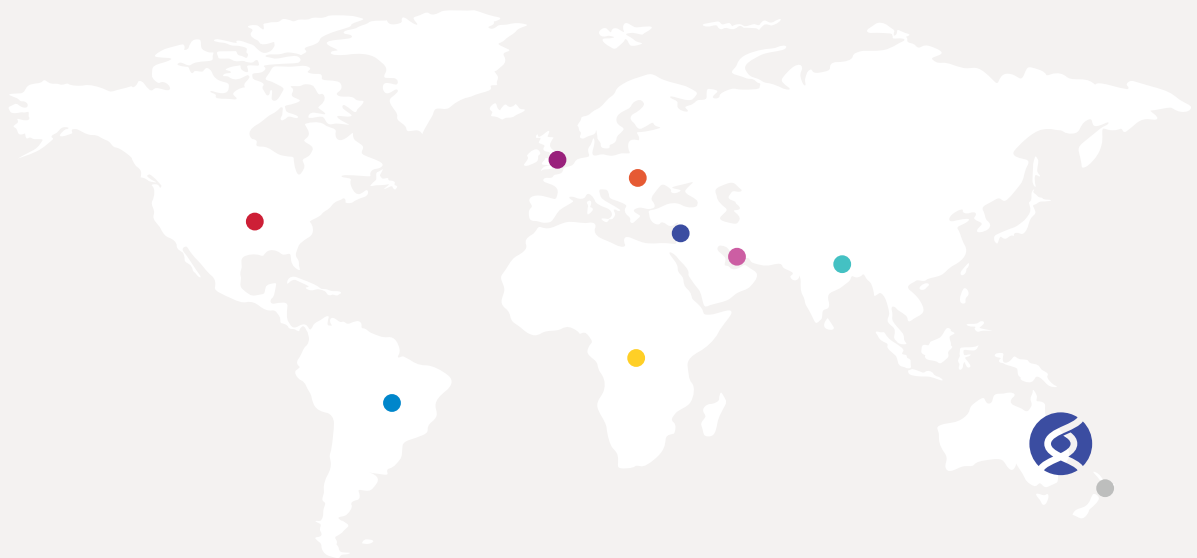
**COVID-19 updates with Prof Goodnow:**  
200 attended 2 virtual seminars

## Garvan Collaborations

Excellence in research is only possible when scientists work together at the cutting-edge, combining their unique expertise and capability. In 2021, Garvan was proud to continue its world-leading collaborations to advance our discoveries.

### Local research with global reach

This graphic demonstrates the reach of Garvan's research collaborations, with each number referring to joint publications with international institutions.



### Key

- Europe **126**
- North America **135**
- United Kingdom **33**
- Asia **115**
- Israel **12**
- Middle East **27**
- South America **12**
- New Zealand **17**
- Africa **12**

# Garvan Publications

Peer-reviewed scientific journals serve as a key mechanism for scientists to share their research and expertise. This shared knowledge allows scientists to advance their understanding and develop better ways to predict, diagnose and treat disease.

## Cover Issues



**Current Opinion in Cell Biology**  
Quantifying and visualising the nuances of cellular dynamics in vivo using intravital imaging



**Science Advances**  
Intravital imaging technology guides FAK-mediated priming in pancreatic cancer precision medicine according to Merlin status



**Immunology & Cell Biology**  
2 Photon in vivo Imaging of Dendritic Epidermal T cells (DETC) in mouse ear skin



**Nature Biotechnology**  
2 Photon in vivo Imaging of Dendritic Epidermal T cells (DETC) in mouse ear skin

## Papers in key journals

- 1 Nature Reviews Cancer
- 4 Nature
- 4 Science
- 1 Nature Reviews Genetics
- 2 Cell
- 3 Nature Biotechnology
- 2 Nature Medicine
- 1 Journal of Clinical Oncology
- 3 Nature Genetics
- 2 BMJ



**463**

total publications in 2021, including journal articles, reports, reviews, letters, books and book chapters.



**340**

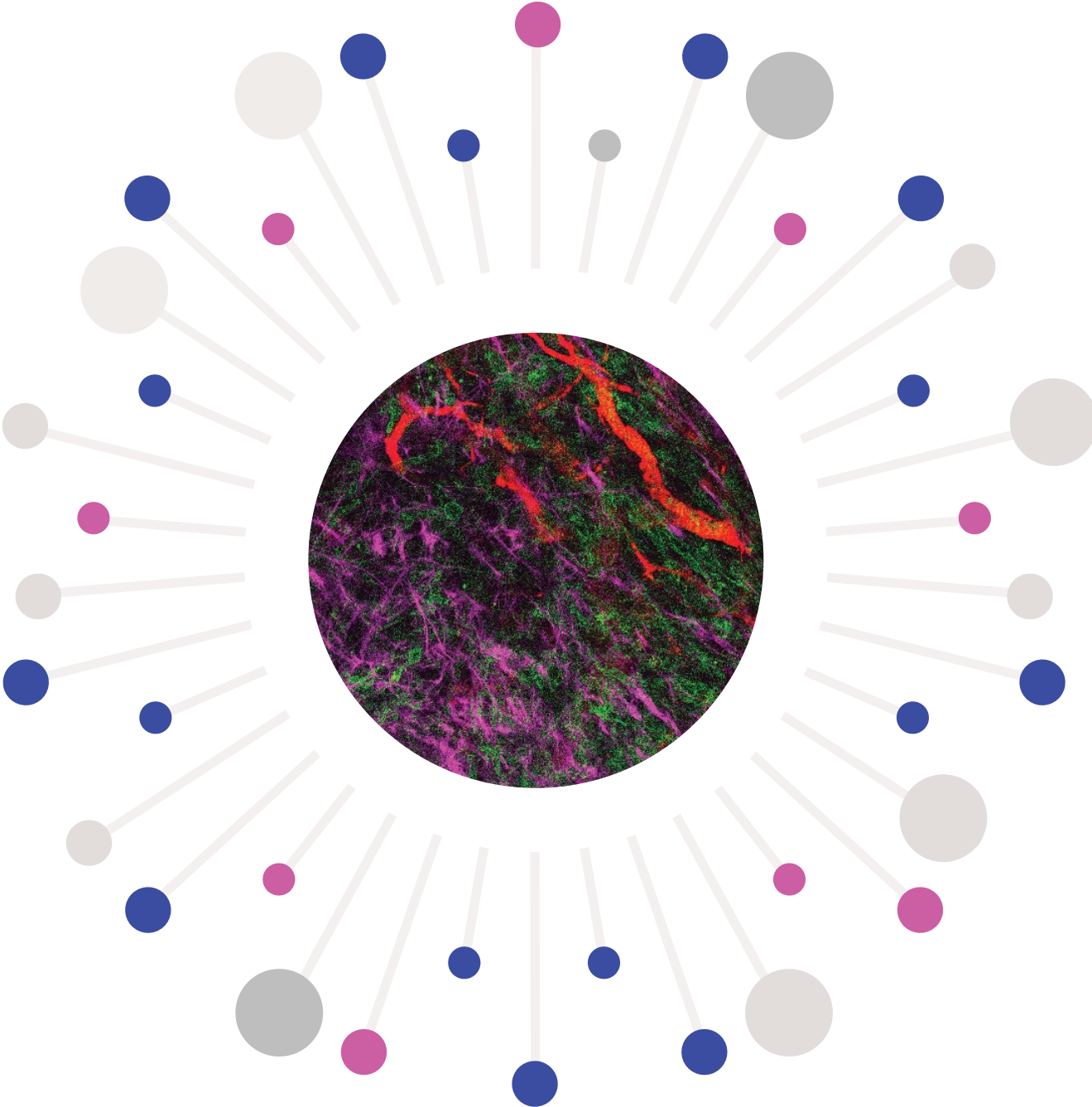
original research papers.



**143**

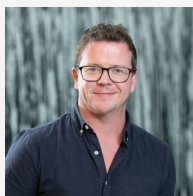
publications in journals with an impact factor greater than 8.

**See page 73 for a full list of Garvan's 2021 publications.**



# Cancer

Advances in cancer treatments and early detection capabilities have improved the outlook for many in recent years.



**From the head**  
Professor Paul Timpson



*Advances in cancer treatments and early detection capabilities have improved the outlook for many in recent years. Despite these developments, cancer remains a leading cause of death in Australia. At Garvan, we seek to further improve clinical outcomes for all cancer patients by combining excellence in cancer research with world-leading genomic and imaging technologies, and clinical trials to target both common and rare cancers.*

*Cancer is fundamentally a genetic disease. Thanks to our remarkable advances in research capability, we can analyse the DNA of a patient's tumours to recommend treatment tailored to their unique genetic profile. Increasingly, we are also making advances in understanding how the environment around a tumour influences a range of factors including the cancer's aggressiveness, its ability to spread and its susceptibility to treatment. Together, our discoveries are pointing to new approaches for cancer therapy, with many already being translated into clinical trials.*

*In 2021, we made breakthrough discoveries on new ways to make tumours more sensitive to chemotherapy and to analyse cancer cells and classify them according to which form of treatment may prove the most effective.*

*Our teams have worked closely with clinicians and researchers at other institutions around Australia and the world to optimise our ability to make scientific advances with clinical impact. The Kinghorn Cancer Centre has been integral in bringing together this scientific knowledge with the medical expertise of St Vincent's Hospital and bringing these findings directly to patient care.*

*These projects exemplify our vision to innovate new ways to detect and treat cancer, to ultimately improve clinical outcomes for all patients.*

## Research highlight

### Genomic sequencing helps target treatment for personalised cancer medicine

Every tumour is a unique collection of cells with their own genomic fingerprint. Garvan researchers are using this knowledge and the powerful genomic sequencing capabilities at the Institute to discover new ways to target each cancer's unique vulnerabilities through efforts like the Molecular Screening and Therapeutics (MoST) trials program and TOPOGRAPH. The TOPOGRAPH (Therapy-Oriented Precision Oncology Guidelines for Recommending Anti-cancer Pharmaceuticals) database was developed to bring together all known genomic cancer markers in a single place to assist oncologists in recommending therapeutic treatments in precision cancer medicine. TOPOGRAPH is uniquely useful in the Australian context because it combines up-to-date information on treatments approved for use in Australia in both clinical and trial settings. This tool was designed to systematically organise the vast amount of data from clinical trials and regulatory authorities into an accessible, easy to use platform for oncologists to maximise the therapeutic benefit to patients.

MoST also screens tumours in patients with rare or aggressive cancers for genetic markers indicating a particular therapy may prove beneficial. One of the major trials within the MoST program examines whether a treatment for psoriasis could also help treat patients with sarcomas – rare and aggressive cancers that arise in connective tissue and may occur anywhere in the body. The phase II clinical trial is a world first investigation into whether targeting the immune molecule IL23 could improve outcomes for sarcoma patients.



### Research highlight

## Pancreatic cancer 'priming' may make chemotherapy more effective

A new approach to 'prime' the tumour environment may improve how effective chemotherapy is for pancreatic ductal adenocarcinoma, one of the most aggressive forms of pancreatic cancer. In preclinical models, a team at Garvan was able to enhance the tumours' response to chemotherapy by reducing the stiffness and density of the connective tissue known as the stroma, which reduced the cancer spread by up to 50%.

The researchers investigated FAK – a molecule produced by pancreatic cancer that increases the stiffness of the stroma and helps cancer cells to grow, mobilise and metastasise. State-of-the-art intravital imaging techniques revealed how live cancer cells responded to treatment in real time, which revealed that blocking FAK before administering chemotherapy made the tumour more sensitive to treatment. The research has paved the way to a clinical trial that will assess whether the potential new therapeutic approach can improve outcomes for patients with one of the most lethal forms of cancer.

### Research highlight

## Pancreatic cancer clinical trial program to target genome and scar tissue

A national clinical trial program led by researchers and clinicians at UNSW Sydney and the Garvan Institute is testing a promising new targeted therapy for pancreatic cancer. The MoST-P clinical trial program provides patients with access to either targeted therapies matched to the genomic signature of their individual tumour or targeted to the tumour environment (or stroma). These two pancreatic cancer sub-studies aim to tackle what is currently a critical barrier to existing treatments – the scar tissue barrier around pancreatic tumours. The approach in this trial is a step towards personalised medicine and pancreatic cancer, involving co-targeting of the cancer genome and specific signals from the stroma. Pancreatic cancer is one of the most lethal forms of cancer, with a five-year survival of only 10% in Australia. Pancreatic tumours often show no obvious signs or symptoms in the early stages of disease, and by the time most cases are diagnosed, the cancer has already begun to spread outside the pancreas and is often inoperable.



### Research highlight

## New discovery in breast cancer treatment

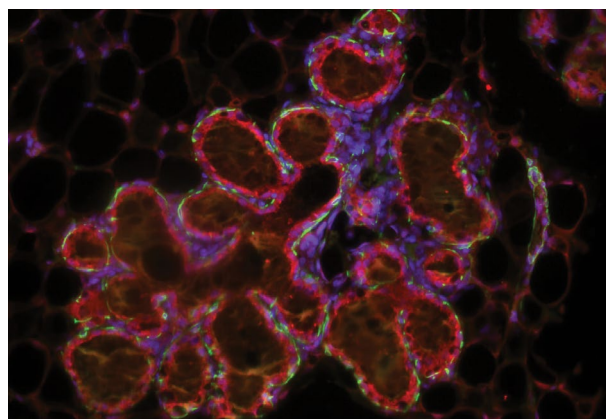
A collaboration between researchers at the University of Adelaide and the Garvan Institute has found new evidence about the positive role of androgens in breast cancer treatment with immediate implications for women with oestrogen receptor-driven metastatic disease. The international study looked at the role of androgens – commonly thought of as male sex hormones but also found at lower levels in women – as a potential treatment for oestrogen receptor-positive breast cancer. While endocrine therapy is standard-of-care for oestrogen receptor-positive breast cancer, resistance to these drugs is the major cause of breast cancer mortality. Using cell-line and patient-derived models, the team demonstrated that androgen receptor activation by natural androgen or a new androgenic drug had potent anti-tumour activity in all oestrogen receptor-positive breast cancers, even those resistant to current standard-of-care treatments. In contrast, androgen-receptor inhibitors had no effect. This work has immediate implications for women with metastatic oestrogen receptor-positive breast cancer, including those resistant to current forms of endocrine therapy.

### Research highlight

## Breast cancer 'ecotypes' present new path to personalised treatment

A collaboration led by Garvan researchers has revealed a new way of classifying breast cancer subtypes based on their cell profile which could help to personalise treatments for patients. By analysing breast cancer biopsies from patients at Sydney hospitals using cellular and spatial genomics technologies, the researchers revealed more than 50 distinct cancer, immune and connective cell types and states, which could assign breast cancers to one of nine cancer 'ecotypes', each of which was associated with a different cancer prognosis. Breast cancers are currently classified into three clinical subtypes (luminal, HER2+ and triple negative), based on specific receptors they do or do not produce. While these subtypes are used to estimate prognosis and guide treatments, not all breast cancers respond to this strategy, with the disease still claiming 3,000 lives each year in Australia alone.

Current methods for classifying breast cancers only provide a limited picture of the complex biology contained in the



tumours. Classifying breast cancers based on their entire composition of cells can provide a new and comprehensive view of a cancer. The team is now aiming to develop a clinical test that will 'ecotype' cancers to determine which treatment is best suited to which patient.

#### News highlight

### A/Prof Marina Pajic to lead precision therapy research for pancreatic cancer – thanks to Snow Fellowship

A prestigious \$8 million Snow Medical Research Foundation Fellowship provided by Terry and Ginette Snow and their family will support A/Prof Marina Pajic at the Garvan Institute of Medical Research to develop personalised approaches for treating pancreatic cancer, a disease projected to become the second leading cause of cancer death globally by 2030. A/Prof Pajic will lead a research program aimed at improving patient survival by matching treatments to individual pancreatic cancers based on the tumour's 'molecular fingerprint'.

At the molecular level, pancreatic cancer is not one disease – each cancer is unique and varies significantly from those of other patients and from patient to patient. In order to improve patient outcomes, treatment strategies need to be developed based on the individual cancer. Over the past 10 years, A/Prof Pajic and her team have established Australia's largest biobank of genome-sequenced pancreatic cancer biopsies and has identified several promising therapy targets and tailored treatment options which can now progress to patients in clinical trials.

#### Celebrating giving

### Mrs Jane Hemstrich

Since losing her husband to pancreatic cancer in 2010, Visionary donor Mrs Jane Hemstrich has dedicated herself to raising funds to support pancreatic cancer research.

Her fundraising team, "Team Phil", was established in 2011 in memory of her late husband, Philip. The team ran marathons in 2011, 2012 and 2013 to raise awareness and support for the Australian Pancreatic Cancer Genome Initiative.

In 2012, Jane also started the Philip Hemstrich Fellowship in Pancreatic Cancer Research at Garvan. Associate Professor Marina Pajic, at the time an early-career scientist, was the recipient and continues to be supported by the Fellowship. She now co-leads Garvan's precision medicine for cancer program and is working on a new targeted treatment for patients with pancreatic cancer. We are sincerely grateful for Jane's enduring commitment to our pancreatic cancer research; her foundational support has allowed for real progress to be made in the treatment of patients with pancreatic cancer.

***"Having lost both my husband Phil and his father Reg to pancreatic cancer I am passionate about research into treatments for this intractable disease. It has been an absolute delight to see Marina's progress and to support her efforts."*** – Mrs Jane Hemstrich





Image: Garvan's Dr Kate Patterson



# Healthy Ageing

Our scientists are leaders in ageing research, using some of the most advanced techniques to investigate degenerative diseases.



**From the head**  
Professor Katherine Samaras



*Healthy ageing relies on a complex mix of genetic, environmental and social factors. Age-related health conditions can come in many forms – changes to the nervous system can lead to Parkinson's disease, dementia, hearing loss and eye diseases, while changes to the cells that control metabolism can lead to diabetes. Skeletal diseases such as osteoporosis are also an important consideration, with bone disease estimated to impact almost a million Australians.*

*Patients are at the centre of Garvan's research. We are focused on addressing the unmet needs of those living with age-related diseases by increasing our understanding of these conditions, discovering new treatments and more effectively diagnosing conditions to ensure patients receive the best care at the right time so they can lead longer, healthier lives.*

*Our scientists are leaders in ageing research, using some of the most advanced techniques to investigate degenerative diseases. In 2021, we published groundbreaking discoveries including a new type of bone cell with important implications for the treatment of bone diseases such as osteoporosis. Our team identified for the first time the genes that control skeletal development and uncovered a link between bone loss and cognitive decline in women. We have also created new tools to help inform clinicians of the unique risks their patients face and how they might be mitigated.*

*At Garvan, we work closely with clinical collaborators and are conducting and preparing trials in diabetes, osteoporosis, dementia, Parkinson's disease and muscle maintenance. Our aim is to improve clinical outcomes and enable a healthier life as we grow older.*

## Research highlight

### New type of bone cell could reveal targets for osteoporosis treatment

Researchers at Garvan have discovered a new type of bone cell that may reveal new therapeutic approaches for osteoporosis and other skeletal diseases. The new cells, which the researchers term 'osteomorphs', are found in the blood and bone marrow, and fuse together to form osteoclasts which help break down and recycle old parts of the skeleton through a process known as resorption. This process is part of healthy development but can contribute to diseases such as osteoporosis if the resorption occurs faster than new bone is created.

The osteomorphs were first identified through intravital imaging of living bone tissue where the osteoclasts were observed splitting apart into smaller cells and then reforming as osteoclasts. The study identified that the osteomorphs have a unique genomic profile separate to osteoclasts that reveals promising and as yet unexplored targets for therapy for a number of skeletal diseases.

Much of our osteoporosis research is being made possible through the generous and enabling support of Mrs Janice Gibson and the Ernest Heine Family Foundation.



### Research highlight

## Cognitive decline may help predict future fracture risk in women

A 16-year study led by Garvan researchers has revealed a link between cognitive decline, bone loss and fracture risk in women. The association between cognitive decline and bone loss was weaker in men. The study of individuals aged 65 and older has revealed a potential new approach to help identify older people who may be at risk of fracture. Bone loss and cognitive decline are major public health issues, but both are 'silent diseases' that can go undetected and untreated for long periods, often until the conditions are severely progressed.

This study has revealed a link between the two in women, which suggests that cognition should be monitored together with bone health, as a decline in one could mean a decline in the other. These findings may help refine best practice guidelines of how cognition and bone health are monitored in older age, to ensure appropriate treatment can be more effectively administered. Additionally, the study showed that cognitive decline over the first five years was associated with a 1.7-fold increase in future fracture risk in women in the subsequent 10 years. This was independent of the level of bone loss. Around the world, 200 million people are affected by osteoporosis and more than 35 million by dementia – numbers which are expected to double over the next two decades due to a global increase in life expectancy.

### Research highlight

## Boosting body heat production: a new approach for treating obesity

A receptor that helps conserve energy when food is scarce may be the key to a safer approach to treating diet-induced obesity according to a new study from Garvan researchers. In a study using experimental models and fat tissue biopsies from obese individuals, the team revealed that blocking a specific receptor of the molecule neuropeptide Y (NPY), which helps our body regulate its heat production, could increase fat metabolism and prevent weight gain. The Y1 receptor

acts as a 'brake' for heat generation in the body. The study showed that blocking this receptor in fat tissues transformed the 'energy-storing' fat into 'energy-burning' fat, which switched on heat production and reduced weight gain. Most of the current medications used to treat obesity target the brain to suppress appetite and can have severe side effects that limit their use. The study revealed an alternative approach that targets the fat tissues directly, which may potentially be a safer way to prevent and treat obesity.

### Research highlight

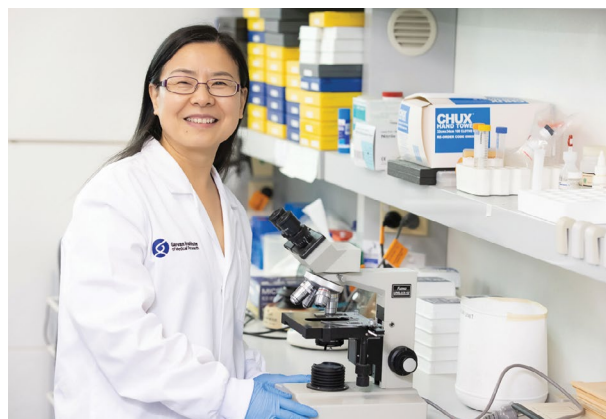
## New map reveals genes that control the skeleton

Research led by the Garvan Institute of Medical Research has for the first time mapped the unique genetic profile of the skeleton's 'master regulator' cells, known as osteocytes. The study outlines the genes that are switched on or off in osteocytes, a type of bone cell that controls how other types of cells make or break down parts of the skeleton to maintain strong and healthy bones. This new information provides a kind of genetic shortlist that clinicians and researchers can look to when diagnosing bone diseases that have a genetic component. Importantly, the majority of genes that were found to be active within osteocytes had no previously known role in bones. This discovery will help researchers understand what controls the skeleton, determine which genes are important in rare and common skeletal diseases, help identify new treatments that can stop development of bone disease and understand the impacts of current therapies, and also restore lost bone.

### Research highlight

## A 'skeletal age' calculator to predict bone fracture risk

Garvan researchers have developed a computational model to calculate 'skeletal age', a personalised estimate of an individual's risk of bone fracture and premature death. The skeletal age calculator, which will be accessible to doctors and health professionals, aims to better identify those at risk of a first bone fracture and subsequent fractures, and also estimates how fractures impact life expectancy. Existing models to



predict the risk of an initial fracture, such as the Garvan Fracture Risk Calculator, are already available to doctors. However, it was unclear why some individuals do well after an initial fracture, while others go on to sustain further fractures and have a higher risk of mortality. The team developed a sophisticated computational model which could simultaneously predict an individual's risk of subsequent fractures and consequently, their chance of premature death using data from Garvan's Dubbo Osteoporosis Epidemiology Study. Osteoporosis is a major national health issue and estimated to affect more than 900,000 Australians. The cost of osteoporosis and fracture in Australia is \$3.4 billion annually. The researchers hope the calculator will be a valuable tool for initiating discussions between health professionals and their patients on how to improve bone health, which may involve medication, exercise, increasing dietary calcium and getting enough vitamin D.

### Research highlight

## Vitamin D deficiency may impair muscle function

New research has uncovered a possible link between vitamin D deficiency and impaired muscle function, which could help older adults better maintain muscle strength as they age. The study led by a team at Garvan used experimental models to determine the effects of diet-induced vitamin D deficiency in the mitochondria of skeletal muscle cells. The results show that there is a clear link between vitamin D deficiency and oxidative capacity in skeletal muscle – an important measure of muscle health. Multiple studies have previously linked low vitamin D levels to poor muscle strength, particularly in older people. However, studying the role of vitamin D in muscle performance of older people has been difficult as other pre-existing health conditions can also affect their vitamin D status. After three months of diet-induced vitamin D deficiency, skeletal muscle mitochondrial function in the experimental models was found to be impaired by up to 37%. These findings suggest that vitamin D deficiency decreases mitochondrial function, as opposed to reducing the number of mitochondria in skeletal muscle



### Celebrating giving

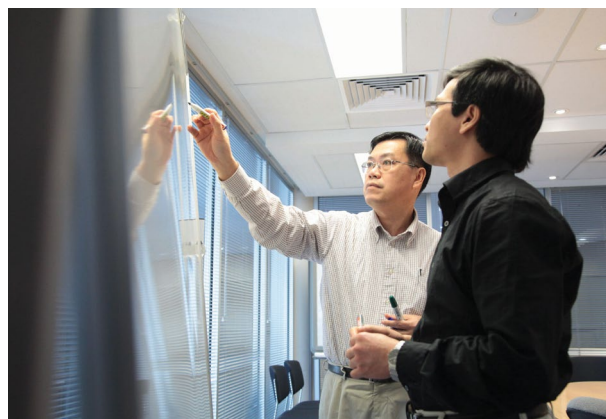
## Mr Des and Mrs Jan Sly

Mr and Mrs Des and Jan Sly have been donating to Garvan every year since 2008. They believe that, "medical research doesn't get the publicity that a lot of the major charities get, so it is very important to get behind and support these organisations."

The couple first heard of Garvan after attending a funeral where the attendees were asked to donate to the Garvan Institute of Medical Research in lieu of flowers. Sadly, both Jan's parents passed away after suffering from different forms of Alzheimer's disease and dementia. This inspired the couple to dedicate their gift to the purchase of crucial lab equipment for Alzheimer's disease research.

"As we are getting older, and it is a disease that is affecting larger numbers of the population, we decided we would prefer to donate to fund a specific piece of lab equipment rather than it just go into a pool of donations. Donating this way gives you a feeling of being connected and actually helping in the moment, rather than the Garvan researchers having to wait until funds are available," Jan and Des commented.

The timing of their gift was perfect. When Jan and Des reached out, Professor Joseph Powell was looking at an extension to the stem cell wet lab area for his cell culture work. The equipment arrived in June 2021 and the couple is planning a visit to see it in person and meet with Professor Powell later this year.



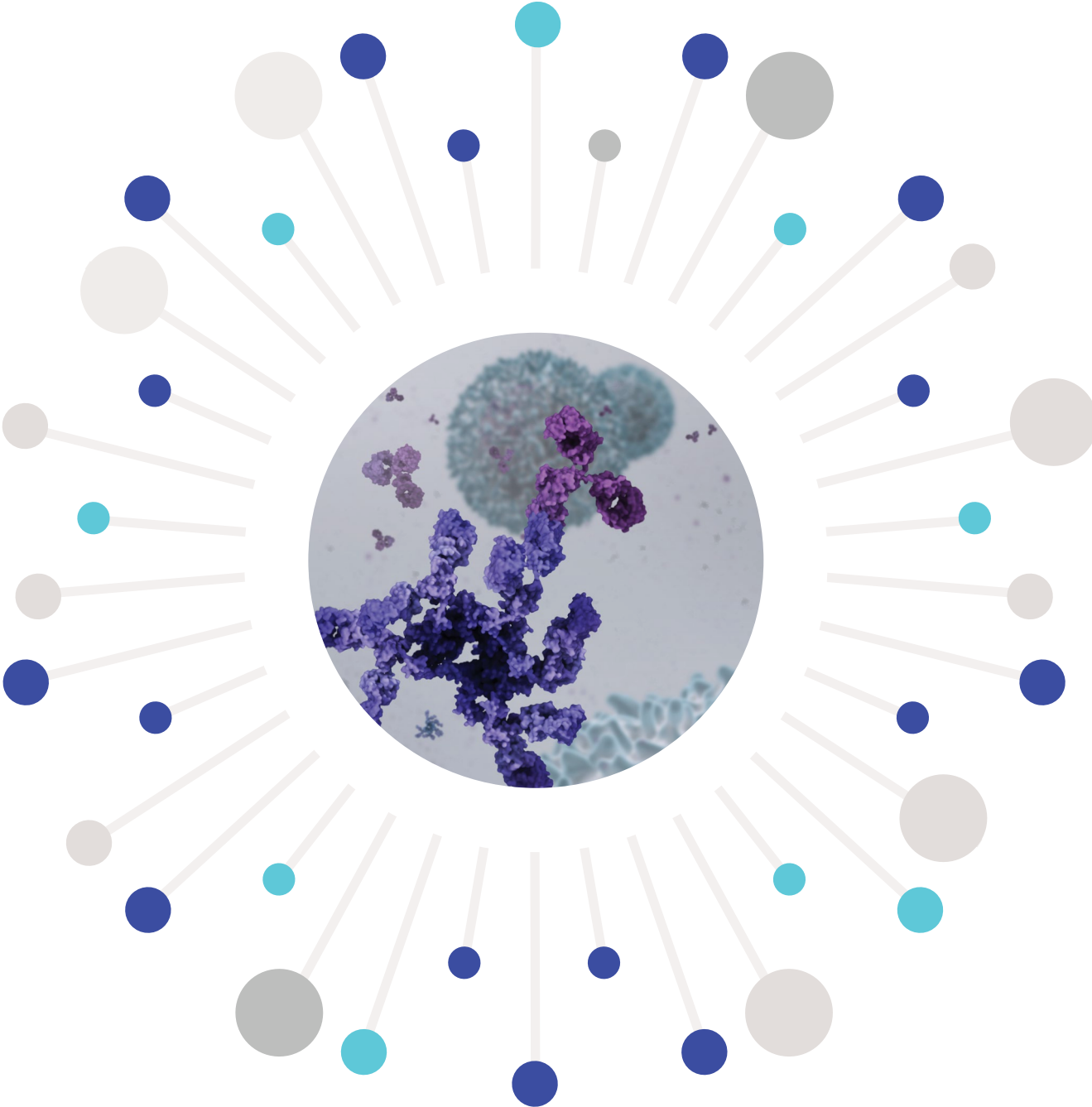


Image: Dr Ofir Shein-Lumbroso

# Immunity and Inflammation

Public awareness of the immune system and the vital role it plays in our health has remained high throughout 2021 as the global COVID-19 pandemic continued to unfold in new and unprecedented ways.



**From the head**  
Professor Stuart Tangye



*Public awareness of the immune system and the vital role it plays in our health has remained high throughout 2021 as the global COVID-19 pandemic continued to unfold in new and unprecedented ways. At Garvan, our expertise in this field presented the unique opportunity to study the evolution of the coronavirus and the impacts that infection with new and evolving variants has on our bodies.*

*Research programs that were activated at the start of the pandemic began to mature in 2021, showcasing the incredible knowledge and capability at Garvan and among our collaborators. These include Garvan leading the Oceania Hub of the COVID Human Genetic Effort (CHGE), which contributed to the discovery of the cause of severe COVID in 10-20% of cases, as well as identifying mechanisms to potentially improve vaccines against SARS-CoV-2. But alongside these important discoveries, our core mission of using pioneering technologies to understand the root cause of immune disease was pushed to new heights. Over the course of the year, we published important studies with collaborators in the Clinical Immunogenomic Research Consortium of Australasia (CIRCA), which uncovered the elusive cause of a rare genetic immune disorder affecting young children. The CIRCA program also identified three young adults who overcame an often-fatal immune disease thanks to spontaneous changes to their DNA.*

*Our research also uncovered new mechanisms within the immune system, including how antibodies make the switch to better immunity and a new immune defence mechanism as the cause of a severe inflammatory disease. These findings have inspired new studies that will continue the search for new ways to improve outcomes for patients with immune disease through new treatments and better diagnostic techniques.*

## Research highlight

### Tracking down the 'elusive' gene variant behind a devastating immune disorder

Garvan researchers discovered an elusive genetic variant to be the root cause of a debilitating immune condition affecting a young family. The team found that two young children in the same family had variations in a section of their DNA that does not code for protein production. This change impacted the DOCK8 gene that plays an important part in healthy immune function. Disruption to the DOCK8 gene causes a rare but often fatal condition known as DOCK8 deficiency, a disease characterised by severe and recurrent bacterial, viral and fungal infections, as well as allergies and eczema. Because this genetic variation was located outside of the 'protein-coding' region of the DOCK8 gene, it took a long time to pin down this genetic lesion as the cause of the children's poor health. By adopting a multidisciplinary approach involving a variety of advanced diagnostic tools, the Clinical Immunogenomic Research Consortium of Australasia (CIRCA) team was able to initially recognise this condition without a genetic confirmation. This led to two of the children being successfully treated by bone marrow transplantation. Once the genetic defect had been identified, the researchers were able to screen three other children in the family and confirm that they would not develop DOCK8 deficiency. This discovery highlights that we are continually learning more about which gene variants can impact health, and how important it is to have other tools such as RNA sequencing to complement whole-genome sequencing in providing diagnoses to patients.



### Research highlight

## Inherited immune condition reversed by random DNA change

Researchers at Garvan have discovered that three patients with a severe genetic immunodeficiency spontaneously repaired the harmful variants in their DNA and restored normal immune function over time. As cells grow and divide to produce new cells, DNA is copied from the parent cell to provide instructions for the new daughter cells. Random changes that occur as the DNA is copied are usually harmless but in some cases are associated with the development of diseases like cancer. However, the Garvan-led Clinical Immunogenomics Research Consortium Australasia (CIRCA) found three patients with DOCK8 deficiency had repaired the faulty genes through a rare DNA change known as somatic reversion. DOCK8 deficiency is a rare, inherited condition caused by errors in the DOCK8 gene and is characterised by recurring bacterial, viral and fungal infections, as well as severe allergic reactions and some cancers. Unexpectedly, one patient in the CIRCA network with DOCK8 deficiency and two from overseas also underwent somatic reversion. This surprising discovery has implications for future therapies and treatments for the often-fatal disease.

### Research highlight

## The unleashed virus defence at the root of a spectrum of diseases

Researchers have identified a new immune defence mechanism as the cause of a severe inflammatory disease affecting two unrelated children, explaining a mysterious set of skin, brain and blood diseases that arise when this defence system fails to be kept on a tight leash. Led by the Garvan Institute of Medical Research, the team discovered that specific changes in a gene called SAMD9L unleashed an immune response that normally activates in our body's cells only after they are infected by a virus. Alterations to the SAMD9L gene changes in the two children revealed how the leash works.

This research reveals a new immune defence mechanism that explains a string of inherited diseases that have been confounding doctors around the world: sometimes presenting as brain disease affecting balance and coordination, sometimes as a dangerous lack of blood cells, and sometimes as life-threatening inflammation of the skin and other vital organs. These findings will help identify future cases of these rare conditions, which will help clinicians make decisions more quickly regarding the patient's treatment.

### Research highlight

## How antibodies make the switch to better immunity

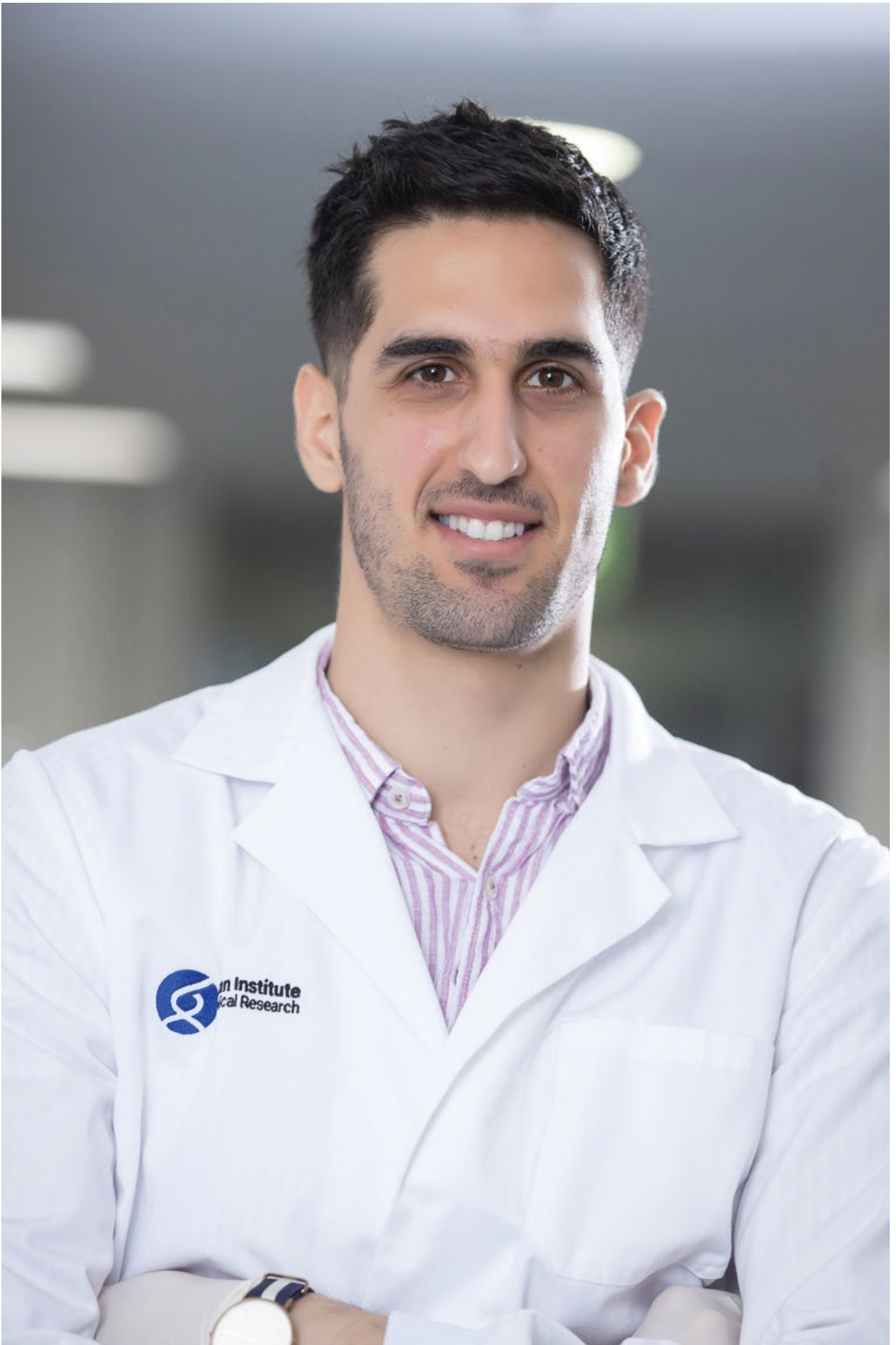
Researchers have uncovered how antibodies that are specialised to different immune 'disposal systems' become the dominant form in the bloodstream, a process which is critical to our immune system's ability to destroy pathogens and a key objective for the development of effective vaccines. Findings led by the Garvan Institute have revealed this new form of antibody selection happens in germinal centres – the body's 'antibody tuning centres' located in lymphoid organs such as the lymph nodes, spleen and tonsils. This new mode of selection is based on the antibody's constant region, which is responsible for activating immune cells and pathways that can dispose of foreign antigens. Interestingly, the team discovered that this process happens in parallel with affinity selection. This research is another piece of the puzzle in our in-depth understanding of the processes that occur in the germinal centre. It will underpin the design of experimental models of immune disease that will help researchers develop new therapeutic approaches in future.

### Celebrating giving

## Paul & Judy Hennessy: The Stuart Furler Travel Award

Stuart Furler was a long-serving member of the Diabetes and Obesity Research Group at Garvan. He sadly passed away from pancreatic cancer in 2006 at the age of only 57 years. Family members Paul and Judy Hennessy, keen to honour his lifelong commitment to the nurturing of early-career scientists, established the Stuart Furler Travel Endowed Fund at Garvan in his memory. Each year, two third-year PhD students are awarded \$5,000 each to present a poster or talk at a major international conference relevant to their field of research, as well as to visit research groups overseas to discuss potential collaborations and/or postdoctoral positions.

Annually, these sought after and competitive awards provide impactful and motivational support to Garvan's PhD students. Dr Deborah Burnett, a Research Officer in the Immunogenomics Lab, was a lucky recipient in 2017. She says, "This award came at a critical time of my career as I completed my PhD and was exploring options for the next stage of my research development. The receipt of this award allowed me to travel to and present my work at several laboratories in Germany, Italy, France and Switzerland, as well as at an international Keystone Conference in Germany. Not only did this travel experience allow me to establish my international profile in the field of immunology research, but it allowed me to develop a long-term and ongoing collaboration with a laboratory in Germany. I later travelled back to this laboratory after receiving a DAAD Short Term Research Grant, to learn a critical research technique that I was then able to bring back and establish at Garvan. I am very thankful for the receipt of the Stuart Furler Award and I genuinely believe it changed the direction of my future career in science."



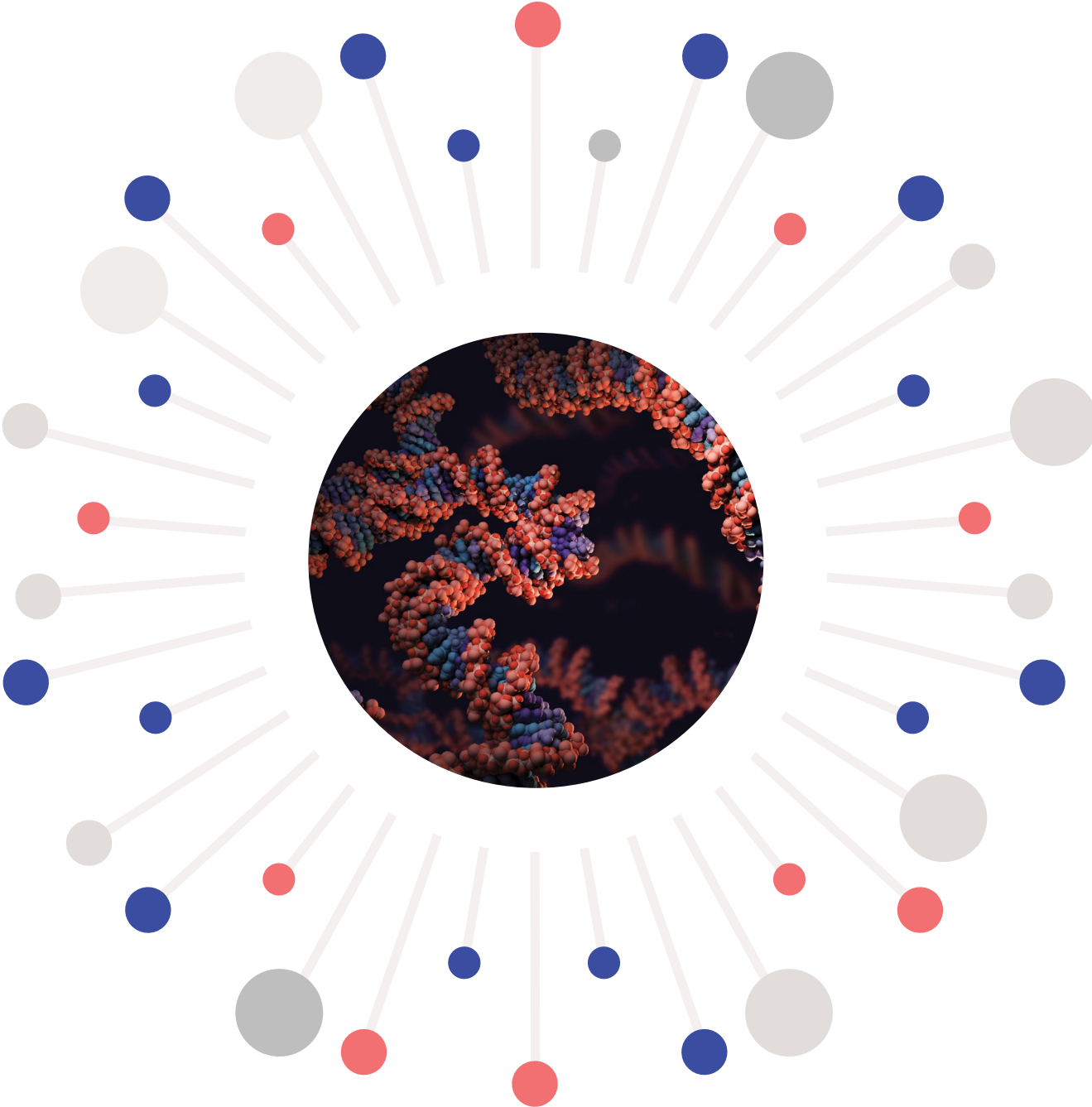


Image: Garvan's Dr Kate Patterson



# Genomics and Epigenetics

Our understanding of our DNA has advanced in leaps in bounds since its humble beginnings.



**From the head**  
Professor Susan Clark FAA FAHMS



*Our understanding of our DNA has advanced in leaps in bounds since its humble beginnings. Only 30 years ago, a global team of scientists began working on The Human Genome Project to transform the science of our DNA. Now, a generation later, DNA sequencing is a routine and invaluable cornerstone of our healthcare system.*

*Genomics has been shown to underpin almost every aspect of health. It drives the latest advances in the research and treatment of most disease types while playing an increasingly integral role in international policy making during the course of the COVID-19 pandemic. Yet there is still tremendous opportunity to further explore and understand the six billion-letter code of our DNA and how it gives rise to every cell, tissue and organ in our bodies.*

*These advances are further guided by the field of epigenetics – the study of the chemical modifications of DNA that influence how our same DNA sequence can be read differently across different cellular contexts. Our researchers at Garvan are world leaders in this field. We are investigating how epigenetic changes to DNA control cell development and how changes to epigenetic patterns contribute to some of the most devastating diseases, including cancer.*

*To study the epigenome, we are using and helping to develop new sequencing approaches to uncover the array of chemical modifications on the DNA. High-performance visualisation and computational tools reveal an unprecedented level of detail in our understanding of how alterations to DNA can change cell behaviour.*

*In 2021, we used our expertise to analyse the 3D structure of the coronavirus to help visualise how it functions and potentially identify different locations on the virus' surface that could be targeted by new vaccines and therapies. Our studies of the epigenome also uncovered how changes to methylation tags on genes can affect the way DNA is copied and influence the development of cancer cells.*

## Research highlight

### Epigenetic change found in cancers linked to DNA's 3D instability

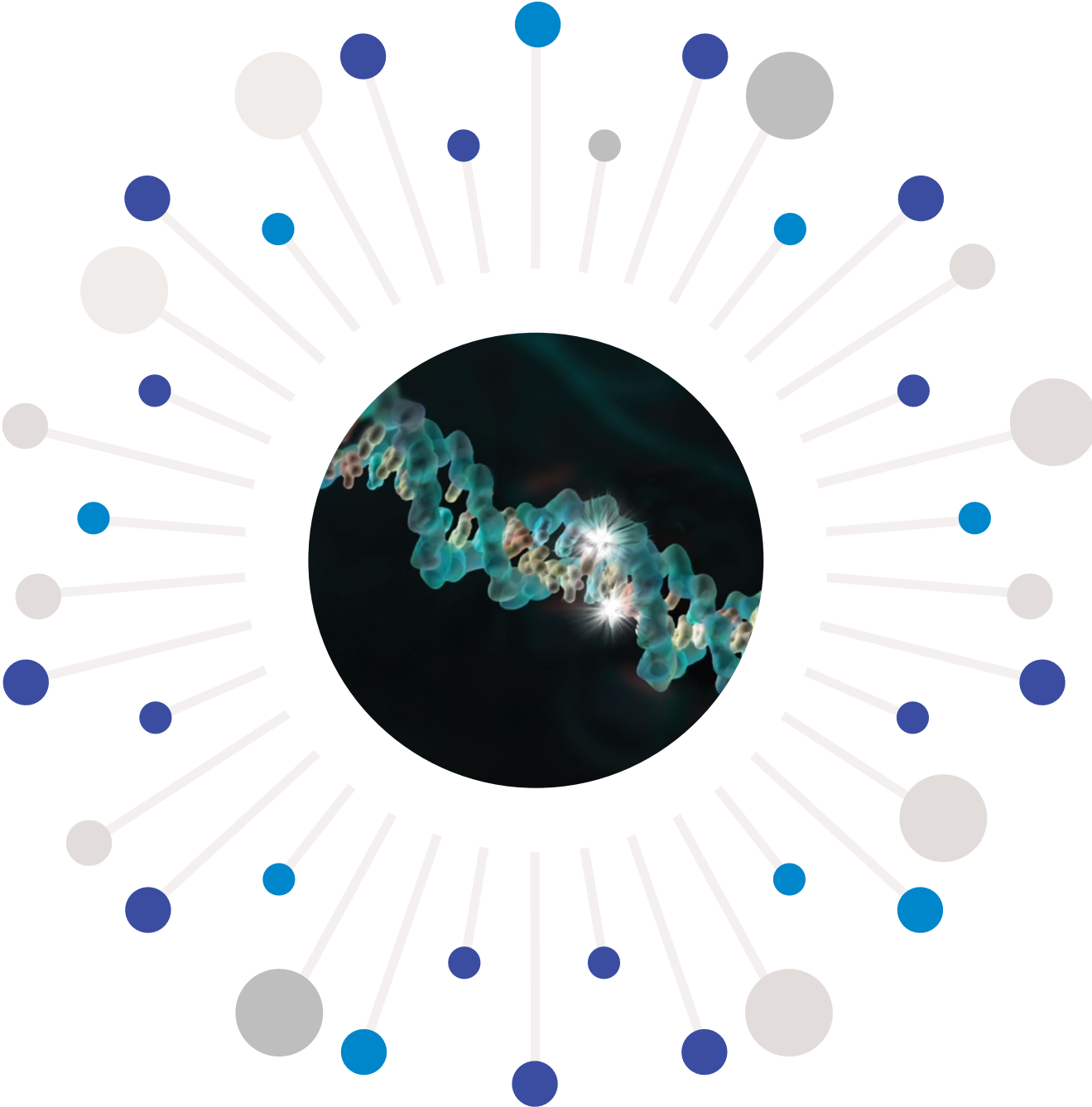
Researchers led by the Garvan Institute have discovered new insights into DNA demethylation – a change to the 'epigenome' (the additional layer of instructions on our DNA) that occurs gradually as we age and is found at high levels in many cancers. Using a single-cell analysis technique developed at Garvan, the team has revealed that demethylation can change the sequence in which DNA is copied when cells divide and also destabilise DNA's three-dimensional structure.

The findings provide potential new insights on cancer formation and may have implications for the impact of epigenetic therapies, which are already undergoing clinical trials. This study provides evidence that DNA methylation is more than just something that controls how DNA is read – it clearly plays a key role in the way the DNA is organised in our cells in three dimensions.

## Research highlight

### 3D analysis of SARS-CoV-2 reveals clues on virus tactics

The most comprehensive analysis of the 3D structure of SARS-CoV-2 to date has revealed new insight on how the virus infects human cells and replicates. A team led by Garvan and including the CSIRO's Data61 compiled more than 2,000 different structures involving the coronavirus's 27 proteins. The analysis identified viral proteins that 'mimic' and 'hijack' human proteins – tactics that allow the virus to bypass cell defences and replicate. These structural models can be freely accessed from the Aquaria-COVID resource, a website designed by the team to help the research community 'zoom in' on potential new targets on the virus for future treatments or vaccines, and crucially investigate new virus variants. The Aquaria-COVID resource contains a level of detail of SARS-CoV-2's structure that is not available anywhere else, giving an unprecedented insight into the virus' activity and highlighting key mechanisms used by the coronavirus; these mechanisms, in turn, may guide the development of new therapies and vaccines.



# Kinghorn Centre for Clinical Genomics

The Kinghorn Centre for Clinical Genomics (KCCG) is a key part of Garvan's bench-to-bedside approach to medical research, supporting the translation of foundational genomics into clinical care.



**From the heads**  
Mary-Anne Young



Associate Professor  
Sarah Kummerfeld

*The Kinghorn Centre for Clinical Genomics (KCCG) is a key part of Garvan's bench-to-bedside approach to medical research, supporting the translation of foundational genomics into clinical care. The KCCG helps lay the groundwork to accelerate genomic discoveries and effectively translate genomic information into actionable health care.*

*One of the most prominent examples of this work is our ongoing work using world-leading genomics technologies to advance disease diagnosis. Our expertise in this field has been successfully shared with Australia's health authorities to help monitor the COVID-19 pandemic and the genomic variations between evolving strains of the virus. This same technology can also be applied to other areas of health, such as cancer care. One such project has validated the use of DNA sequencing to detect fragments of DNA from cancerous cells that break off from a tumour and circulate around the body through the bloodstream. This breakthrough will have important implications for cancer diagnosis, patient care and clinical outcomes.*

*We have continued to collaborate with and support world-leading clinical research programs including the Lions Kids Cancer Genome Project, the Australian Genomics Health Alliance KidGen 'HIDDEN' Real Genetics Project and the Clinical Immunogenomics Research Consortium Australasia (CIRCA).*

*The Kinghorn Foundation and their ongoing catalytic philanthropic investment in the KCCG has been vital to the Centre's success. We are grateful to the Foundation and look forward to taking our research, translation and scientific collaborations to new heights in the coming year.*

## Research highlight

### Cancer DNA blood tests validated by international research team

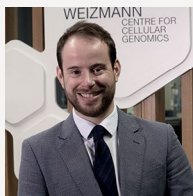
An international team, led by the Garvan Institute, conducted an independent assessment of five commercially available assays for tumour DNA sequencing – a fast, cheap and less invasive method to diagnose and monitor cancer. When cancer cells develop, they accumulate mutations in their DNA, fragments of which enter the bloodstream when cancer cells break down and are known as circulating tumour DNA (ctDNA). Thanks to assays employing next-generation sequencing, these ctDNA fragments can now be detected in a patient's blood samples, which could be used to identify and monitor cancer as an alternative to more invasive tissue biopsies.

The researchers revealed that all assays could reliably detect ctDNA when it made up 0.5% of the total DNA in blood, a level of sensitivity that allows detection, genetic analysis and monitoring of late-stage and metastatic tumours. The study is a major milestone for the use of ctDNA assays as cancer diagnostics, outlining best-practice guidelines and uncovering key areas of future development. The research forms part of the United States FDA-led Sequencing Quality Control Phase 2 project, which aims to develop standard protocols and quality control metrics for the use of next-generation sequencing in precision medicine, to make it a reality for patients. This study is the most comprehensive evaluation of analytical performance among ctDNA assays to date and represents a significant step forward in the field.



# Garvan-Weizmann Centre for Cellular Genomics

The Garvan-Weizmann Centre for Cellular Genomics is one of the most sophisticated, high-throughput cellular genomics facilities in the world, internationally recognised and uniquely positioned to accelerate research from the lab to the bedside.



## From the head

Professor Joseph Powell

*Cells are the foundational unit of life. To understand the complex human biology that underpins disease, we must understand the fundamental role different cell types play before we can advance health diagnostics, medical treatment and preventative measures.*

*The Garvan-Weizmann Centre for Cellular Genomics is one of the most sophisticated, high-throughput cellular genomics facilities in the world, internationally recognised and uniquely positioned to accelerate research from the lab to the bedside. Our cellular genomics research is aimed at revealing how individual DNA profiles influence disease risk. Thanks to years of work, we are now in an exciting position to translate these findings into new diagnostic tests, precision treatments and launch initiatives to uncover new therapeutic targets.*

*Throughout 2021, our collaborations with clinicians in Australia and overseas enabled us to analyse patients' samples using our latest platforms in cell isolation, analysis, high-performance computing and bioinformatics. This research is carried out in partnership with the UNSW Cellular Genomics Futures Institute and the Innovation Centre at the Victor Chang Cardiac Research Institute.*

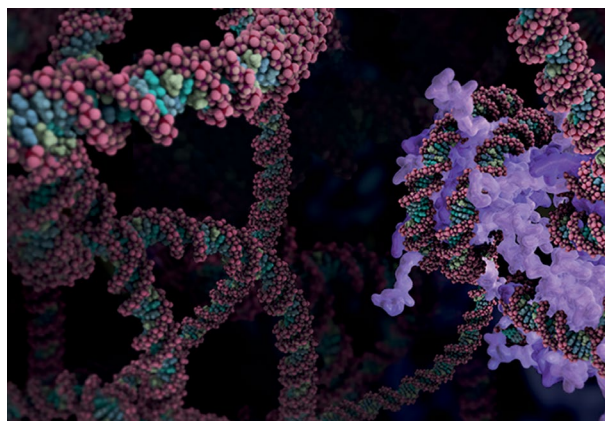


## Research highlight

### Study shows vast potential of genomics-driven medicine approaches

Research led by the Garvan Institute has made a crucial step forward in the understanding of how our own DNA information influences our personal disease risk, thanks to cutting-edge cellular genomics technology. By analysing the gene activity of 64,018 individual skin cells, the team revealed for the first time that common DNA variants – the kind that make each individual unique – have distinct effects on the gene activity of different cell types.

In their study, the researchers identified the eQTLs in skin biopsies from 79 individuals. But instead of analysing the gene activity in 'bulk', the team used cellular genomics to measure the gene activity of 64,018 cells individually. They discovered 29,800 eQTLs, of which only 12% could be pinpointed in 'bulk' biopsy samples. The rest acted in a cell type-specific manner. As a result, the team was able to link, in unprecedented detail, the genetic effects of the individuals' personal DNA variation to the gene expression of their different cells. These findings are a crucial proof-of-principle step that demonstrates the potential of harnessing cellular genomics for personalised medicine. The research forms part of a global effort to map disease-causing genes and demonstrates the significant potential cellular genomics technology has for developing more personalised ways to diagnose and treat disease.



### Research highlight

## New discovery to advance genomics-driven precision medicine

By analysing genomic data from more than 30,000 people, an international team has revealed thousands of new regulatory regions that control disease-linked genes – a resource that is now available to researchers worldwide. The findings, co-led by the Garvan Institute, are a significant step forward for genomics-driven precision medicine and could help identify markers that reveal which patients will benefit most from which treatment.

In this study, the researchers used specialised machine-learning algorithms to analyse genomic data from the blood samples of 31,684 individuals to uncover new regulatory regions on the human genome known as expression quantitative trait loci (eQTLs). By pinpointing these eQTLs, researchers are able to better understand which genes directly contribute to disease risk and which could be targeted with precision treatments. This study provides an entirely new view of genetic regulation by uncovering an in-depth picture of how genes and disease are linked. It is the most comprehensive analysis of how human genetic variation affects gene expression to date.

### News highlight

## Australian Academy of Science honours Professor Joseph Powell

For his pioneering work in cellular genomics, Professor Joseph Powell has been awarded the prestigious 2021 Ruth Stephens Gani Medal from the Australian Academy of Science. The Ruth Stephens Gani Medal is awarded annually to recognise outstanding contributions to research in human genetics, including clinical, molecular, population and epidemiological genetics, and cytogenetics. Professor Powell, who is Director of the Garvan-Weizmann Centre for Cellular Genomics and Deputy Director of the UNSW Cellular Genomics Futures

Institute, is among 24 researchers to be recognised with honorific awards by Australia's most prestigious scientific organisation. Professor Powell's research is focused on understanding how differences in DNA act at the level of individual cells – the building blocks of the human body. He works at the cutting edge of cellular genomics technology to investigate why diseases arise in different cell types, and how they can be diagnosed and treated more precisely by targeting the disease-driving cell populations.

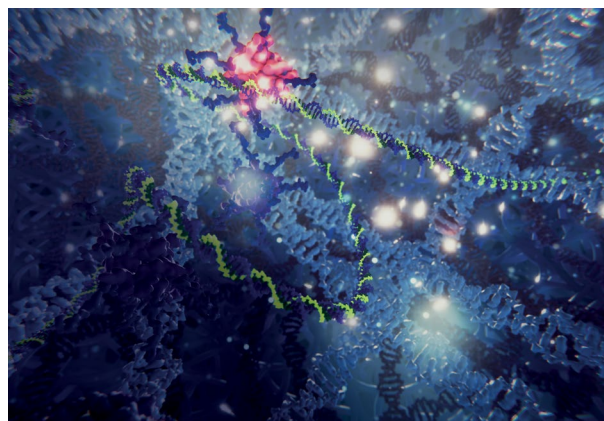
The ultimate aim of Professor Powell's research is to identify how new therapeutics can be developed based on the genetic and cellular profile of patients. His work also aims to determine how DNA differences between people lead to differences in their response to existing treatments, and to determine which therapy will give the best outcome for each patient.

### Celebrating giving

## The Renshaw Foundation

2021 marked a decade of The Renshaw Foundation being involved with Garvan, and significantly, the year they became Governors. With more than 35 years' experience in the global pharmaceutical industry, Mr Maurice Renshaw, Director of the Renshaw Foundation, has a personal and professional interest in medical research. Recognising that Garvan investigates many diseases and leads a number of diverse, high-impact medical research projects, rather than supporting only a specific disease or area of medical research, The Renshaw Foundation chose to direct this generous donation to support the areas of most pressing need at Garvan. Mr Renshaw says, "we are very pleased to support the dedicated scientists at Garvan to help translate their research and brilliant ideas to innovative clinical practice to improve the quality and length of life."

We are incredibly grateful to Mr Renshaw and The Renshaw Foundation for this donation, which will help fund scientists to continue their crucial work.



# The rise of population genomics

The next decade will see a transformation of medicine and biology, key to this evolution is population genomics.

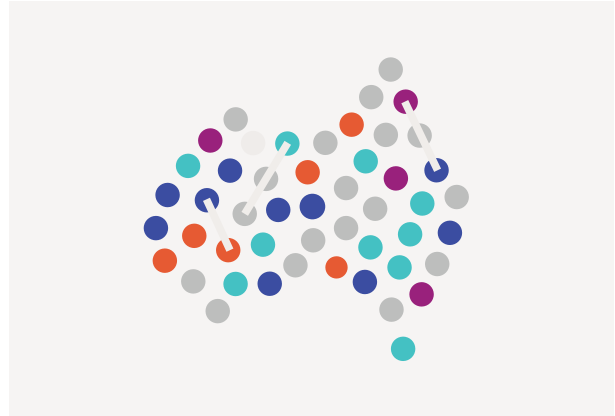
**As the world moves from a standardised to an individualised model of care built around deep genomic data from every patient, major challenges lie ahead for Australia to reach its full potential in utilising genomic medicine to treat disease.**

Currently, a lack of significant national experience and infrastructure for the management of very large genomic data sets, combined with the fact that many Australian communities are not currently represented in global genomic reference databases, leaves us at risk of being left behind in this medical revolution.

Overcoming these challenges will require expertise and investment in population genomics: the generation and analysis of massive-scale data sets of human genetic variation, combined with information on health and clinical outcomes.

Big data has the potential to power unparalleled advancements in human health, but this progress will be limited by the quality, magnitude and diversity of the genomic data available to researchers and clinicians. Today, existing databases relied on by researchers worldwide are based primarily on data from people of European and American descent. The remarkable diversity of Australia, in part due to more than a quarter of our population being born overseas, means that at least 3.5 million people come from communities that are largely or entirely missing from genomic databases. Accurate disease diagnosis for severe genetic disease is much less likely for people from genomically underrepresented communities, which includes people of Aboriginal and Torres Strait Islander backgrounds and many other Australians of non-European ancestry.

In 2021, the Centre for Population Genomics (CPG) was launched as a partnership between the Garvan Institute of Medical Research (Garvan) in Sydney and the Murdoch Children's Research Institute (MCRI) in Melbourne. Led by Professor Daniel MacArthur, the CPG leverages the complementary strengths of both medical research institutes: Garvan's leadership in genomics and the handling of large-scale datasets, alongside MCRI's deep expertise in working with large cohorts of children with rare paediatric diseases, and the translation of research findings into clinical outcomes.



Population genomics has the potential to be transformative to rare disease patients in Australia through faster and more accurate diagnosis. The CPG will provide patients with desperately needed answers, and empower these individuals and their families to make informed decisions about their healthcare and potential treatment. With hundreds of thousands of Australians suffering from undiagnosed rare disease, many from genomically under-represented populations, the expansion of existing genomic databases will provide answers for tens of thousands of Australians.

The CPG will strive to make genome-driven medicine a reality for all Australians through comprehensive disease prediction, accurate diagnosis and effective treatment for all the people of Australia. It aims to advance knowledge, drive innovation in genomic medicine, improve health equity and change the landscape of the Australian healthcare system for the better, enabling global access to these advances, with open access science a key principle of the Centre.

The work of the CPG will enable the application of population genomics at scale and fast-track its integration into routine healthcare across Australia, with a tangible and immediate impact on the lives of patients and their families.

***“Australia’s diversity, scientific talent, and healthcare system represent an incredible opportunity for us to lead the world in genomic medicine. We need to build that future in a way that ensures no Australian is left behind.”***

– Professor Daniel MacArthur, Director,  
Centre for Population Genomics

# Seeing in the dark

In 2021, the ACRF INCITe Centre was established, enabling researchers to image the 'dark space' of cancer for the first time.

**Thanks to a generous grant of \$3 million from Australian Cancer Research Foundation (ACRF), the Garvan Institute established the ACRF Centre for Intravital Imaging of Niches for Cancer Immune Therapy (ACRF INCITe Centre), a custom-built microscopy centre to image the 'dark space' of cancer-immune interactions, which will enable new advances in cancer research.**

Based at the Garvan Institute, the ACRF INCITe Centre houses two Australian-designed microscopes – the 'EndoNICHEscope' and 'Molecular NICHEscope' – that will enable researchers to see immune cells and molecules at the cancer site move and interact in real time – below the surface of tumours and deep inside tissues.

The Centre will address a major challenge in the treatment of cancer: why some patients respond to immunotherapies, designed to arm the immune system against cancer, whereas others do not.

"Cancers hide from the immune system in highly complex and dynamic environments that can't be visualised by conventional microscopes," says Professor Tri Phan. "The custom-built microscopes in the ACRF INCITe Centre will overcome the current limitations and allow us to finally answer questions that we have not been able to address before. Our goal is to make a promising cancer therapy even more effective for patients."

Immunotherapy has greatly advanced cancer treatment over the past four decades and is highly effective for some cancer patients, including for half of those with advanced melanoma. However, immunotherapy is effective in less than 30% of patients with advanced lymphoma, or kidney, bladder or lung cancer; for those affected by breast, prostate or pancreatic cancer, the treatment is rarely effective.

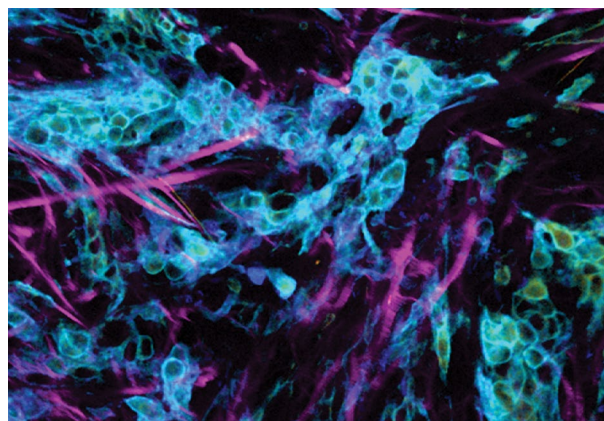
"For immunotherapy to be more effective, we need to bridge the gap in our understanding of how cancer cells interact with their local microenvironment to adapt to constantly changing conditions and how they evade immune destruction. These interactions are often short-lived and occur in sites that are inaccessible to visualisation by conventional microscopic techniques," says Associate Professor Marina Pajic.

The ACRF INCITe Centre will enable researchers to see inside tumours at unprecedented temporal and spatial resolutions. "This is the first intravital imaging centre dedicated to studying cancer-immune cell interactions in vivo and at the molecular level. It will give us a comprehensive view of how the immune system can work to fight cancer," says Professor Paul Timpson.

The INCITe Centre unites an interdisciplinary team of world-class experts in cancer biology, physics and engineering at the Garvan Institute, the Australian National University, University of Technology Sydney, QIMR Berghofer, Harry Perkins Institute of Medical Research, the Centre for Cancer Biology and Olivia Newton-John Cancer Research Institute.

Collaborators from 23 research labs from across Australia will access the technology via a virtual network to investigate fundamental cancer biology, the role of cells, molecules and genes that regulate cancer-immune interactions, and new therapeutic approaches to enhance immunity against cancer.

The researchers will address crucial questions, such as how immune cells can be activated in a breast cancer, how cancer-immune interactions can be manipulated to target cancer cells lying dormant in niches of bones, and how cancer cells use 'immune cloaking' to stay undetected.



# COVID-19

Medical research has proven to be an invaluable part of the effort to protect people around the world from COVID-19 infection.

**Throughout 2021, the vaccines that were developed in record time helped save millions of lives by reducing the severity of disease, limiting the spread of the virus and minimising people's risk of infection. Meanwhile, ongoing research into how the virus spreads and mutates has given health authorities vital insights into how they can prepare for future strains and limit the impacts of the COVID-19 crisis into the future. Scientists at the Garvan Institute of Medical Research have been an integral part of this progress.**

Our excellence in antibody research, immunology, cellular genomics and whole-genome sequencing perfectly positions us to deliver valuable contributions to the global fight against COVID-19. Yet, at the same time, our researchers have also maintained their ongoing research into cancer, diabetes and metabolism, diseases of the immune system, diseases of bone and neurodegeneration, as well as genomics and epigenetics to ensure all aspects of our health can be safeguarded into the future.

## Research highlight

### Researchers reveal a strategy for next-generation COVID-19 vaccines

Existing variants of coronavirus, such as the Delta strain, have already partially reduced the efficacy of antibodies generated by current vaccines to prevent COVID-19 infection, although they remain highly effective at preventing death and hospitalisations. However, a study led by the Garvan Institute has revealed a guide to developing COVID-19 vaccines that both prevent the coronavirus from infecting human cells and that are more resistant to evolving viral strains. The team's key criteria for antibodies generated by future vaccines are to target regions of the SARS-CoV-2 viral surface that are unlikely to mutate and share key features that the researchers found could block the virus from infecting human cells.

Remarkably, the researchers found in experimental models that immunising with surface proteins from related viruses, such as SARS-CoV-1, the virus responsible for the original 2003 SARS epidemic, generated antibodies that met these criteria. Around 80% of antibodies formed in the experiment bound to the 'class 4 epitope' region, which is conserved among coronaviruses and may therefore be less likely to mutate in the future. In contrast, when the experimental models were immunised with a SARS-CoV-2 protein, the antibodies targeted regions of the coronavirus spike protein that are prone to mutations that allow the virus to easily escape. These findings indicate that targeting SARS-CoV-2 may not be the most effective vaccination strategy moving forward, and that immunising against a related virus may produce an antibody response that has greater resistance against emerging strains.





## Research highlight

### What's behind the common COVID-19 vaccine side effects?

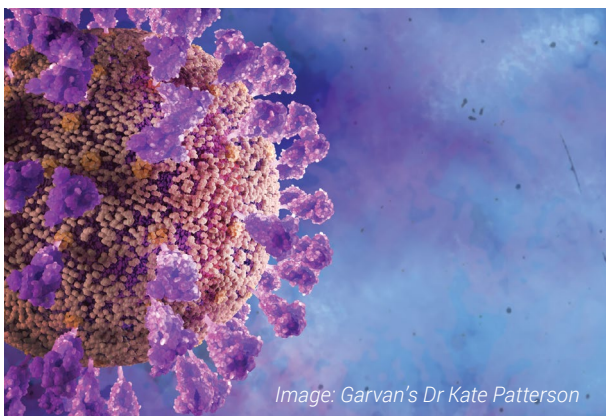
After receiving a COVID-19 vaccine, many experience mild yet common symptoms, such as headache, fatigue and muscle pain – side effects reported by hundreds of thousands of Australians in a national survey. These vaccine side effects have led to hesitancy in some younger people, who may have more symptoms following a COVID-19 vaccine than during an infection with coronavirus itself. However, these common post-vaccine side effects are a reassuring sign that the immune system is doing its job in responding to the vaccine. They signal type I interferon production – the body's in-built immune stimulator that elicits a powerful immune response to eliminate the pathogen and also generates memory immune cells that protect against re-infection.

During an infection with a viral pathogen, the immune system jumps into action. A crucial part of this response is the immune molecule interferon. Named for its ability to 'interfere' with virus replication, interferon rapidly signals cells to heighten their defences and prevent viruses from replicating in human cells. Interferon then begins to act on immune cells, causing B cells to expand and produce specific antibodies that enter the bloodstream to inactivate the virus. At the same time interferon stimulates T cells to destroy cells that have ingested the virus. Together the combined attack by these two types of immune cells eliminates the pathogen quite quickly. Meanwhile, interferon stimulates some of the specific T and B cells generated during the initial infection to survive and

form long-lived memory cells, which provide long-term protection against a second encounter with the same pathogen.

Although direct evidence is still lacking, it is highly likely that the side effects of COVID-19 vaccines are simply a reflection of strong interferon production. In fact, therapeutic injection of interferon, which is currently used to treat hepatitis B and hepatitis C infections and multiple sclerosis, is known to induce the same side effects as COVID-19 vaccines.

However, because SARS-CoV-2 may suppress interferon production, young people who are more likely to have only mild symptoms from the virus may experience more pronounced side effects from the vaccine. Young people and women naturally make more interferon, and they are also the group that has the most side effects to the COVID-19 vaccine. Thankfully, these symptoms are mild and pass quickly and indicate that vaccine is doing its job of stimulating the immune system to protect against disease.



# PhD completions 2021

## Congratulations to all Garvan students awarded PhDs and Masters in 2021.

At Garvan, we have postgraduate students researching in almost every disease area across the Institute. In partnership with UNSW Sydney, through which most of our students are enrolled, Garvan is committed to supporting the important contributions our students make in the development of scientific knowledge and skills for the future.

### **Kai Lun Lee**

Supervised by Ross Laybutt & Jeng Yie Chan  
*"The role of XBP1 and the adaptive unfolded protein response in beta-cell compensation and survival in conditions of increased metabolic stress"*

### **Megan Crumbaker**

Supervised by Anthony Joshua & Vanessa Hayes  
*"Clinical applications of genomic analyses in prostate cancer"*

### **Oliver Skinner**

Supervised by Mike Rogers & Marcia Munoz  
*"New insights into the link between protein prenylation and inflammation using models of mevalonate kinase deficiency (MKD)"*

### **Anthony Lau**

Supervised by Elissa Deenick & Stuart Tangye  
*"An investigation into the impact of dysregulated PI3K $\delta$  signalling on B cell development and autoimmunity"*

### **Tingting Gong**

Supervised by Vanessa Hayes & Eva Chan  
*"Structural variations: detection and annotation in cancer genomes"*

### **Sunny Wu**

Supervised by Alex Swarbrick, Daniel Roden & Aurelie Cazet  
*"Elucidating the functional diversity of stromal cells in breast tumours using single-cell and spatial transcriptomics"*

### **Andre Martins Reis**

Supervised by Timothy Mercer, James Blackburn & Ira Deveson  
*"The development of reference standards for genomics"*

### **Sara Wahlroos**

Supervised by Elgene Lim & David Gallego-Ortega  
*"Effect of exercise alone and in combination with systemic therapy on breast cancer"*

### **Lisa Ewans**

Supervised by Marcel Dinger, Tony Roscioli & Sarah Kummerfeld  
*"An analysis of next generation sequencing in Mendelian disorders: diagnostic potential and clinical utility"*

### **Sarah Alexandrou**

Supervised by Liz Caldon & Elgene Lim  
*"Elucidating the mechanisms of resistance to CDK4/6 inhibitors and endocrine therapy in ER+ breast cancer"*

### **Andrew Law**

Supervised by David Gallego Ortega, Fatima Valdes Mora, Christopher Ormandy & Samantha Oakes  
*"Strategies for targeting the tumour microenvironment using high fidelity 3D culture systems"*

### **Megan Barnett**

Supervised by Christopher Goodnow, Joanne Reed & Susan Clark  
*"Exploring germline contribution to response and toxicity to treatment with anti-PD-1/PD-L1 for non-small cell lung cancer by whole genome sequencing"*

### **Ghamdan Al-Eryani**

Supervised by Alex Swarbrick, Simon Junankar & Tri Phan  
*"Development and implementation of multimodal single cell technologies for human immune profiling"*

### **Etienne Masle-Farquhar**

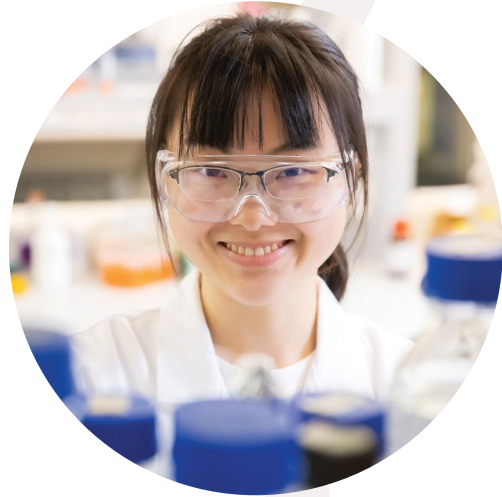
Supervised by Christopher Goodnow  
*"Understanding gene mutations driving autoimmune disease and lymphoid malignancy"*

### **James Torpy**

Supervised by Alex Swarbrick & Nenad Bartonicek  
*"An investigation of genomic instability and its impact on cancer development and heterogeneity"*

### **Sam Ross**

Supervised by Ozren Bogdanovic & Susan Clark  
*"Canonical and non-canonical DNA methylome dynamics during vertebrate development"*



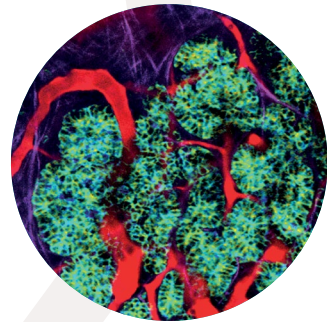
## Masters of Science

### **Natasha Masand**

Supervised by Ozren Bogdanovic & Susan Clark  
*"Epigenetic regulation of evolutionarily conserved cancer/testis antigens"*

### **Danson Wooi**

Supervised by James Blackburn & Timothy Mercer  
*"Investigation of the fusion gene landscape in sarcoma through targeted capture sequencing of 255 genes in archived patient samples"*



# Garvan Institute of Medical Research

## Board of Directors

The Board of Directors for the Garvan Institute of Medical Research donate their time and expertise. They are responsible for policy development and effective governance of the Institute's affairs.

### **John Schubert AO - Chair**

*Nominated by the Trustees of St Vincent's Hospital*

Dr Schubert is Chairman of the Garvan Institute of Medical Research, Chairman of the Great Barrier Reef Foundation and a director of the Garvan Research Foundation Board. He has held positions as Chairman of the Commonwealth Bank of Australia, Non-Executive Director of BHP Billiton Limited, BHP Billiton Plc and Qantas Airways Limited, Chief Executive Officer of Pioneer International Limited, Chairman of WorleyParsons Limited and G2 Therapies Ltd, Chairman and MD of Esso Australia Ltd, and Non-Executive Director of Hanson Plc.

### **Annabelle Bennett AC SC**

*Nominated by the Trustees of St Vincent's Hospital*

The Hon Dr Bennett was formerly a Judge of the Federal Court of Australia. She is presently Chancellor of Bond University, Arbitrator with the Court of Arbitration for Sport, Chair of the Australian Nuclear Science and Technology Organisation (ANSTO), Chair of Gardior Pty Ltd, Chair of the Advisory Group of Judges to the World Intellectual Property Organisation (WIPO) and the Trustee of The Infrastructure Fund (TIF). Dr Bennett has extensive knowledge and experience in intellectual property arising from her position as a Judge, as a senior counsel specialising in Intellectual Property and as President of the Copyright Tribunal.

### **Annette Cunliffe RSC (until October)**

*Nominated by the Sisters of Charity*

Sister Cunliffe was the Sisters of Charity Congregational Leader. She has been President of the Conference of Leaders of Religious Institutes (NSW), President of Catholic Religious Australia, Inaugural Chair of the Stewardship Board of Catholic Health Australia and a senior lecturer at the Australian Catholic University. Until the end of 2018 she was one of two executive officers of the National Committee for Professional Standards of the Catholic Church in Australia.

### **Philip Cunningham OAM (from October)**

*Nominated by the Sisters of Charity*

A/Prof Cunningham OAM is the Chief Operating Officer at the St Vincent's Centre for Applied Medical Research and Chief Scientist at the NSW State Reference Laboratory for HIV at St Vincent's Hospital. He is the past Vice President of the Australasian Society of HIV Medicine (ASHM), co-chair

on the National HIV Testing Policy Expert Reference Group and he is a visiting Senior Research Fellow at the Kirby Institute, UNSW Sydney.

### **Chris Goodnow FAA FRS**

*Nominated by the Garvan Institute Board of Directors*

Prof Goodnow FAA FRS is Executive Director of the Garvan Institute of Medical Research, The Bill and Patricia Ritchie Foundation Chair as Head of the Immunogenomics Laboratory at Garvan, and Director of the Cellular Genomics Futures Institute at UNSW Sydney. He has had an extensive international research career. He has been a faculty member at Stanford University and the Australian National University, and has been closely involved in several biotechnology start-up companies. He is best known for discovering immune tolerance checkpoints by integrating molecular genetics and genomics with immunology, for which he received numerous awards and election to the Australian Academy of Science, the UK Royal Society and the US National Academy of Science.

### **Stephen Johns**

*Nominated by the Garvan Research Foundation*

Mr Johns is the independent Chairman of the ASX listed Goodman Group and a Director of the European Australia Business Council. He is a former Chairman and Non-Executive Director of Brambles Limited, Leighton Holdings Limited and Spark Infrastructure Group, and a former Senior Executive and Non-Executive Director of Westfield Group. He has a Bachelor of Economics degree from the University of Sydney and is a Fellow of the Institute of Chartered Accountants in Australia and the Australian Institute of Company Directors.

### **Paul Kelly**

*Nominated by the Trustees of St Vincent's Hospital*

Dr Kelly is a founding Managing Partner of OneVentures, a leading Australian venture capital firm, and serves as Chair of the Investment Committee of its Healthcare fund, and on the Risk Management Committee. An Australian physician, serial entrepreneur and experienced biotechnology and life sciences executive, he currently has over 35 years' experience in clinical medicine and medical science, and 25 years' experience in commercialising life science-related technologies in Australia, Europe and North America.

### **Helen Nugent AC**

*Nominated by the NSW Minister for Health*

Dr Nugent is the Chairman of Ausgrid, a Non-Executive Director of Insurance Australia Group Limited and TPG Telecom. She has been the Chairman of the National Disability Insurance Agency, the National Portrait Gallery of Australia, Veda Group, Australian Rail Track Corporation, Funds SA, Swiss Re (Australia) and Sydney Airport, and a Non-Executive Director of Macquarie Group, among others. She is a Companion of the Order of Australia, a recipient of the Australian Government Centenary Medal and was recently awarded the Order of Merit by the Australian Olympic Committee.

### **Patricia O'Rourke**

*Nominated by the Sisters of Charity*

Adjunct Prof O'Rourke is the CEO of St Vincent's Health Australia Public Hospitals Division. She also serves on the board of the Aikenhead Centre for Medical Discovery and Epiminder. She is a graduate of the Australian Institute of Company Directors and a member of the Harvard Business Club of Australia.

### **Vlado Perkovic**

*Nominated by UNSW Sydney*

Prof Perkovic is the Dean of the Faculty of Medicine at UNSW Sydney, a Nephrologist at the Royal North Shore Hospital and a Non-Executive Director of St Vincent's Health Australia, as well as several independent Medical Research Institutes. He has previously been the Executive Director of The George Institute, President of the Association of Australian Medical Research Institutes and on the Board of the Australian Clinical Trials Alliance. He is a Fellow of the Royal Australasian College of Physicians, and of the Australian Academy of Health and Medical Sciences.

### **Roger Reddel AO (from July)**

*Nominated by the Federal Minister for Health*

Prof Reddel is a medical oncologist, molecular geneticist and an internationally renowned expert on cancer cell immortalisation. He is Executive Director of Children's Medical Research Institute (CMRI), Westmead, the Sir Lorimer Dods Professor of the University of Sydney, a Fellow of the Australian Academy of Science and a Fellow of the Australian Academy of Health and Medical Sciences.

### **Anthony Schembri AM**

*Nominated by the Sisters of Charity*

A/Prof Schembri is the CEO of St Vincent's Health Network Sydney, Adjunct Professor in Health Sciences at the Australian Catholic University, Adjunct Professor at the School of Medicine, University of Notre Dame and Associate Professor of the Faculty of Medicine at UNSW Sydney. He is a Director on the boards of Central & Eastern Sydney Primary Health Network, the National Centre for Clinical Research for Emerging Drugs and the St Vincent's Curran Foundation, and is co-chair of Australian Catholic University/

St Vincent's Nursing Research Institute. He has held a range of volunteer appointments in youth services, human rights and anti-violence organisations.

### **Russell Scrimshaw**

*Nominated by the Federal Minister for Health*

Dr Scrimshaw is the Garvan Research Foundation Board Chairman. He is currently also Non-Executive Director of the Garvan Institute of Medical Research, Non-Executive Chairman of Tech Project Group P/L, Deputy Chairman of Ignition Advice P/L and the Executive Chairman of Torrus Capital P/L and Scrimshaw Nominees P/L and also Chairman of Australian Philanthropic Fund, the Scrimshaw Foundation. Previously, he held senior executive positions at Fortescue Metals Group Ltd (FMG), Commonwealth Bank, Optus and IBM. He was also a Non-Executive Board Chairman at Sirius Minerals plc, and Executive Director for FMG, and Non-Executive Director of Commonwealth Properties Ltd, EDS Australia, Mobilesoft Ltd, Telecom New Zealand Australia P/L and Athletics Australia.

### **Jillian Segal AO**

*Nominated by UNSW Sydney*

Ms Segal is the former Deputy Chancellor UNSW Sydney. She is the chairman of AICC (NSW), General Sir John Monash Foundation and the Independent Parliamentary Expenses Authority (IPEA). She is President of the Executive Council of Australian Jewry (ECAJ), a Trustee of the Sydney Opera House, and a director of the Grattan Institute and Rabobank Australia Limited. She is a member of the International Board of the Weizmann Institute of Science and the Council for the Order of Australia. She has been a senior regulator, lawyer and a director of other listed and government organisations.

### **Ronald Trent**

*Nominated by the NSW Minister for Health*

Prof Trent is Head of the Department of Medical Genomics at the Royal Prince Alfred Hospital and Director for the Institute of Precision Medicine & Bioinformatics at the Sydney Local Health District. He is the President of the School Council for the Sydney Boys High School and past Secretary of the Sydney Girls High School Foundation. He is a Fellow of the Royal Australasian College of Physicians, the Royal College of Pathologists of Australasia, and the Australian Academy of Technology and Engineering.

### **Catriona Wallace (from October)**

*Nominated by the Garvan Research Foundation*

Dr Wallace is an Executive Director of Gradient Institute (Responsible AI) and the Chair of Artesian Capital's AI Accelerator and Fund, Boab AI. Dr Wallace is also an Adjunct Professor at the AGSM, UNSW, she Co-Chairs Sir Richard Branson's The B-Team's AI Coalition and is a Director of Reset Australia. Dr Wallace has been recognised as one of Australia's pre-eminent scientists by the Royal Institution of Australia and as the Most Influential Woman in Business and Entrepreneurship by the AFR.

# Garvan Research Foundation

## Board of Directors

The Garvan Research Foundation Board was established in 1981. They oversee the effective marketing and fundraising activities of the Garvan Research Foundation, ensuring Garvan's innovative research is supported.

### **Russell Scrimshaw – Chair**

Dr Scrimshaw is the Garvan Research Foundation Board Chair. He is currently Non-Executive Chairman of Tech Project Group P/L, Deputy Chairman of Ignition Advice P/L and the Executive Chairman of Torrus Capital P/L, the Australian Philanthropic Fund, the Scrimshaw Foundation and Scrimshaw Nominees P/L. Previously, he held executive positions at Fortescue Metals Group Ltd (FMG), Commonwealth Bank, Optus and IBM. He was also a Non-Executive Board Director for Commonwealth Properties Ltd, EDS Australia, Mobilesoft Ltd, Telecom New Zealand Australia P/L and Athletics Australia.

### **Chris Goodnow FAA FRS**

Prof Goodnow FAA FRS is Executive Director of the Garvan Institute of Medical Research, The Bill and Patricia Ritchie Foundation Chair as Head of the Immunogenomics Laboratory at Garvan, and Director of the Cellular Genomics Futures Institute at UNSW Sydney. He has had an extensive international research career. He has been a faculty member at Stanford University and the Australian National University, and has been closely involved in several biotechnology start-up companies. He is best known for discovering immune tolerance checkpoints by integrating molecular genetics and genomics with immunology, for which he received numerous awards and election to the Australian Academy of Science, the UK Royal Society and the US National Academy of Science.

### **Nick Abrahams**

Mr Abrahams is the Global Head of Technology and Innovation at Norton Rose Fulbright and has deep commercial expertise and global networks in the technology space. He is a Co-Founder of leading online legal site, LawPath. He was a Non-Executive Director on ASX300 software company, Integrated Research for six years. He is a director of the Sydney Film Festival and is on the board of the Vodafone Foundation, and past President of the Australian Communications and Media Law Association. He is the author of two books: Digital Disruption in Australia and Big Data, Big Responsibilities: A Guide to Privacy & Data Security for Australian Business.

### **Jane Allen**

Ms Allen is a founding Partner of Maritana Partners, a specialist Governance Advisory business. Previously she was a Managing Partner at Egon Zehnder in Australia, where she also held a leadership role across Asia Pacific. A member of Chief Executive Women, Ms Allen has an MBA from Harvard Business School and a Bachelor of Arts from Smith College. She is also a Director of the American Australian Association Limited, which promotes cooperation and understanding between the United States and Australia.

### **Michael Cannon-Brookes**

Mr Cannon-Brookes is a Director of Cannon-Brookes Consulting Pty Ltd, and a CEO-level executive coach with Foresight Global Coaching. He established Citibank in Australia in 1985. He was Managing Director of Freehill, Hollingdale & Page from 1991-1994. After 15 years overseas with IBM, where he was IBM's Vice President, Global Strategy for Growth Markets, he retired in July 2012. Mr Cannon-Brookes, a UK citizen, took Australian citizenship in 1994. He graduated with Honours in Law from Cambridge University. For 8 years, he was a Global Board Member of Advance.org, and is a Fellow of the Australian Institute of Company Directors.

### **Sue Cato AM**

Ms Cato is recognised as one of Australia's leading corporate communication and issues management experts, having managed some of the largest issues confronting corporate Australia and beyond. Ms Cato established Cato Counsel in 2003 as a corporate communications company providing high-level strategic transaction support and public and corporate affairs advice. Cato Counsel has since evolved into Cato & Clive. Ms Cato is on the board of the National Gallery Australia Foundation, is an advisory board member of Sydney Contemporary and is an Ambassador of Women for Election Australia. She is also a member of Chief Executive Women and is on the board of the creative think tank, A New Approach.

### **Wallis Graham**

Ms Graham is a finance industry professional, with experience in funds management, corporate finance, private equity and investment banking. She is currently a Director of Servcorp Limited, a member of the Board of Governors of the Wenona School, a Director of the Wenona Foundation, a Director of the Sydney Youth Orchestras and a Director of the John Brown Cook Foundation. She also holds a Senior Consulting role with Energy Capital Partners. Wallis has a BA in Economics Modified with Mathematics from Dartmouth College in the United States.

### **Rajeev Gupta**

Mr Gupta is a Partner of the cross-over technology focused investment fund, Alium Capital. Mr Gupta began his career at Goldman Sachs where he worked in the investment group in Hong Kong, Singapore and New York with a focus on listed and unlisted technology companies. He then utilised his technology investment experience as a portfolio manager at both Tribeca & Merricks Capital where he ran global technology funds. He then built his own 25-person technology start-up called Geckolife, before establishing Alium Capital. Mr Gupta holds a Bachelor and Honours degree in Finance,

Econometrics and Law from the University of Sydney. He is also a CFA and CMFAS charter holder, as well as being a AICD Member.

#### **Hamish McLennan**

Mr McLennan is a media and marketing industry executive. He is the Chairman of Rugby Australia, REA Group, and of HT&E, and Vice Chairman of Magellan Financial group and a Non-Executive Director of Scientific Games and Claim Central P/L. He was Executive Chairman and CEO of Ten Network Holdings until July 2015 and prior to that he was Executive Vice President, Office of the Chairman, at News Corp (formerly News Corporation). Mr McLennan has also held the role of global Chairman of Young & Rubicam, part of WPP, the world's largest communications services group. He has previously served on the Board of Directors for the United Negro College Fund (UNCF) and the US Ad Council.

#### **John Meacock (from February)**

Mr Meacock is a Global Advisor and Non-Executive Director. Until recently he was the Global Chief Strategy Officer responsible for strategy, innovation and geo-political risk for Deloitte across the globe. He is an advisor to Deloitte In Asia and Australia, Advisory Board Member of Clear Dynamics and Weare8, and an adviser to a range of ASX100 companies. He was previously the Deputy Chair of Deloitte's Global Board, a member of the US Finance and Investment Advisory Board for the Australian Government, Chairman of the Brett Whiteley Foundation, Director of Asia Society and Director Wenona Girls School.

#### **Simon Mordant AO**

Cav. Prof Mordant is Executive Co- Chairman of Luminis Partners. He is also Co-Vice Chair of MOMA PS1 in New York and Chair's the NSW Government Visual Arts Board and is Chair of Lend Lease Barangaroo Public Art Committee. He is a Trustee of the American Academy in Rome and a member of the Executive Committee of Tate International Council and of the International Council of the Museum of Modern Art in New York. An Enterprise Professor at the Centre of Visual Art (CoVA) at the University of Melbourne, and an Adjunct Professor at Universita Cattolica in Milan and Rome, he is also on the boards of the Centre for Independent Studies and the Ethics Centre. He has been awarded a Knighthood in the Order of the Star of Italy, and is Inaugural International Ambassador for Gallerie dell'Accademia Museum in Venice. In November he was sworn in as Honorary Consul to San Marino in Australia.

#### **Greg Paramor AO**

Mr Paramor is the Chairman of the Leftfield Group and a Non-Executive Director of the Charter Hall Group. He the former Managing Director of Folkestone Limited. He was the Co-Founder of Growth Equities Mutual, Paladin Australia and the James Fielding Group and CEO of Mirvac. He is a past president of the Property Council of Australia and of the Investment Funds Association. He has been involved with of a number of not-for-profit groups including the current chair of BackTrack Youth Works, and a director of The Nature Conservancy – Australian Trustee. He is a board member of the Sydney Swans and Sydney Swans Foundation.

#### **Geoff Raby AO**

Dr Raby is Chairman and Founder of Geoff Raby and Associates, a Beijing-based corporate advisory firm providing strategic advice and analysis on China. He is an Independent Non-Executive Director of Yancoal and OcenaGold and was also on the Board of Fortescue Metals Group. He was Australian Ambassador to China (2007-2011), DFAT Deputy Secretary responsible for North Asia and for Trade Negotiations (2003-2007), APEC Ambassador, and Ambassador to the WTO. He was Head of the Trade Policy Issues Division at the OECD in Paris and Head of DFAT's Trade Negotiations Division. He founded and led DFAT's East Asia Analytical Unit. He also Chairs a number of not-for-profit organisations in Australia.

#### **Isabella Rich (from August)**

Ms Rich is a Principal at Our Innovation Fund Venture Capital, LP. She previously worked at Boston Consulting Group in both Australia and the US where she was strategic consulting across multiple industries, including advising some of the largest pharmaceutical companies globally. Ms Rich is also on the Board of JCA, co-leading the 25-40 cohort. She also has experience in the not-for-profit space, consulting for organisations such as The Bread-and-Butter Project and Carriageworks. Ms Rich joined the Foundation Board in August 2021.

#### **John Schubert AO**

Dr Schubert is Chairman of the Garvan Institute of Medical Research, Chairman of the Great Barrier Reef Foundation and a Director of the Garvan Research Foundation Board. He has held positions as Chairman of the Commonwealth Bank of Australia, Non-Executive Director of BHP Billiton Limited, BHP Billiton Plc and Qantas Airways Limited, Chief Executive Officer of Pioneer International Limited, Chairman of WorleyParsons Limited and G2 Therapies Ltd, Chairman and MD of Esso Australia Ltd, and Non-Executive Director of Hanson Plc.

#### **Peter Young AM**

Mr Young is currently a Principal for The Adelante Group, and a Board member of the Australian Haydn Ensemble. He was previously Chairman of Standard Life Investments Australia, Aberdeen Standard Investments Australia, Barclays Australia, Queensland Investment Corporation (QIC), Transfield Services Infrastructure Fund, and of the Australian Federal Government-owned Export Finance and Insurance Corporation (EFIC). He is a former Non-Executive Director of Fairfax Media, the Sydney Theatre Company, PrimeAg Australia, a Trustee of NSW Art Gallery, and subsequently a Trustee of the Queensland Art Gallery, and a member of the Board of the Great Barrier Reef Foundation. He is a recipient of the Australian Federal Government's Centenary Medal and in 2008 was appointed a Member of the Order of Australia (AM) for his services to business and commerce.

## Peer-reviewed grants and fellowships

Many of Garvan's ground-breaking discoveries are supported by competitive, peer-reviewed funding, which underpins our researchers' salaries and research activity.

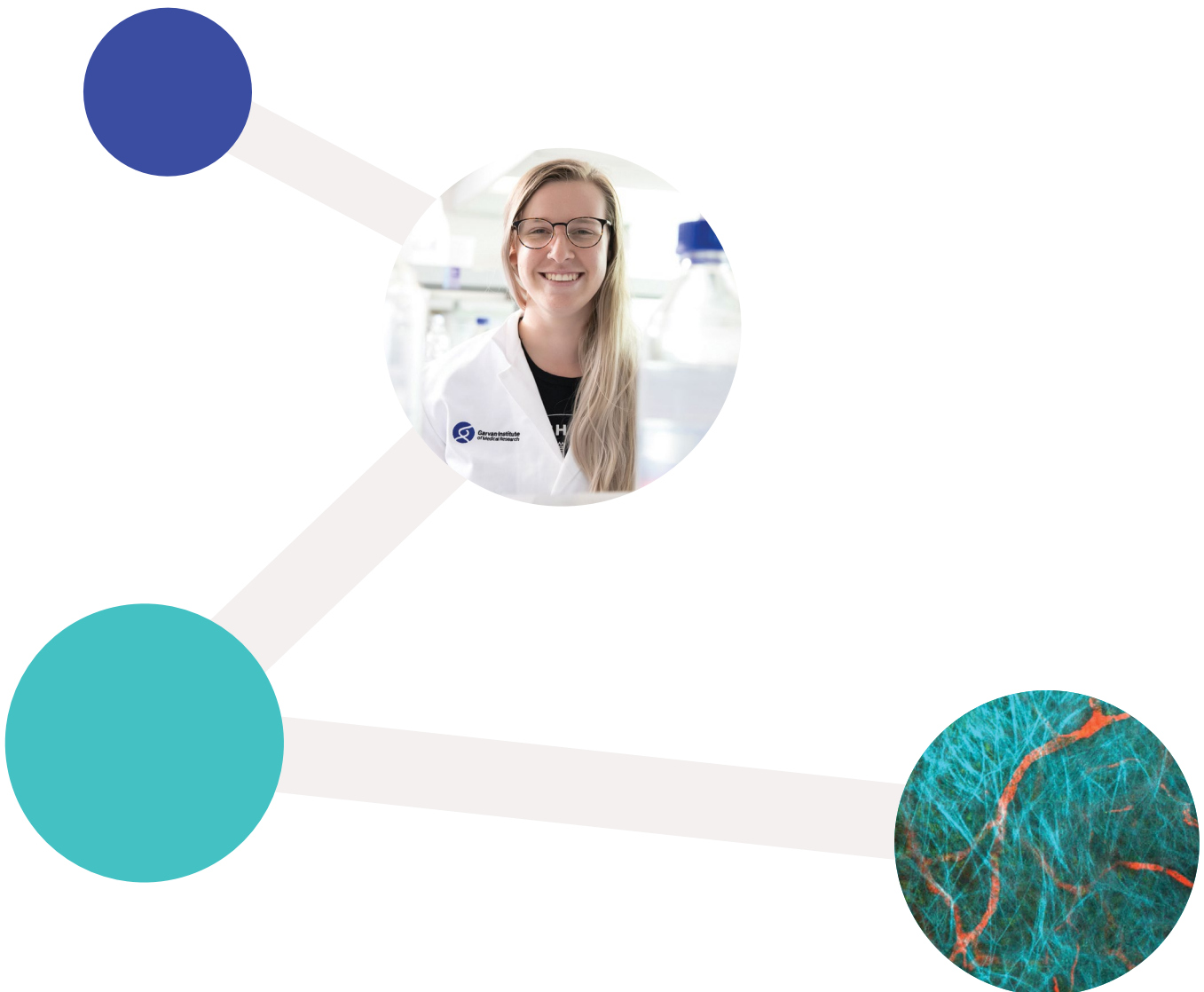


**From the Deputy Director**  
Professor Peter Croucher

*Competitive fellowships and grants from the National Health and Medical Research Council (NHMRC) and other funding bodies are selected in a highly competitive process, where panels of experts assess applications and rank them on scientific merit, innovation and the track record of investigators.*

*When successful, grant proposals demonstrate how highly we are regarded by our peers in the medical research sector; however, the competition for available grants remains high and limited budgets only allow a small proportion of applications to be funded in each round.*

*Community support, fundraising and the contributions of Garvan's donors cannot be emphasised enough as critical to making the excellent work of our researchers possible. Philanthropy enables our researchers to both continue their important research and embark on new innovative research paths until they are able to acquire competitive grant funding.*





# Garvan-led grants

## Peer-reviewed funding

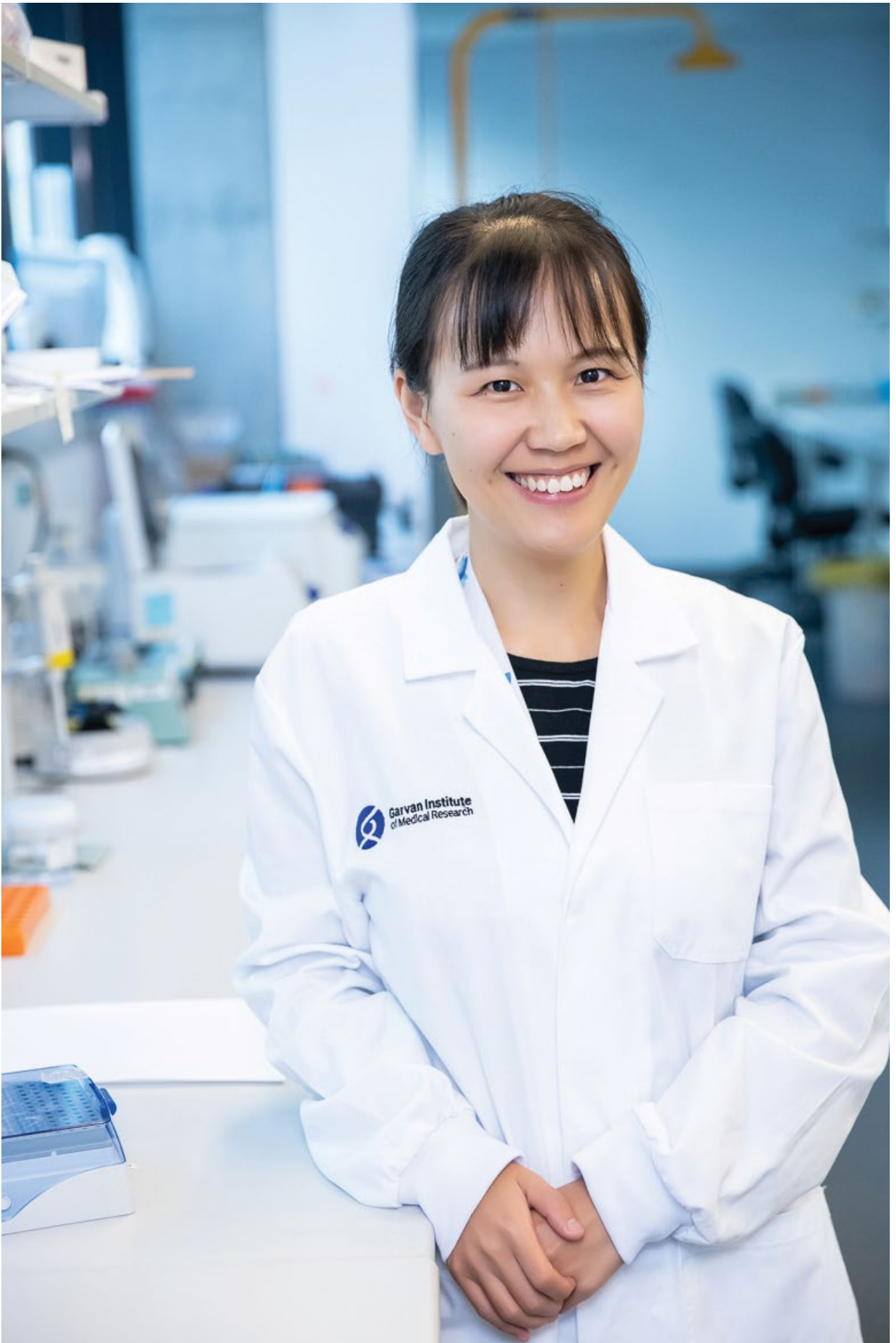
Funding Body	Type of Grant	Principal Investigator	Co-Investigators	Project Title	Amount funded	Years
Australian & New Zealand Bone & Mineral Society	ANZBMS and Bone Health Foundation Grant-in-Aid	Michelle McDonald		Prevention of rebound bone loss and fracture induced by denosumab withdrawal	\$25,000	1
Cancer Australia	Priority-driven Collaborative Cancer Research Scheme	Marjan Naeini		Investigating immune clusters in oesophageal cancer	\$91,630	1
Cancer Council NSW	Project Grants	David Croucher	Sharissa Latham Thomas Cox	Repurposing clinically approved HDAC inhibitors to prevent relapse of metastatic triple-negative breast cancer	\$450,000	3
	Project Grants	Alexander Swarbrick	Mun Hui Joakim Lundeberg (KTH Royal Institute of Technology, Sweden)	Integrative pan-cancer analysis of stromal cells	\$449,888	3
	Project Grants	Jessica Chitty	Thomas Cox Paul Timpson	Targeting the scaring response in pancreatic cancer and improving chemotherapy	\$449,514	3
	Project Grants	Robert Weatheritt	Javier Fernandez-Chamorro Christine Chaffer	What makes triple-negative breast cancer tumours more likely to spread beyond the breast?	\$448,284	3
	Project Grants	Paul Timpson	Jennifer Morton (Beatson Institute, Glasgow) Peter (Yingxiao) Wang (University of California, San Diego, USA)	Targeting metabolic instability in pancreatic cancer using humanised antibody blocking in live tumours: reducing growth while stopping pancreatic cancer spread	\$450,000	3
	Project Grants	David Croucher	Walter Kolch (University College Dublin)	Improving outcomes for high-risk neuroblastoma through personalised treatment strategies	\$450,000	3
Diabetes Australia Research Trust	Project Grants	Lei Zhang		Brainstem circuitries as intervention points for type 2 diabetes treatment	\$60,000	3
	Project Grants	Carsten Schmitz-Peiffer	Trevor Biden Kathy Samaras	Proof-of-principle: inhibitors of protein kinase C epsilon as dual action agents for the treatment of type 2 diabetes	\$60,000	1
	Project Grants	Nikki Lee	Herbert Herzog	Central leptin signalling through NPY neurons regulates glucose homeostasis	\$60,000	1
	Project Grants	Ross Laybutt		XBP1 maintains $\beta$ -cell identity by repressing an alpha-cell program	\$60,000	1
Juvenile Diabetes Research Foundation International	Pilot and Innovation Awards	Shane Grey	Leszek Lisowski (Children's Medical Research Institute)	First-generation beta-SMART AAV system	US\$439,516	2
Lung Foundation Australia	Evangeline Lim Lung Cancer Research Grant	Amelia Parker		Novel stromal biomarkers as the foundation of precision medicine in squamous lung cancer	\$10,000	1

# Garvan-led grants continued

## Peer-reviewed funding

Funding Body	Type of Grant	Principal Investigator	Co-Investigators	Project Title	Amount funded	Years
Medical Research Future Fund	Clinical Trials Activity: Rare Cancers, Rare Diseases and Unmet Need - Stream 2	Christine Chaffer	Anthony Joshua Rachel Dear (University of Sydney) Frances Boyle (University of Sydney) Leonard Goldstein	4CAST: A phase I/II study evaluating the safety and efficacy of VT-464 in combination with chemotherapy in patients with metastatic breast cancer	\$668,444	3
Medical Research Future Fund	Emerging Priorities and Consumer Driven Research Initiative - Childhood Cancer Research Grant	David Croucher	Prof Walter Kolch (University College Dublin)	Rationalised inclusion of HDAC inhibitors with standard-of-care chemotherapy to improve outcomes for primary and relapsed neuroblastoma	\$614,017	3
Michael J Fox Foundation for Parkinson's Research	Expanding Biological Understanding of Parkinson's Disease	Antony Cooper	Justin O'Sullivan (University of Auckland)	Confirming the trans-effect in PD gene regulation	\$34,579	2
National Breast Cancer Foundation	Investigator Initiated Research Scheme	Tatyana Chtanova	David Gallego-Ortega (UTS) Fabio Zanini (UNSW)	Harnessing immune plasticity to develop new immune therapies for breast cancer	\$396,000	2
	Investigator Initiated Research Scheme	Alex Swarbrick	Kylie James Sandra O'Toole	Targeting B cells for breast cancer immunotherapy	\$597,474	3
	Investigator Initiated Research Scheme	Clare Stirzaker	Susan Clark Elgene Lim Sarah-Jane Dawson (Peter MacCallum Cancer Centre) Mun Hui Darren Korbie (University of Queensland)	Novel epigenetic blood test for breast cancer detection and monitoring	\$712,335	3
	Investigator Initiated Research Scheme	Dan Roden	Alex Swarbrick Elgene Lim Sandra O'Toole	Unravelling cellular and spatial heterogeneity in human breast cancers	\$499,983	3
	Investigator Initiated Research Scheme	Liz Caldon	Elgene Lim	Reactivating cell death pathways to overcome combination therapy resistance in metastatic ER+ breast cancer	\$525,848	3
	Investigator Initiated Research Scheme	Sharissa Latham	David Croucher Jonathan Morris (UNSW) Thomas Cox	Developing a selective oncogenic JNK inhibitor into a clinically viable therapeutic for metastatic triple-negative breast cancer	\$266,000	2
National Health and Medical Research Council	Ideas grant	Tri Phan		Location! Location! Location! Geospatial control of memory B cell reactivation in vaccine-induced immunity	\$684,360	3
	Ideas grant	Ross Laybutt		Type 2 diabetes relief by UPR-mediated beta cell protection	\$1,000,959	5
	Development Grant	Thomas Cox	Paul Timpson Marina Pajic Adnan Nagrial (Westmead Hospital) Anthony Gill (Royal North Shore Hospital)	A first-in-class tumour matrix targeting approach to enhance chemotherapy in pancreatic cancer	\$827,500	3

Funding Body	Type of Grant	Principal Investigator	Co-Investigators	Project Title	Amount funded	Years
National Health and Medical Research Council	Ideas grant	Andy Philp	Paul Coen (Translational Research Institute, USA) Julien Ochala (University of Copenhagen) Sophie Joannis (Manchester Metropolitan University)	Enhancing mitochondrial energetics to prevent age-associated muscle weakness	\$799,706	3
	Ideas grant	David Herrmann	Alexandra Zanin-Zhorov (Equilibre Pharmaceutical, USA) Sandra O'Toole	Single-cell intravital imaging guides anti-fibrotic therapy to improve standard-of-care treatment in triple-negative breast cancer	\$599,808	3
	Ideas grant	Shane Grey	Megan Barnet Simon Barry (University of Adelaide)	Harnessing a novel immune check point for cancer killing	\$924,922	3
	Ideas grant	David Croucher	Sharissa Latham	Targeting metastatic triple-negative breast cancer with a selective oncogenic JNK inhibitor	\$674,218	3
	Ideas grant	Thomas Cox	Sharissa Latham	SPARC as a key regulator of breast cancer metastasis and resistance to therapy	\$798,196	3
	Ideas grant	Susan Clark	Clare Stirzaker	3D nuclear re-organisation potentiates genomic structural variations in prostate cancer	\$838,167	3
	Ideas grant	Ozren Bogdanovic	Alvaro Gonzalez Rajal	The rogue germline: deciphering mechanisms of cancer testis antigen reactivation in cancer	\$791,930	3
Pfizer Australia	General Research Grant	Ann McCormack	Nele Lenders	Towards personalised medicine for pituitary tumours	\$40,000	1
PKD Foundation of Australia	Research grant	Amali Mallawaarachchi	John Shine Mark Cowley (Children's Cancer Institute) Ira Deveson Timothy Furlong Yvonne Hort	Investigating gene conversion as a mechanism of disease in autosomal dominant polycystic kidney disease	\$30,000	1
Ramaciotti Foundation	Ramaciotti Health Investment Grants	Kylie James		Multi-omics assay for accurate colorectal cancer risk prediction	\$90,142	1
	Ramaciotti Health Investment Grants	James Thompson	Phillip Stricker	PIAS Trial: prospective study of 68Ga-PSMA PET/CT additional to mpMRI in men undergoing biopsy during active surveillance for prostate cancer	\$100,000	1
Royal Australasian College of Physicians	Jacquot Research Establishment	Amali Mallawaarachchi		Investigating mechanisms of disease in autosomal dominant polycystic kidney disease through combining established clinical cohorts and cellular genomic technologies	\$90,000	1
St Vincent's Clinic Foundation	Sister Bernice, Packer Family Foundation Research Grant	Jerry Greenfield	Andrew Jabbour (Victor Chang Cardiac Research Institute) Christopher Hayward (St Vincent's Hospital) Peter MacDonald (St Vincent's Hospital) Lisa Raven (St Vincent's Hospital) Christopher Muir (St Vincent's Hospital)	A phase 2, randomised, placebo controlled trial of SGLT2 inhibition with empagliflozin on metabolic, renal and cardiac outcomes in recent cardiac transplant recipients	\$120,000	1



# Garvan-led grants continued

## Peer-reviewed funding

Funding Body	Type of Grant	Principal Investigator	Co-Investigators	Project Title	Amount funded	Years
St Vincent's Clinic Foundation	AMR Translational Research grant	Venessa Chin	Joseph Powell Richard Gallagher (St Vincent's Hospital)	Using single cell RNA sequencing to understand the genomic drivers of metastasis in human papilloma associated cancers of the oropharynx	\$50,000	1
	Annual Research grant	Christine Chaffer	Rachel Dear (St Vincent's Hospital)	Inhibition of PPARgamma to prevent breast cancer metastasis and treat chemotherapy resistant disease	\$40,000	1
	Annual Research grant	Brooke Pereira	Paul Timpson Hao-Wen Sim (St Vincent's Hospital)	Personalised medicine approaches for anti-fibrotic targeting and gemcitabine/ abraxane treatment in pancreatic cancer guided by intravital (in vivo) imaging	\$40,000	1
	Annual Research grant	Clare Stirzaker	Susan Clark Elgene Lim Braydon Meyer Neil Portman Sanjeev Kumar (St Vincent's Hospital)	Targeting therapy resistant triple-negative breast cancer using epigenetic therapy	\$40,000	1
University of New South Wales	Triple-I Clinical Academic Group Seed Grant Funding	Tri Phan		Immune cloaking – a pan-cancer tissue-specific cancer dormancy program underlies immune control of metastatic relapse	\$75,000	1
	Cardiac, Vascular and Metabolic Medicine Theme Networking grant	Jennifer Snaith	Jerry Greenfield	A novel online tool to diagnose double diabetes using biomarkers: towards cardiovascular risk reduction by personalised adjunctive treatment of insulin resistance in type 1 diabetes	\$30,000	1
US Dept of Defense Congressionally Directed Medical Research Programs	Breast Cancer Research Program - Breakthrough Award Level 2	Alexander Swarbrick	Elgene Lim Mun Hui Stuart Tangye Charles Perou (University of North Carolina, USA) Joakim Lundberg (KTH Royal Institute of Technology, Sweden)	Systems immunology for breast cancer	US\$930,581	3
	Prostate Cancer Research Program - Idea Development Award	Vanessa Hayes	Riana Bornman (University of Pretoria, South Africa) Sean Patrick (University of Pretoria) Shinga Mutambirwa (University of Pretoria) Weerachai Jaratlersiri (Garvan) David Wedge (University of Manchester, UK) Gail Prins (University of Illinois, USA) Jeannette Bensen (University of North Carolina, USA) Massimo Loda (Cornell University, USA) Ros Eeles (Institute of Cancer Research, UK)	High-risk prostate cancer in southern Africa, unravelling the genome and exposome (TARGET Africa)	US\$749,183	3

# Collaborative grants

## Peer-reviewed funding

Funding Body	Type of Grant	Admin Institution	Garvan Investigator/s	Co-Investigators	Project Title
Australian Research Data Commons	Australian BioCommons	University of Melbourne	Warren Kaplan Sarah Kummerfeld	Bernard Pope (Australian BioCommons) Andrew Lonie (Australian BioCommons)	The Human Genome Platform
Medical Research Future Fund	Rapid Applied Research Translation Grant	University of New South Wales	David Thomas Mandy Ballinger Frank Lin	Natalie Taylor (UNSW) Katherine Tucker (Prince of Wales Hospital) Millita Zaheed (Prince of Wales Hospital) David Goldstein (Prince of Wales Hospital) April Morrow (The Daffodil Centre, The University of Sydney) Kathryn Leaney (Translational Cancer Research Network) Margaret Gough (Translational Cancer Research Network) Liz Schroeder (Macquarie University) Phyllis Butow (University of Sydney) Jane Young (University of Sydney) Sandy Middleton (St Vincent's Hospital)	P-OMICs-flow: integrating precision oncology into clinical programs
	COVID-19 Vaccine-Associated Thrombosis with Thrombocytopenia Syndrome	Monash University	Tri Phan	Huyen Tran (Monash) Chunilal (Monash) Jim Buttery (Monash) Vivien Chen Nicholas Wood Dr Freda Passam (University of Sydney) Nigel Crawford (Murdoch) Prof Paul Monagle Dr James McFadyen	A national, multi-centre study evaluating thrombotic thrombocytopenia syndrome associated with ChAdOx1 and other SARS-CoV-2 vaccines
	Genomics Health Futures Mission	Monash University	Mary-Anne Young David Thomas	Paul Lacaze (Monash University) John McNeil (Monash University) John Zalcborg (Monash University) Roger Milne (Cancer Council Victoria) Paul James (Peter MacCallum Cancer Centre) Martin Delatycki (Murdoch Children's Research Institute) Kristen Nowak (Department of Health, WA) Tu Nguyen-Dumont (Monash University)	Population genomic screening of young adults to prevent cancer in Australia

Funding Body	Type of Grant	Admin Institution	Garvan Investigator/s	Co-Investigators	Project Title
Medical Research Future Fund	Genomics Health Futures Mission	Murdoch Children's Research Institute	Daniel MacArthur	Andrew Sinclair (Murdoch Childrens Research Institute) Sally Dunwoodie (Victor Chang Cardiac Research Institute) Robert Bryson-Richardson (Monash University) Ian Smyth (Monash University) Tessa Mattiske (Monash University) Bruce Bennetts (Children's Hospital at Westmead) Jozef Gecz (University of Adelaide) Kristi Jones (Sydney Children's Hospitals Network) Nigel Laing (University of Western Australia) Nathan Palpant (University of Queensland) Kelly Smith (University of Melbourne) Zornitza Stark (Murdoch Children's Research Institute) Patrick Tam (Children's Medical Research Institute) Coral Warr (University of Tasmania) Gareth Baynam (King Edward Memorial Hospital for Women) Josephine Bowles (University of Queensland) John Christodoulou (Murdoch Children's Research Institute) Tristan Hardy (SA Pathology) Richard Harvey (UNSW) Julian Heng (Curtin University) Massimo Hilliard (University of Queensland) Gary Hime (University of Melbourne) Livia Hool (University of Western Australia) Robyn Jamieson (Children's Medical Research Institute) Elizabeth Palmer (UNSW) Chirag Patel (Genetic Health Queensland) Leonie Quinn (Australian National University) Tony Roscioli (Sydney Children's Hospital) Hamish Scott (Central Adelaide Local Health Network) Amanda Spurdle (Queensland Institute of Medical Research) Tiong Yang Tan (Murdoch Children's Research Institute) Paul Thomas (University of Adelaide) Tracy Dudding-Byth (University of Newcastle) Mathew Wallis (University of Tasmania) Ernst Wolvetang (University of Queensland)	The Australian Functional Genomics Network
	2020 Genomics Health Futures Mission	University of Sydney	Daniel MacArthur	Anne Cust (University of Sydney) Julia Steinberg (University of Sydney) Karen Canfell (University of Sydney) Alison Pearce (University of Sydney) Dorothy Keefe (University of Adelaide) Michael Caruana (University of Sydney) Gemma Bilkey (Department of Health WA) Martin McNamara (Sax Institute) Naomi Wray (University of Queensland)	Genomic risk prediction and risk-tailored screening and early detection for common cancers

# Collaborative grants

## Peer-reviewed funding

Funding Body	Type of Grant	Admin Institution	Garvan Investigator/s	Co-Investigators	Project Title
Medical Research Future Fund	Genomics Health Futures Mission	James Cook University	Amali Mallawaarachchi Ira Deveson	Andrew Mallett (James Cook University) Stephen Alexander (University of Sydney) Melissa Little (Murdoch Children's Research Institute) Cas Simons (Murdoch Children's Research Institute) Ian Smyth (Monash University) Catherine Quinlan (Murdoch Children's Research Institute) Thomas Forbes (Murdoch Children's Research Institute) Kushani Jayasinghe (Murdoch Children's Research Institute)	The KidGen National Kidney Genomics Program - improving outcomes for Australian families with genetic kidney disease
	Genomics Health Futures Mission	Murdoch Children's Research Institute	Daniel MacArthur	Zornitza Stark (Murdoch Children's Research Institute) Sebastian Lunke (Murdoch Children's Research Institute) Amanda Spurdle (Queensland Institute of Medical Research) Simon Sadedin (Murdoch Children's Research Institute) Cliff Meldrum (NSW Health Pathology) Karin Kassahn (Central Adelaide Local Health Network) Denis Bauer (CSIRO Australian e-Health Research Centre) Ilias Goranitis (University of Melbourne) Chirag Patel (Genetic Health Queensland)	A national large scale automated reanalysis program to increase rare disease diagnosis
	Frontier Health and Medical Research Program	University of Queensland	Joseph Powell	Grant Montgomery (University of Queensland) Gita Mishra (University of Queensland) Louise Hull (University of Adelaide) Gustavo Carneiro (University of Adelaide) Caroline Gargett (Monash) Luk Rombauts (Monash) Jason Abbott (UNSW)	EndoAIMM: earlier diagnosis and personalised treatments for endometriosis
National Health and Medical Research Council	Ideas Grant	Univeristy of Technology Sydney	Subo Thavaneswaran	David Gallego-Ortega (UTS) Hongxu Lu (UTS)	High-fidelity tumouroids: accelerating next generation personalised medicine
	Partnership Project	Macquarie University	Jacqueline Center	Andrew Georgiou (Macquarie University) Johanna Westbrook (Macquarie University) William Rawlinson (UNSW) Kate Curtis (University of Sydney) Jeffrey Post (Prince of Wales Hospital) Andrea Horvath (NSW Health Pathology) Kenneth Hillman (UNSW) Janaki Amin (Macquarie University) Zoltan Endre (UNSW)	Establishing a digital health foundation for outcomes-based diagnostic excellence, safety and value



## Equipment grants 2021

### Peer-reviewed funding

Funding Body	Type of Grant	Project Title	Principal Investigator	Co-Investigators	Amount Funded
University of New South Wales	Research Infrastructure Scheme: Supporting Collaborative Research - NHMRC Equipment Grant	Mitochondrial profiling of model systems and 3D organoids (Seahorse XFe24)	Andrew Philp	Nigel Turner (UNSW) Lindsay Edward Wu (UNSW) Carsten Schmitz-Peiffer Dorit Samocha-Bonet Thomas Cox Elyse Filipe David Gallego-Ortega Tri Giang Phan Linda Dansereau Ozren Bogdanovic Antony Cooper	\$145,248

## Fellowships and scholarships 2021

### Peer-reviewed funding

Sponsor	Project Category	Principal Investigator	Project Title	Amount funded	Years
Australian Research Council	Future Fellowships	Robert Weatheritt	Dissecting cell cycle regulation using programmable gene editing technology	\$925,739	4
Cancer Institute NSW	Early Career Fellowship	Brooke Pereira	Personalised medicine approaches for anti-fibrotic targeting and gemcitabine/abraxane treatment in pancreatic cancer guided by intravital (in vivo) imaging	\$456,151	3
	Early Career Fellowship	Kendelle Murphy	A personalised approach to uncoupling the tumour-stroma feedback loop using the phase II ready FAK inhibitor, AMP945, in combination with standard-of-care chemotherapy in pancreatic cancer guided by Merlin status	\$444,500	3
National Health and Medical Research Council	Investigator Grant (EL1)	Mandeep Singh	Molecular and genomic profiling of rogue lymphocytes in autoimmune disease using single-cell genomics	\$650,740	5
	Investigator Grant (EL1)	Ruth Pidsley	Decoding the epigenome of the tumour microenvironment for improved patient outcomes in prostate cancer	\$650,740	5
	Investigator Grant (L3)	Daniel MacArthur	Building a foundation for equitable population-scale genomic medicine	\$3,427,015	5
	Investigator Grant (L3)	Christopher Goodnow	Revealing how tolerance checkpoints fail in human autoimmune diseases and how to target therapy	\$2,500,000	5
	Investigator Grant (L3)	Peter Croucher	The dormant cancer cell life cycle	\$3,427,015	5
	Investigator Grant (L3)	Robert Brink	Germinal centres, antibodies and immunological disease	\$2,927,015	5
Pancare Foundation	Phil Sly Research Scholarship	Antonia Cadell	Dissecting the role of subcellular JNK activity in pancreatic cancer	\$90,000	3
Snow Medical Research Foundation	Snow Fellowship	Marina Pajic	Precision Oncology for Pancreatic Cancer Research Program	\$4,999,828 (years 1-5)	8
The American Association of Immunologists	Careers in Immunology Fellowship	Julia Bier	Lymphocyte dysfunction in the development and control of lymphoma	\$54,144	1

# Financial highlights

## Statement of financial position as at 31st December 2021

### Profit and loss statement

Revenue	2021	2020	Expenditure on research activities	2021	2020
	A\$'000	A\$'000		A\$'000	A\$'000
Fundraising and grant income			Sequencing consumable expenses	3,519	3,309
NHMRC fellowships, scholarships and other grants	12,144	12,706	Employee benefits expenses	60,192	57,070
Peer-reviewed research grants	6,577	12,162	Other research expenses	14,783	14,759
NSW government grants	6,818	9,261	Depreciation and amortisation expenses	5,991	7,063
Other grants	12,914	23,297	Administration expenses	4,029	2,946
Donations received	47,728	48,107	Fundraising expenses	2,709	2,308
UNSW contribution	8,871	6,961	Building and scientific expenses	7,607	8,545
	95,052	112,494	Finance costs	554	564
Other income			<b>Total expenses</b>	<b>99,384</b>	<b>96,564</b>
Revenue from contracts with customers	13,127	11,232	<b>Total comprehensive income for the year</b>	<b>12,336</b>	<b>26,723</b>
Investment income / (loss)	3,565	(468)			
Share of losses of associates accounted for using the equity method	27	43			
Net loss on foreign exchange	(51)	(14)			
	16,668	10,793			
<b>Total revenue</b>	<b>111,720</b>	<b>123,287</b>			

## Balance sheet

<b>Assets</b>	<b>2021</b>	<b>2020</b>	<b>Liabilities</b>	<b>2021</b>	<b>2020</b>
	A\$'000	A\$'000		A\$'000	A\$'000
<b>Current assets</b>			<b>Current liabilities</b>		
Cash and cash equivalents	29,211	47,968	Lease liabilities	1,050	900
Trade receivables	4,641	11,251	Trade and other payables	9,671	7,015
Financial assets at fair value through profit and loss	101,439	15,788	Employee benefit obligations	6,054	6,853
Sequencing consumables	1,886	1,019	Deferred revenue	42,416	36,281
Term deposits	43,089	84,678	<b>Total current liabilities</b>	<b>59,191</b>	<b>51,049</b>
Other current assets	1,575	633	<b>Non-current liabilities</b>		
Biological assets	209	382	Lease liabilities	5,680	6,440
<b>Total current assets</b>	<b>182,050</b>	<b>161,719</b>	Employee benefit obligations	1,254	1,167
<b>Non-current assets</b>			<b>Total non-current liabilities</b>	<b>6,934</b>	<b>7,607</b>
Property, plant and equipment	69,662	69,241	<b>Total liabilities</b>	<b>66,125</b>	<b>58,656</b>
Investments accounted for using the equity method	120	93	<b>Net assets</b>	<b>195,887</b>	<b>183,551</b>
Right-of-use assets	10,042	10,959	<b>Equity</b>		
Intangibles assets	138	195	Reserves	118,067	110,571
<b>Total non-current assets</b>	<b>79,962</b>	<b>80,488</b>	Retained surplus	77,820	72,980
<b>Total assets</b>	<b>262,012</b>	<b>242,207</b>	<b>Total equity</b>	<b>195,887</b>	<b>183,551</b>

The Statement of Financial Position provided above, together with the attached Income Statement, have been extracted from the audited general purpose financial statements of Garvan Institute of Medical Research and its controlled entities. The summary financial information does not include all the information and notes normally included in a statutory financial report. The audited general purpose financial report can be obtained upon request to the Chief Operating Officer.

The statutory financial report (from which the summary financial information has been extracted) has been prepared in accordance with the requirements of the Australian Charities and Non-for-profits Commission Act 2012 and Regulations 2013, Australian Accounting Standards and other authoritative pronouncements of the Australian Accounting Standards Board.

# Justine Flynn

## One of Garvan's wonderful volunteers



Justine Flynn has taken on many roles in her life that have led to a very satisfying and varied career. Starting out as a company cadet at Grace Bros, she was given the opportunity to grow and undertake different management roles across Sydney. Justine's experience saw her transition into a significant role at LEGO Australia where she worked for seven years. During this time, she was given the opportunity to travel to Denmark to see where it all started with that little plastic brick that continues to delight children across the world.

Justine then went on to work as Administration Manager at a law firm in the Sydney's Central Business District for 13 very happy years. The law firm had a strong connection to the Sisters of Charity, who founded St Vincent's Hospital in 1857, introducing her to Garvan.

Following her career, Justine knew she would be seeking to venture into volunteer work. In her words, "I wanted to give back by applying the skills that I had learnt throughout my career, to a worthy organisation. Just as I was thinking about my next chapter, a contact informed me of Garvan's volunteer program."

In September 2016, we invited Justine to come into the Institute to begin as a volunteer in Supporter Services. "As soon as I walked through the glass doors, I felt right at home." Justine's contribution to the Foundation is incredibly appreciated as she brings excellence in all areas of day-to-day activities and tasks.

***"I have found it both so enjoyable and rewarding to be able to contribute to the function of Supporter Services in the Garvan Research Foundation. It is a privilege to be part of such an inspiring and dynamic Institute that has worked so hard towards an ever-greater understanding and treatment of disease."***

Without incredible individuals like Justine and our other volunteers, Supporter Services wouldn't be able to run as smoothly and productively as it does. Thank you for your continual support, Justine.

# Join the Garvan family

Our research relies on the generous support of our community, which enables our scientists to push the boundaries of medical research – and find better diagnostics and personalised treatments for some of the most devastating diseases.



## **Donate today:**

A donation, no matter how big or small, can help our scientists continue to do their crucial work. You can easily donate online or by phone.

## **Donate regularly:**

By becoming a Partner for Discovery, your monthly donation will give our researchers the momentum needed to make amazing discoveries.

## **Leave a gift in your Will:**

Become a Garvan Partner for the Future by including a gift in your Will and leave a lasting legacy of longer, healthier lives for future generations.

## **Donate in memory:**

Giving in memory of a loved one can be a powerful and lasting way to celebrate their life – while contributing to medical research.

## **Donate in celebration:**

In celebration donations are a great way to commemorate a special occasion in your life.

## **Make a major gift:**

Major gifts can be made in a variety of ways according to your personal situation and preferences. You can choose to give personally, via a Private Ancillary Fund, through a trust or foundation, or through your Will.

## **Donate through your pay:**

Workplace giving is a simple and tax-effective way for employees to make regular donations to Garvan's medical research directly from their pay.

## **Fundraise for Garvan:**

Fundraising can be a fun and rewarding team-building exercise at your school or work, or even a fitness goal. It doesn't take much to be a hero and help raise funds for medical research.

## **Corporate partnerships:**

Joining the Garvan community as a corporate partner is a sound business decision and one that could make a significant difference to the long-term health of our community.



## **Donate now**

**[garvan.org.au](https://garvan.org.au)**

**1300 73 66 77**

**[foundation@garvan.org.au](mailto:foundation@garvan.org.au)**

# An impossible choice

## In 2021, Garvan challenged Australians to choose: who would you donate to?

It's an impossible choice, of course.

Although Australians are an overwhelmingly generous group of people – donating more than \$11 billion to charities in 2021 – the choice of which organisation to donate to can be overwhelming. This is even truer for those who wish to support medical research, with over 5,000 disease-related charities in Australia alone.

A person's choice of charity is often deeply personal, informed by individual experience. With the average person developing 8 chronic diseases over their lifetime, coupled with the wish to support our family and friends living with disease through the organisations researching these illnesses – it can often feel like somebody is missing out, or that we are simply not doing enough.

### How then, do we choose who to donate to?

As you know, through the power of Garvan's genomics research, we can help them all. To raise awareness of the breadth of Garvan's research with the public, we posed this question through Disease Dilemmas, a national advertising campaign that ran from March to July 2021.

***“Genetic research at Garvan is important because it gives patients like myself with incurable diseases, it gives us hope for the future that one day we may not have to live with many of the symptoms that we currently live with, that these incurable diseases may eventually become curable. It provides us with that hope and that's really what we need.”*** – Ashleigh

For the campaign, 12 incredibly generous individuals living with diseases ranging from breast cancer to Parkinson's disease shared their story with us. In a series of portraits featuring these everyday individuals, the campaign challenged the public to consider the question: Who would you donate to? The campaign, while provoking, puts faces to diseases that are often discussed in statistics and numbers. The striking portraits are a poignant reminder of the impact disease can have on our loved ones – our sisters and brothers, mothers and fathers, husbands and wives, grandparents, friends and neighbours.

Taking over TV, newspapers, outdoor furniture, public transport, social media and even the MCG in Melbourne, our aim was to increase awareness of the breadth of Garvan's genomics research, and to inspire people across the country to support our mission, 'to harness all the information encoded in our genome to better diagnose, treat, predict and prevent not just one, but many devastating diseases'.

***Hope is so important when you have a degenerative disease, because it's not actually the disease that's affecting your day-to-day. It's the lack of hope. It's the knowing that at this point, this is as good as you'll ever be. I'm really thankful for that hope.”*** – Rosie

The campaign resonated with people across Australia, with a 61% increase to the Garvan website, and more than 87 million impressions. The campaign also won the Grand Award (first prize) in the Pharma and Medical category at the London International Awards. Only nine campaigns were shortlisted in this category across two years of work, globally; and only 16 Grand Awards were presented in total across all categories and across thousands of entries. It also won a gold and a bronze in other categories.

As a not-for-profit, our priority is to always support Garvan's cutting-edge research. This campaign will ensure that Garvan continues to attract donors that share our vision of a healthy future for everyone. We also extend our sincere gratitude to BWM Isobar, the creative agency who worked with us on a pro bono basis to create this campaign; and to their advertising partners, who offered their assets – whether they were TV ads or outdoor billboards – free of charge. Their generosity has enabled us to share Garvan's innovative research further than has ever been possible before.

### To find out more visit: [diseasedilemmas.org](https://diseasedilemmas.org)

Kathren, Candice, George, Andrea, Rosalie, Kieran, Nicole, Brian, Shervin, Hosam, Angela and Ashleigh – thank you for sharing your stories with us.



**PANCREATIC  
CANCER**

**TYPE 1  
DIABETES**

**MULTIPLE  
SCLEROSIS**

**OSTEOPOROSIS**

**KIDNEY  
DISEASE**

**IMMUNE  
DISEASE**

**BREAST  
CANCER**

**PARKINSON'S  
DISEASE**

**KIDNEY  
DISEASE**

**BRAIN  
CANCER**

**TYPE 1  
DIABETES**

**IMMUNE  
DISEASE**

# Joe and Betty Banhidi

## Paying it forward through medical research



**Joe and Betty Banhidi thought they'd retired in 1992, but a chance article Joe read about the new Australian Alpaca Centre put the couple's plans on hold as he fell in love with the affectionate animals.**

Alpacas were to occupy their next 25 years, first in breeding and showing, then in machine knitting garments from the fleeces they produced, which they sold at Canberra's Old Bus Depot Market. However, their lives were shattered in September 2013, when Joe was diagnosed with aggressive mantle cell lymphoma. During six months of heavy chemotherapy, the couple's eyes were opened to the impact of illness – and how medical research can help.

"When I was told that the cancer was not curable it was a shock, but it's manageable, and God willing it will become more manageable as science advances further," says Joe.

Thankfully, Joe is now in his fifth year of remission and continues to convey a sense of gratitude to medical research for saving his life. "What I've got is incurable, but because of medical research it's manageable," he says.

When the time came for Joe and Betty to review their Will, they wanted to honour the medical research that saved Joe's life. Their interest in medical research led them to the Garvan Institute. Following tours at both Garvan's Darlinghurst and Moss Vale research facilities, they chose to become Garvan Partners for the Future (those who have left a lasting legacy to our medical research by including a bequest in their Will).

***"We are enjoying the benefit of those who contributed to medical research before us. So, in a way we are transferring our thanks for that support towards the future."*** – Joe

Thank you to Joe and Betty, and all of Garvan's Partners for the Future, for your heartfelt generosity and farsighted vision of better health to future generations.



## Partners for the Future

Our generous supporters come from all walks of life and give in various ways. We extend our gratitude to all of these wonderful supporters who have chosen to include a future bequest to Garvan in their Will.

Mrs Margaret Abercrombie  
Anthony Abrahams and Wendy Sillence  
Mrs Margaret Adams  
Ms Ronelle Adams  
Mr Ray Addison  
Mr Ken Allen AO and Mrs Jill Allen  
Ms Christine Allen  
Mrs Suzanne Allen  
Mr & Mrs V & E Annuk  
Ms Wilhelmina Antoniesen  
The Late Hon. Ian Armstrong AM OBE  
Mr Ian A N Armstrong  
Mr Peter Askew  
Miss Margaret Atkinson  
Australian Ladies Variety Association Inc  
Ms Melisa J Ball  
Ms Jane Banfield  
Mr & Mrs Joseph and Elizabeth (Betty) Banhidi  
Mr David Barclay  
Mr Alan Barnes & Mr Peter Bolton  
Mr & Mrs David and Robyn Barnett  
Patricia Barnett  
Mr Wal Barrett  
Mr Keith Barton  
Mrs Esther Bartram  
In Loving Memory of Eileen & George Campbell  
Mrs K Beales  
Mr & Mrs Barry and Jennifer Beck  
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Mrs Sheila Bell  
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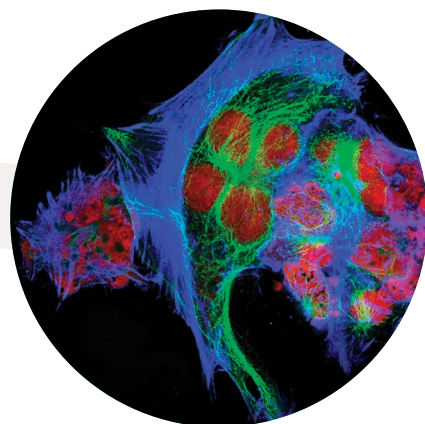
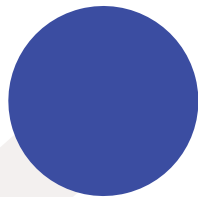
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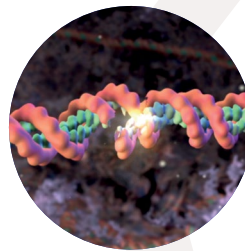
In 2021, Garvan was privileged to receive bequests from the estates of these farsighted, generous people in our community.

We extend our heartfelt thanks to these supporters and condolences to their loved ones and friends. Their legacies will transform the health and lives of future generations.

### In loving memory of :

Heather Adie  
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# In memory

In 2021, we mourned the passing of several members of our Garvan family. Here we remember two very special supporters who made a lasting impact on their community.



*John, Mary and their Mum*



*John and Sophie in Kubota*



*Mary in her new tractor*

## **Mary H Thompson & John E Thompson**

In 2021, Garvan gratefully received a remarkably generous bequest from the late Mary Helena Thompson and her late brother, John Ekin Thompson.

Born and raised in Sydney, siblings Mary and John began their careers working as a dental assistant and at Qantas, respectively. Before his death, their father James ran a real estate business in Sydney, accumulating a large property portfolio, which was inherited by John and Mary who continued to maintain the holding throughout their lives. The city life was not for them though, and they instead settled down in the Tamworth area. Mary and John were dedicated to each other, and managing their beloved cattle and farms at "Coolamore", "Drumalbyn" and "Kara". They were well known by their friends and community as wonderful, caring people. During their lives they generously supported numerous charities, giving large donations over many years.

Mary and John experienced the devastating impact of disease early in life, becoming highly mindful of the importance of medical research. John was only 13 and Mary 11 when they lost their adored mother to acute pancreatitis. Mary remembered her mother being taken out of the house in terrible pain one day, never to see her again. This devastated Mary and haunted her throughout her life. Sadly, only six years later the siblings suddenly lost their father. Mary could remember asking her dad if he would like a cup of tea, and when she returned he had passed away.

In 2013, John became Mary's carer when unfortunately, her lower left leg was amputated due to complications from an operation. In 2018, John expressed some urgency to find Mary a care facility in town. John's urgency became apparent when he was diagnosed with brain cancer in August. He passed away only a month later in September 2018 at the age of 84. Mary lived comfortably in her care facility for a further two years until she sadly passed in April 2020 at the age of 82.

Gifts in Wills, such as the farsighted gift Mary left to Garvan, are incredibly important. Bequests enable us to allocate funding where it is most needed, and enables our researchers to pursue novel, breakthrough projects that have not yet received government funding. We are incredibly inspired and grateful to Mary and John for their farsighted bequest to Garvan's research. Their amazing and generous legacy will help to transform the lives and health of people around the world.

**Mary H Thompson (13.06.1937-03.04.2020)  
& John E Thompson (05.08.1934-15.09.2018)**





## 2021 Garvan Community

Our wonderful supporters come from all walks of life and give in various ways. They have different reasons for supporting Garvan, but they're all committed to helping achieve our vision of a healthier future for all. Our heartfelt appreciation goes to all those who supported Garvan in 2021.

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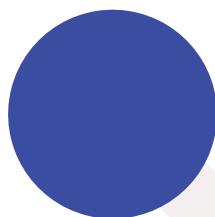
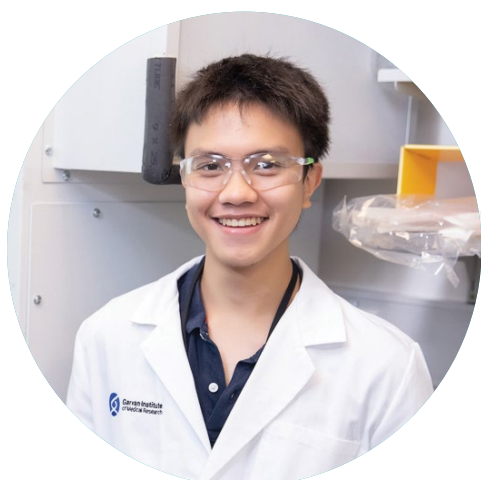
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## Corporate partners

The support and commitment of Garvan's corporate partners is critical to our ongoing success. Although they represent a diverse range of industries, our partners all share our vision of accelerating innovative medical research, for the benefit of all.

### Jewellery with purpose

Since 2016, Paspaley have been supporting Garvan through donations made via their Kimberley bracelet collection. The exclusive Kimberley bracelet is inspired by the rugged beauty of Australia's northwest, featuring sandalwood and hand-selected Australian South Sea pearls unique to the Kimberley. 20% of each piece sold goes towards Garvan's MoST program.

Garvan's Molecular Screening and Therapeutics (MoST) program matches patients with rare and less common cancers who have exhausted all other treatment options to therapies based on their DNA.

Paspaley have been a key partner to Garvan's success by supporting Garvan's life-changing research.

### Driving pancreatic cancer

The Sutton family, both personally and through Suttons Motors, generously support Garvan's pancreatic cancer research. Their contribution supports Professor Paul Timpson's innovative pancreatic cancer research.

This long-term investment has allowed Professor Timpson's Lab to progress his research into an incredible new phase – from pre-clinical research to clinical trials. Bringing to life our goal of taking our research from the lab to patients and then back to the lab.

Pancreatic cancer is one of the most lethal cancers with the five-year survival rate sitting at about 10%. Very little progress has been made in the last 40 years – until now. Sutton's continual support has allowed our researchers to drive pancreatic cancer research into the next lane of treatment strategies.

### Powering cancer research

TPG Telecom Foundation (formerly Vodafone Foundation) have been a partner of Garvan for 11 years. Supporting Garvan in a multitude of ways, including powering our cancer research through the DreamLab app.

Complex calculations are required to determine correlations between different traits. These calculations need huge amounts of computing power, and it is these calculations that were computed via the DreamLab app.

The support of TPG Telecom Foundation has allowed Garvan to accelerate progress of our genomic cancer medicine program.

**PASPALLEY**

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## 2021 Publications

Through scientific publications, Garvan's researchers publish discoveries across a wide range of diseases. These discoveries advance outcomes across the scientific field as research findings are made available to the wider community.

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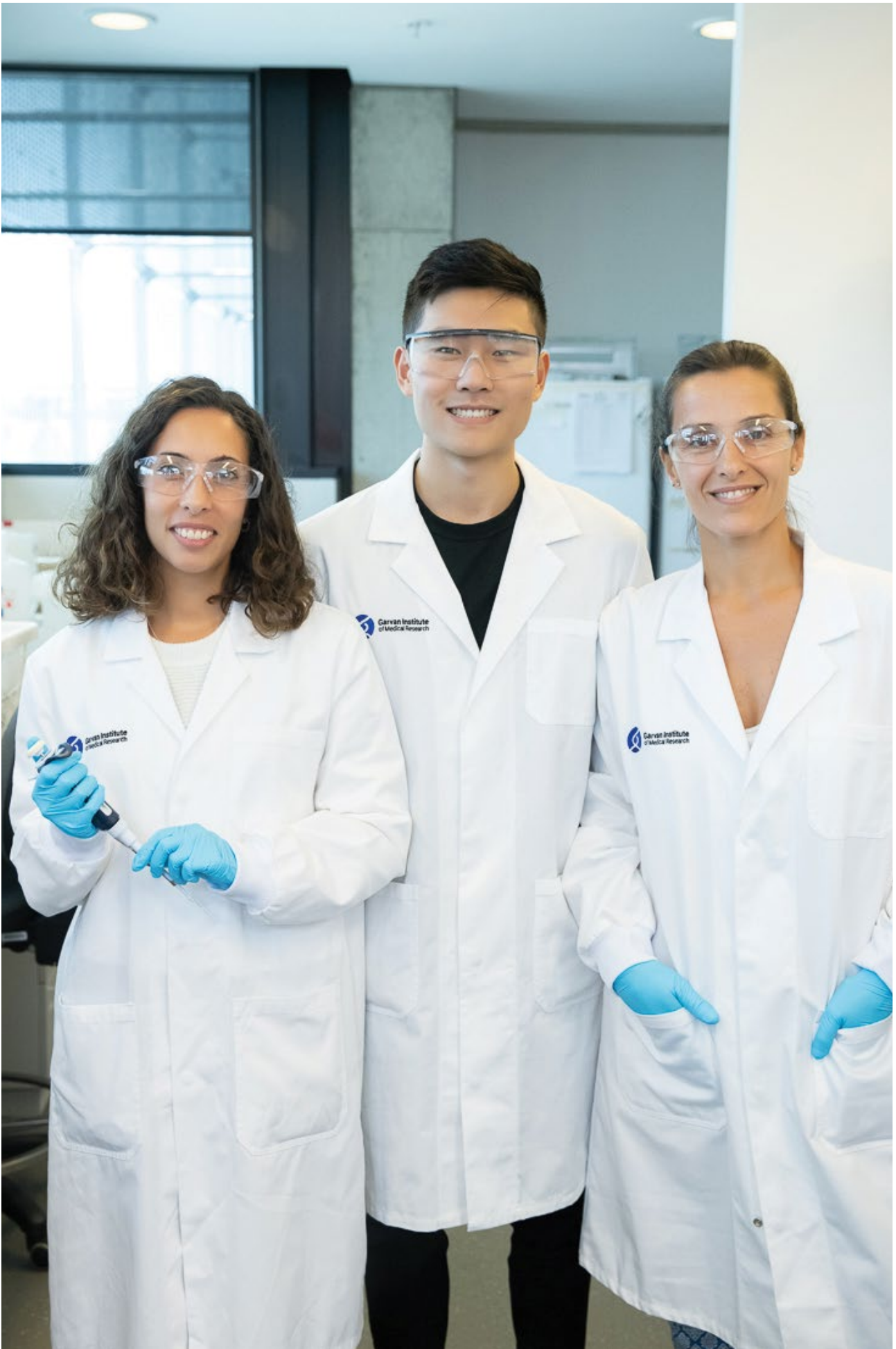
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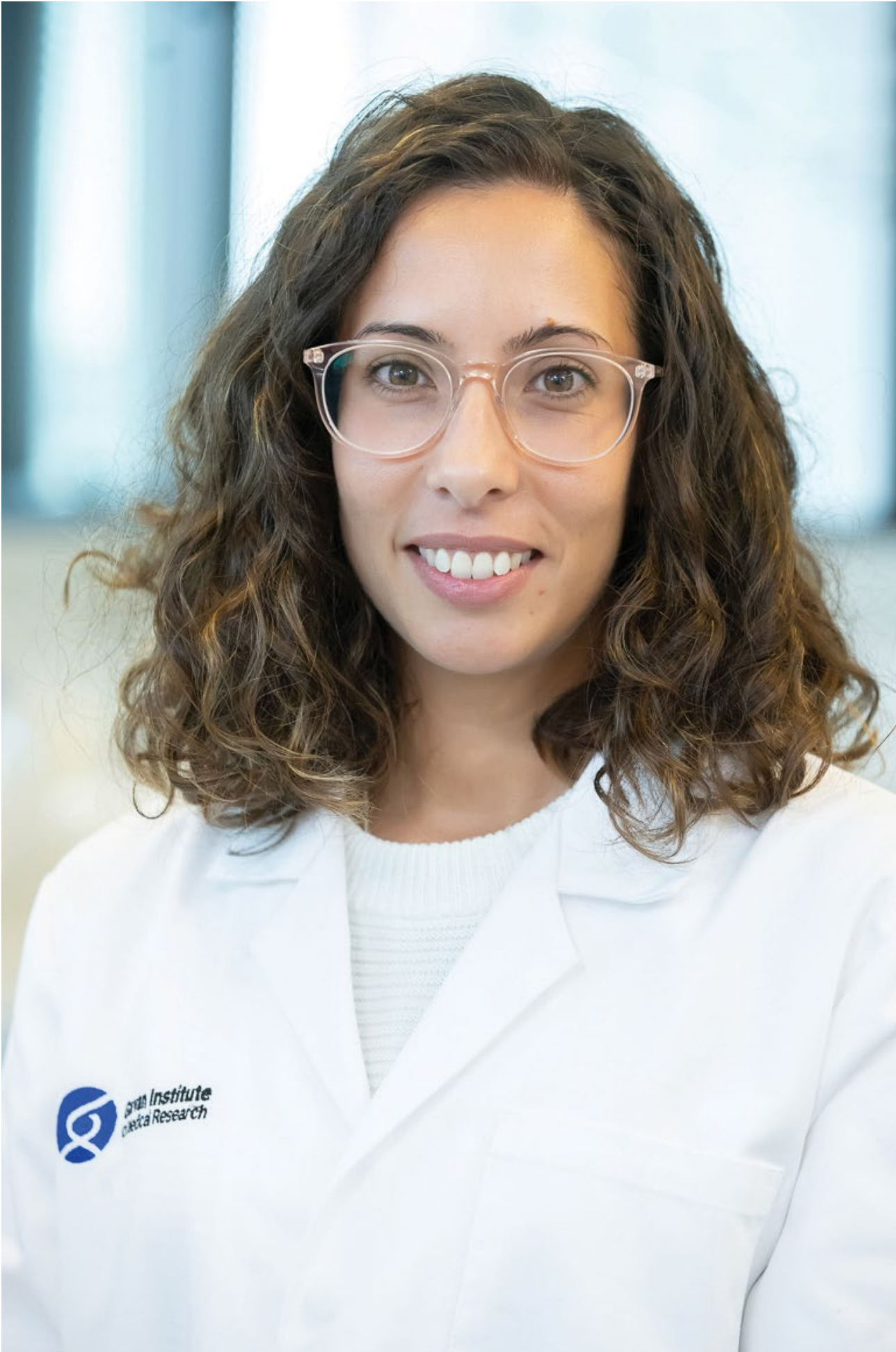
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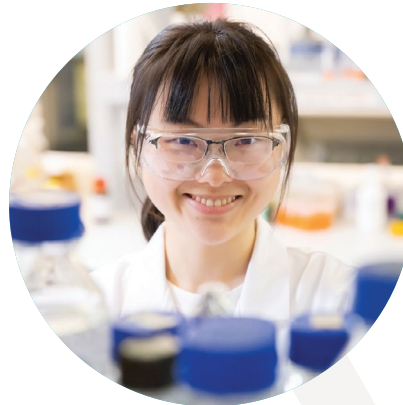
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