

BREAKTHROUGH MEDICAL RESEARCH



2017 Annual Report
GARVAN INSTITUTE OF MEDICAL RESEARCH



MISSION AND VISION

To make significant contributions to medical research that will change the directions of science and medicine and have major impacts on human health. Garvan's ultimate goal is prevention and treatment of major diseases.



Who we are, what we do

Garvan is leading the nation in using genomic analysis to accelerate discovery and enable personalised, precision medicine.

Our researchers pioneer studies into some of the most widespread diseases affecting the community today. Garvan is focused on understanding the role of molecular and cellular processes in health and disease as the basis for developing future preventions and treatments.

For 55 years, Garvan scientists have been achieving significant breakthroughs in the understanding and treatment of diseases.

Aspirations

- To become the most advanced institute in the region in the adoption, application and integration of next-generation genomic and computational approaches and technologies in investigative and translational research.
- To advance knowledge in our key areas of focus that will lead to better understanding, reduced incidence and improved treatments for cancer, osteoporosis, diabetes, obesity, and immunological, skeletal and neurological diseases, and to influence health policy.
- To attract, develop and support exceptionally talented researchers with leading-edge programs addressing key conceptual and practical questions in human biology, and the translation of new knowledge and technologies into clinical applications.
- To embrace and uphold a culture of collegiality, collaboration, inclusivity, consideration, safety, transparency, and high ethical standards.
- To engage stakeholders and the community with our achievements and research vision so that we attract the significant government and donor support needed to empower our transformative agenda.

2017

A year of research
EXCELLENCE
& SUCCESS



Mayan Amiezer, Intravital
Microscopy PhD student,
Immunology Division.

THE ORGANISATION As at 31 December 2017

GARVAN INSTITUTE OF MEDICAL RESEARCH	
BOARD OF DIRECTORS	EXECUTIVE
Chair Dr John Schubert AO	Executive Director Prof John Mattick AO FAA FTSE Deputy Director Prof Chris Goodnow FAA FRS Chief Operating Officer Philip Knox Chief Scientific Officer Dr Marie Dziadek

GARVAN RESEARCH FOUNDATION	
BOARD OF DIRECTORS	EXECUTIVE
Chair Geoff Dixon	Chief Executive Officer Andrew Giles Director of Philanthropy, Bequests and Campaigns Mara-Jean Tilley Director of Fundraising, Marketing and Communications Brad Timms

RESEARCH DIVISIONS		
BONE BIOLOGY	CANCER	DIABETES AND METABOLISM
Head Prof Peter Croucher Faculty A/Prof Paul Baldock Prof Jacqueline Center Prof John Eisman AO Prof Tuan Nguyen Prof Mike Rogers	Head Prof David Thomas Faculty A/Prof Maija Kohonen-Corish A/Prof Elgene Lim Prof Chris Ormandy A/Prof Alex Swarbrick A/Prof Paul Timpson Prof Neil Watkins The Kinghorn Cancer Centre Director Prof David Thomas	Head Prof Mark Febbraio Faculty Prof Trevor Biden Prof Lesley Campbell AM Prof Don Chisholm AO Prof Jerry Greenfield Prof Ted Kraegen A/Prof Ross Laybutt Prof Katherine Samaras A/Prof Carsten Schmitz-Peiffer
IMMUNOLOGY	GENOMICS AND EPIGENETICS	NEUROSCIENCE
Head Prof Stuart Tangye Faculty Prof Antony Basten AO FAA FTSE Prof Robert Brink A/Prof Daniel Christ Dr Tatyana Chtanova Dr Elissa Deenick Prof Chris Goodnow FAA FRS A/Prof Shane Grey A/Prof Cecile King A/Prof Tri Phan Prof Jonathan Sprent FAA FRS	Head Prof Susan Clark FAA Faculty Dr Ozren Bogdanovic A/Prof Marcel Dinger Prof Vanessa Hayes A/Prof Tim Mercer Prof Seán O'Donoghue Prof John Shine AO FAA Kinghorn Centre for Clinical Genomics Head A/Prof Marcel Dinger	Head A/Prof Antony Cooper Faculty Prof Herbert Herzog Prof John Mattick AO FAA FTSE Prof David Ryugo

DEVELOPMENT AND SUPPORT	
Chief Operating Officer Philip Knox <i>Australian BioResources</i> Dr Jenny Kingham <i>Partnerships</i> Christina Hardy <i>Finance and Accounting</i> Samantha Malone <i>Human Resources</i> Simon Hamilton <i>Information Technology</i> Jackson Chan <i>Operations</i> Michael Emerson <i>WHS and Compliance</i> Lisa Moncur	Chief Scientific Officer Dr Marie Dziadek <i>Grants Administration</i> Sonja Bates, Grainne Mullen <i>Student Programs</i> Dr Tracy Anderson <i>Animal Ethics, Governance and Compliance</i> Dr Rayson Tan <i>Animal Welfare</i> Dr Vivian Song <i>Human Research Governance</i> Therese Yim

GENOME.ONE	
BOARD OF DIRECTORS	EXECUTIVE
Chair Paul Brassil	Chief Executive Officer A/Prof Marcel Dinger

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A digital version of this report is available at garvan.org.au/2017-annualreport.

We would like to acknowledge the Gadigal of the Eora Nation, the traditional owners and custodians of the land on which the Garvan Institute of Medical Research is located. We pay respects to the Elders, past, present and future, and recognise the continuing connection and contribution to this land.

CHAIRMAN'S REPORT



Dr John Schubert AO

Chairman, Garvan Institute of Medical Research

What a year it has been. Garvan's researchers, clinicians and thought leaders have achieved a great deal in 2017: producing major research that will impact on clinical practice, translating that research into tangible benefits for patients, and influencing policy and strategic directions for NSW and Australia.

A particular highlight of the year was the launch, in August, of our Australian Genomic Cancer Medicine Program. The Program, which matches therapies with individuals on the basis of genetic information, was launched by the Hon Brad Hazzard, NSW Minister for Health, alongside Professor David Thomas (Head, Cancer Division; Director, The Kinghorn Cancer Centre) and Professor John Simes (Director, NHMRC Clinical Trials Centre).

For me, the most powerful moment of the launch was hearing from Darin Mallawaraachchi – a grandfather whose rare bone cancer is being treated through the Molecular Screening and Therapeutics trial (a key part of the program). Thank you, Darin, for sharing

your journey with cancer, and for outlining the difference that the Program is making, for you and for your family.

As always, I thank all the members of both the Institute and Foundation Boards of Directors, who donate their time and expertise freely for the benefit of Garvan. I welcome Professor Tony Kelleher who joined the board this year.

It has been a great pleasure to work closely with Mr Geoff Dixon, the long-time Chair of the Garvan Research Foundation, who completed his time as Chair this year. I wish Geoff the very best, and look forward to working with his successor, Mr Russell Scrimshaw.

Garvan simply could not do the work it does without the many generous and committed people and groups who support us. Please know that your contribution – whether you give financial support or your time – is crucial and highly valued.

As I write this report in early 2018, the Board has recently announced that Garvan's Executive Director, Professor John Mattick AO FAA FTSE, is to take up a new role as the Chief Executive Officer at Genomics England. This prestigious appointment is recognition of John's considerable successes

here at Garvan, which through his leadership has become one of the world's leading clinical genomics centres. I'd like to take this opportunity to wish John well in his new role, and to thank him warmly for his years of exemplary service to Garvan and to Australian medical research.

I am delighted that Professor Chris Goodnow FAA FRS will succeed John as Executive Director. Chris is one of Australia's most outstanding scientists, with a remarkable track record in applying genomic analysis to the diagnosis and treatment of immune disease. Since 2015, when Chris arrived at Garvan as Deputy Director, we have come to know him as a scientist of exceptional ability and foresight, and as a leader of great vision and warmth.

With Chris at the helm, Garvan is well-placed to continue to implement our strategic vision – transformative science leading to clinical impact across a wide range of major diseases.

We look forward to making an even greater impact on human health in 2018 as the wonderful Garvan team continues on our mission to impact powerfully on human health and to bring that breakthrough research directly to patients in the clinic.

EXECUTIVE DIRECTOR'S REPORT



Professor John Mattick AO FAA FTSE

Executive Director, Garvan Institute of Medical Research

2017 has been a landmark year for Garvan, and it has been satisfying to see the progress we have made. Our central mission is to undertake medical research that informs our understanding of human biology and leads to improved disease outcomes, so I am delighted that we have had so many achievements this year. Among others, we:

- made major advances towards targeted treatments for pancreatic and other cancers;
- uncovered a new approach that could make islet cell transplants feasible for millions of people with type 1 diabetes;
- identified a new approach to rebuilding bone;
- showed that whole-body MRI detects pre-symptomatic cancers in people with a high genetic cancer risk;
- demonstrated that the way our DNA is packaged may influence the progression of prostate cancer;
- showed how our immune system's 'memory' can make vaccinations highly effective; and
- created a new way to study the development of Parkinson's disease.

We have led several initiatives in genomics and big data, which are set to transform the understanding and treatment of disease. These include:

- the Garvan-Weizmann Centre for Cellular Genomics – an initiative of our wide-ranging partnership with Israel's Weizmann Institute of Science, and the only multidisciplinary centre of its kind in the southern hemisphere. This partnership would not have been possible without the insight and advocacy of Garvan Institute Board Director Ms Jillian Segal AM.
- Garvan's Australian Genomic Cancer Medicine Program: an innovative suite of clinical trials, now well underway, that matches therapies with individuals on the basis of genetic information.
- the Garvan-Deakin Program in Advanced Genomic Investigation, a strategic partnership with the Centre for Pattern Recognition and Data Analysis at Deakin University, which will use machine learning and artificial intelligence to gain insights from data.

In December, Garvan reached a major milestone of 17,000 whole genomes sequenced. This reflects Garvan's position at the forefront of clinical genomics. 2017 has also seen the finalisation of our 2017-2021 Strategic Plan, which will ensure Garvan continues to drive change for the health of Australians.

I thank our remarkable community of supporters, whose generous support makes our crucial work possible. My thanks go to our Division Heads, Chief Scientific Officer Marie Dziadek and outgoing Chief Operating Officer Philip Knox who've provided wonderful leadership. I also thank the rest of the outstanding Garvan team – researchers, support staff, students and the Foundation – who together make Garvan such an extraordinary place.

I have recently accepted a new leadership role at Genomics England and will be moving on in mid-2018. My six years here have been among the most fulfilling of my career. I am proud that Garvan is now one of the world's leading genomic centres, pioneering the next generation of medical research and precision healthcare. I will miss this outstanding place, and its people, very much.

I am delighted that Professor Chris Goodnow FAA FRS will succeed me as Executive Director. Chris is an outstanding researcher and leader, who I have been privileged to work closely with. The Institute could not be in better hands – I will watch with great pride as Chris takes Garvan from strength to strength in the pursuit of better health through leading-edge research and technology.

CHAIRMAN'S REPORT



Geoff Dixon

Chairman, Garvan Research Foundation

My final year as Chair of the Garvan Research Foundation has been a momentous one for Garvan.

In 2017, many game-changing research initiatives were achieved. These simply would not have happened without support from the community. These included:

- The launch of the Garvan-Weizmann Centre for Cellular Genomics, a state-of-the-art facility with only recently available technology. It was made possible through a combined gift of \$10 million from three visionary donors – Mr John Roth and Ms Jillian Segal AM, Mr and Mrs Laurie and Di Sutton, and the Johnny Kahlbetzer Family – as well as the NSW Government.
- The Australian Genomic Cancer Medicine Program, a clinical trial for rare and uncommon cancers, is being made available to cancer patients nationally. It has received significant support from organisations like IAG and the Vodafone Foundation, along with individuals like Mr and Mrs Paul and Wendy Jeans and the Norma Wilson Trust.

During my eight years in this privileged position, the calibre of work from Garvan researchers, underpinned by the vision and generosity of our donors, has never ceased to amaze me.

The ongoing philanthropic investment of individuals and organisations – in particular our many long-term supporters, including The Kinghorn Foundation, Mrs Janice Gibson and the Ernest Heine Family Foundation, Mr Len Ainsworth, Mrs Jane Hemstritch, The Bill and Patricia Ritchie Foundation, Mrs Margaret Rose AM, Mr & Mrs Alan and Lynne Rydge, Mr John Roth and Ms Jillian Segal AM, The Paramor Family, Mr & Mrs John and Megan Wade, Ms Lysia O'Keefe and The NELUNE Foundation – has been absolutely crucial to Garvan's success.

Each person who supports Garvan, by remembering us in their Will as a Partner for the Future, giving monthly, fundraising in their community or asking for donations in memory of loved ones, makes a tangible impact.

The leadership team of the Garvan Research Foundation, Andrew Giles, Mara-Jean Tilley and Brad Timms, continue to strive for greatness in supporting Garvan's research.

Before acknowledging the Board of Directors, I'd like to make a special mention of Mr Russell Scrimshaw, who will take my place as Chair of the Garvan Research Foundation from 2018. Russell has an enormously impressive career in Australian business, and his dedication to Garvan is undeniable – he is a major donor, and a member of both Garvan Boards of Directors and the Genome.One Board of Directors.

It has been an honour to work with and get to know the many inspiring and altruistic individuals who have made up the boards of the Garvan Research Foundation and Garvan Institute during the years I have served on both bodies. Thank you to them all.

I also must acknowledge Professor John Mattick's service to Garvan as Executive Director for the last six years. His leadership and vision has taken Garvan to new heights. I congratulate Professor Chris Goodnow on his new appointment; Garvan will thrive under his headship.

Finally, a sincere thank you to all of you who have supported Garvan's researchers. I look forward to seeing Garvan continue to understand more about disease and improve healthcare.



Andrew Giles

Chief Executive Officer, Garvan Research Foundation

The Garvan Research Foundation and Garvan Institute have achieved yet another noteworthy year thanks to the generosity of our community.

Our researchers have launched new initiatives and published significant findings that will change the face of healthcare. We launched the Australian Genomic Cancer Medicine Program (page 20), opened the Garvan-Weizmann Centre for Cellular Genomics (page 33), laid important groundwork to establish a clinical trial for Parkinson's disease (page 36) and prediabetes (page 24) and developed public and medical awareness of genomics and diseases like osteoporosis.

Within the Foundation, our remit is to support the work of the Institute. During 2017, our team has grown to almost 30 dedicated individuals. The expertise and passion within this small but powerful part of the Institute is critical.

We raise the profile of our scientists, promote their work and join with other like-minded organisations to create a stronger voice about the significance

of medical research. Most importantly, we work with you – our team of generous supporters – to enable Garvan's vital research projects.

Garvan leadership has been a key element of 2017. After eight years as the Chair of the Garvan Research Foundation, Mr Geoff Dixon retired from our Board of Directors. Geoff has chaired the organisation for my entire time at the Foundation.

Under his leadership, the Foundation has received more than \$200 million in donations to support the work of researchers at the Garvan. I cannot do justice to Geoff's contribution to Garvan in a few short words. Suffice to say we are, and will continue to be, incredibly grateful for his guidance and dedication.

Our incoming Chair, Mr Russell Scrimshaw, brings a wealth of experience and a unique understanding of Garvan, as he has served as a member of the boards for the Garvan Institute, Foundation and our subsidiary Genome.One.

Professor John Mattick, Executive Director of the Garvan Institute, has also announced his resignation. In his six years as Director, Professor Mattick transformed Garvan into one of the

world's leading genomics research institutes. His departure to Genomics England is an opportunity for Garvan to collaborate more closely with genomics organisations throughout Europe. Garvan will undoubtedly remain in valuable connection with Professor Mattick during the next exciting chapter of his illustrious career.

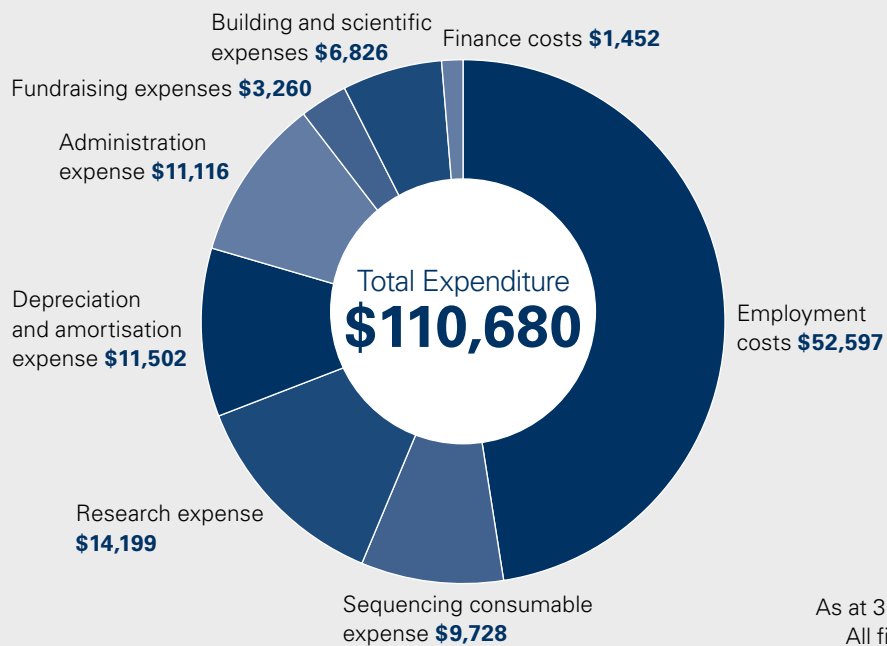
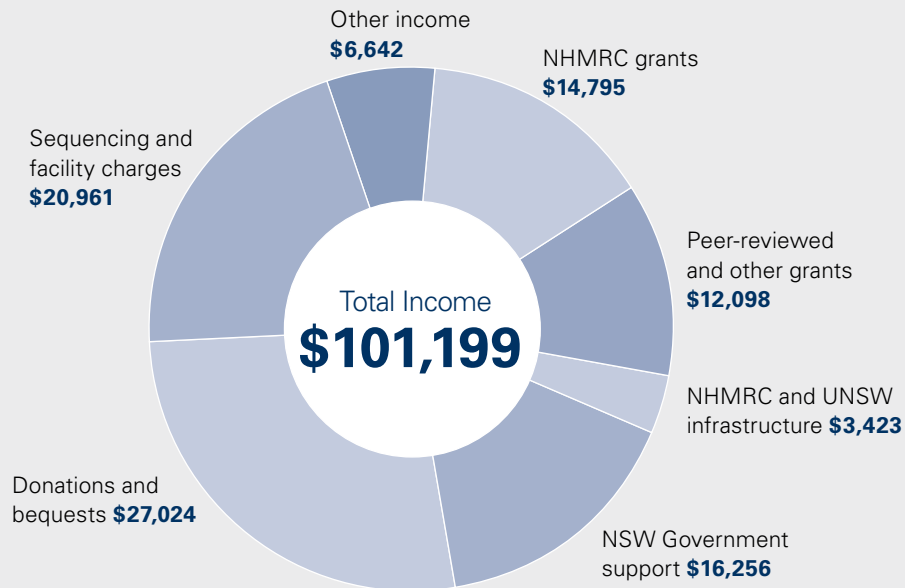
Like many here at Garvan, I was delighted with the appointment of Professor Chris Goodnow as Garvan's next Executive Director. Professor Goodnow is a world-renowned scientist, and his drive will see Garvan continue on its trajectory of success and innovation.

I'm sincerely grateful to our entire community of donors, volunteers and vocal advocates – individuals, Partners for the Future, groups, organisations and ambassadors – your commitment and contribution to research inspires our scientists.

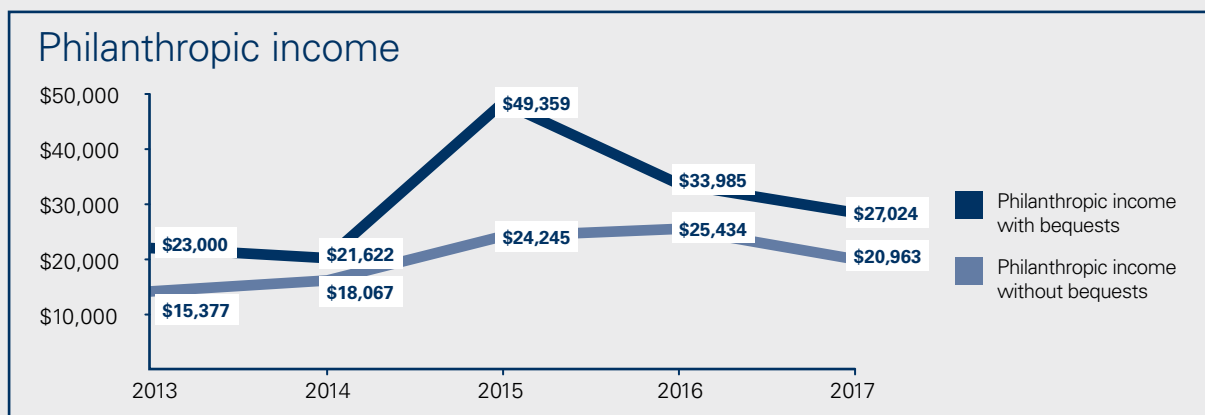
I've said it before ... we're at a tipping point in medical research. The technology and expertise within Garvan is moving us ever-closer to a revolution in healthcare. Thank you for joining and supporting us on the journey. Your support continues to make a real difference to our work.

THE YEAR AT A GLANCE

The year-on-year movement from surplus to deficit is a consequence of several factors. The Garvan Research Foundation continued to receive generous support from a wide cross-section of the community in 2017; however, donations unexpectedly declined by almost \$7 million compared to 2016. Additionally, the Institute made significant but necessary investments in start-up research support and underwriting of Garvan's scientists, as well as in Genome.One.



As at 31 December 2017
All figures are A\$'000



GARVAN AT A GLANCE

Research staff by Division As at 31 December 2017

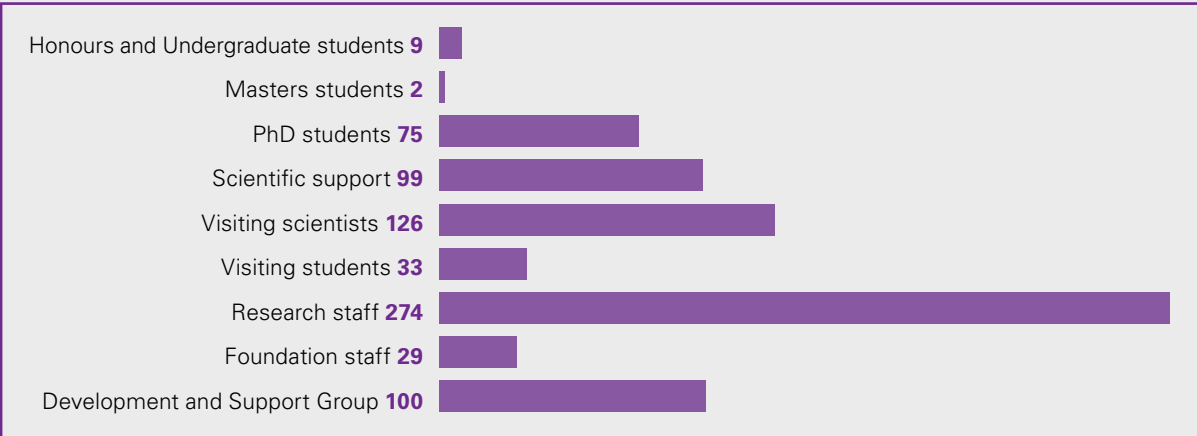
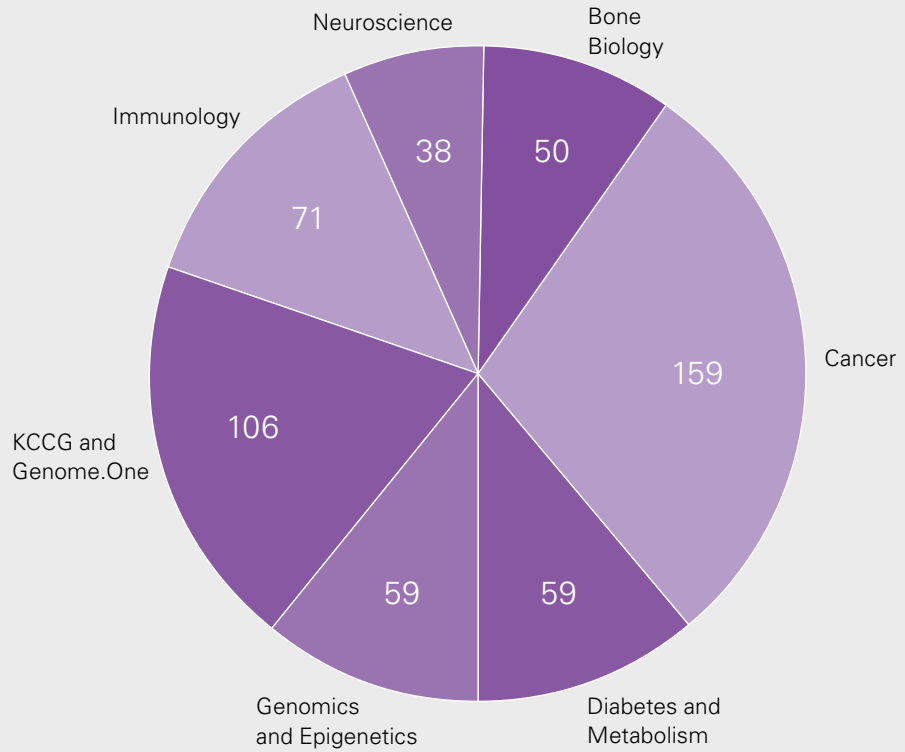
Total Staff

747



Average age

40 yrs



Public and community engagement and education



Working together

Collaboration beyond Garvan

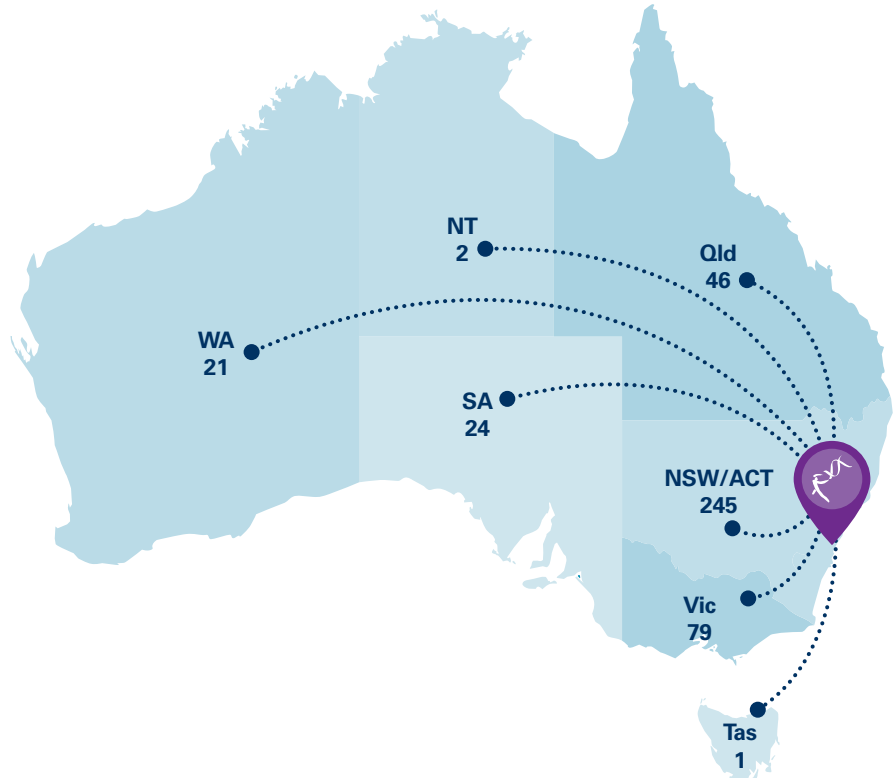
Key partnerships and joint endeavours

Ambitious and collaborative endeavours of many kinds – both on a national and an international scale – are essential to modern medical research.

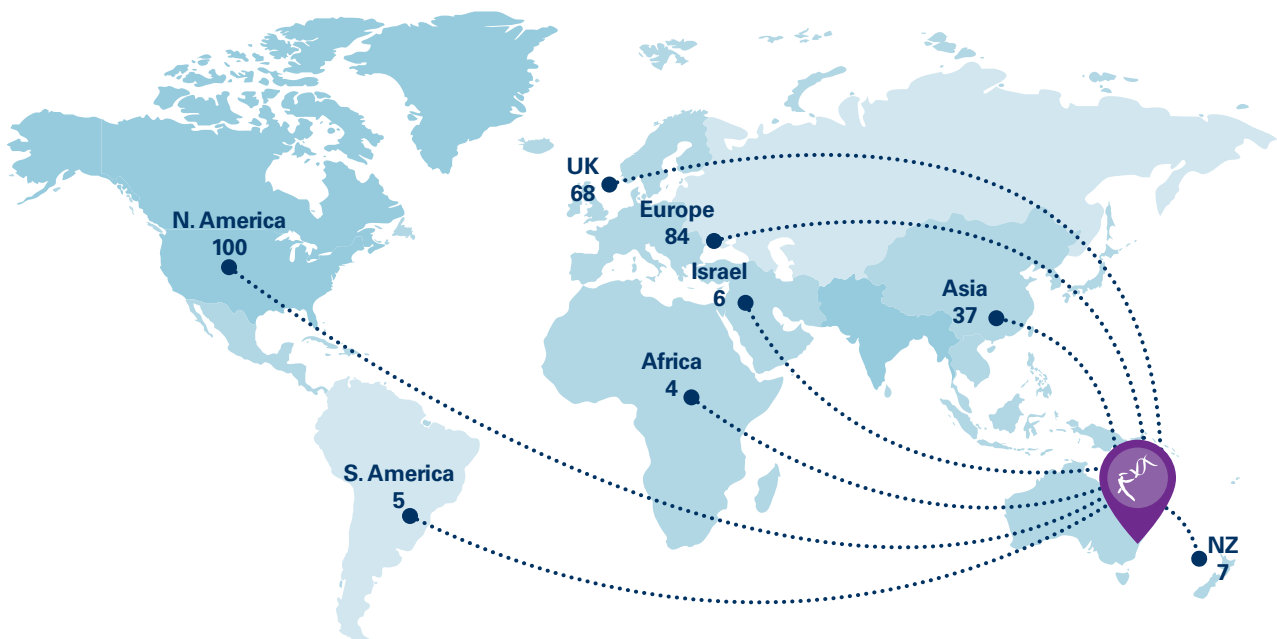
Here are the many locations that Garvan connects with to allow us to advance our groundbreaking discoveries.

The numbers refer to joint publications with other institutions.

Collaborating within Australia



Collaborating around the world



Peer-reviewed funding



21 successful Garvan-led research grants (45%) were written in collaboration with one or more partner institutions.



11 grants led by other institutions included Garvan as a partner.

Read about Garvan's key partnerships and collaborations in 2017 in these stories

- 20** Genomic cancer medicine now a reality
- 21** Childhood cancer clinical trial goes national
- 25** Smart power for cancer research
- 29** Finding answers to autoimmune disease
- 33** Accelerating single-cell understanding
- 37** Supporting career goals
- 40** The frontier of precision medicine
- 42** Driving change through collaboration

86%

of Garvan's publications in 2017 were authored in collaboration with researchers from other institutes.

Publications

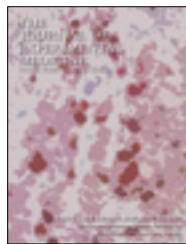


362 total publications in 2017, including journal articles, reports, reviews, letters and book chapters.

93 papers in journals with an impact factor greater than 8.

289 original research papers.

Cover issues



Abolhassani et al., *J Exp Med* 2017; 214:91-106.
"Combined immunodeficiency and Epstein-Barr virus-induced B cell malignancy in humans with inherited CD70 deficiency"



Haddad and Nakamura, *Cell Chem Biol* 2017; 24:1-10
"PINK1-based screen shines light on autophagy enhancers for Parkinson's disease"



Oakes et al., *PLOS Genet* 2017; 13:e1007072
"A mutation in the viral sensor 2'-5'-oligoadenylate synthetase 2 causes failure of lactation"

impact
of an academic journal is a measure reflecting the yearly average number of citations to recent articles.



Vennin et al., *Sci Transl Med* 2017; 9: eaai8504
"Transient tissue priming via ROCK inhibition uncouples pancreatic cancer progression, sensitivity to chemotherapy, and metastasis"



Emmett et al., *J Nu Med* 2017; 58:1972-1976
"Treatment outcomes from 68GaPSMA PET CT informed salvage radiation treatment in men with rising PSA following radical prostatectomy: prognostic value of a negative PSMA PET"

Papers in key journals

- 3** *Cell*
- 1** *Cell Metabolism*
- 3** *Immunity*
- 2** *Journal of Clinical Oncology*
- 2** *The Lancet*
- 2** *Nature*
- 3** *Nature Genetics*
- 1** *Nature Medicine*
- 1** *Science*



Publications Report

For a full listing of Garvan's 2017 publications, please visit garvan.org.au/2017-publications.

Division Report: Bone Biology



Professor Peter Croucher

From the Head

Describe your Division's goal.

Our vision is to eradicate skeletal disease through more accurate prediction and more targeted therapy.

What's your Division's main research focus?

Understanding all the genes that control the skeleton. We are using this knowledge to develop new tests to predict who will develop skeletal diseases, such as osteoporosis and cancers that grow in bone, to better identify who requires treatment and to develop better treatments.

Which Divisions within Garvan do you work most closely with?

One of the fundamental bone cells, the osteoclast, which resorbs bone, is derived from immune cells. We work closely with the Immunology Division, most recently in breakthrough imaging studies that have revealed novel biology for these cells. These findings have informed our current studies into the devastating outcomes of bone cancers, which involve the Cancer and Genomics and Epigenetics Divisions. Another area of research involves the interactions of the skeleton with metabolism, on which we collaborate with Neuroscience and, more recently, Diabetes and Metabolism.

Our strong clinical focus requires close association with St Vincent's Hospital and with the team at Garvan's osteoporosis clinic in Dubbo. We have several major international collaborations, including the Origins of Bone and Cartilage Disease Consortium with Imperial College London and the Wellcome Trust Sanger Institute at Cambridge, as well as a close relationship with the Weizmann Institute in Israel.

Where do you see Bone Biology's research heading?

We can now examine the entire genome, as well as the activity of every cell within bone and bone marrow. This is enabling us to challenge skeletal disease on a scale that was previously unimaginable. We will define the entire cellular and molecular landscape of the skeleton, including the micro-environment within the marrow.

Having a complete understanding of the genes that regulate bone will produce important advances for management of skeletal disease. In combination with our long-standing clinical studies in Dubbo and collaborators overseas, we will harness the power of genetics to improve the prediction of skeletal disease. This will provide a platform to produce a sophisticated genetic test to identify those at risk of skeletal disease. In this manner, we aim to initiate therapy before the catastrophic outcomes of fracture and deformity occur.

Finally, through a growing understanding of how these genes produce their effects in bone, we aim to develop new treatments, better targeted to those who will respond the best and benefit the most. In this manner we aim to better tailor therapy to each patient's needs.

Much of this work is being made possible through the generous support of Mrs Janice Gibson and the Ernest Heine Family Foundation.

Research highlight

Osteoporosis study identifies 150 new genetic risk sites

In the largest ever study of its kind, researchers have identified over 150 new sites in the human genome that are linked to low bone mineral density and to an increased risk of fracture. The international team included Professor Peter Croucher and Scott Youtlen.

The researchers examined genetic and clinical information relating to 150,000 individuals and identified 150 new associated sites in the genome, effectively tripling the number of known sites. They went on to look in depth at each site, exploring their likely impact in cells, preclinical models and through predictive modelling.

The findings vastly increase our understanding of how our genes affect our bone health, and suggest a number of promising therapeutic approaches for osteoporosis.

Kemp et al., *Nat Genet* 49:1468-1475. DOI: 10.1038/ng.3949

Research highlight

Muscle weakness and mortality

Garvan's world-leading Dubbo Osteoporosis Epidemiology Study has led to a new understanding of the impact of bone fractures on the lives of those with osteoporosis. One key finding has been that breaking a bone leads to an increased risk of premature mortality – but the reasons for this have not been well understood.

Professor Tuan Nguyen and his team explored whether muscle weakness



Marcelo Sergio, Bone Biology Senior Research Assistant, and Dr Ryan Chai, Research Officer.

plays a role in post-fracture mortality. The researchers looked at 25 years of data from the Dubbo Study, involving over 1100 study participants, and compared muscle strength before and after fracture, and mortality.

The researchers found that muscle weakness does indeed increase the risk of death after most osteoporotic fracture types. “Low muscle strength also increases the risk of osteoporotic fracture,” says Professor Nguyen. Early interventions to improve muscle strength in older Australians might decrease both fracture itself, and the risk of mortality after fracture.

Pham et al., *J Bone Miner Res* 2017; 698-707. DOI: 10.1002/jbmr.3037

Research highlight

A new way to rebuild bone

Dr Michelle McDonald and her team have demonstrated a new therapeutic approach that can rebuild and strengthen bone. The finding offers hope for those with the debilitating bone cancer, multiple myeloma.

The current treatment for myeloma-associated bone disease, bisphosphonate drugs, prevents further bone loss but doesn't restore damaged bones. The researchers speculated that if they could inhibit the protein sclerostin, which halts bone formation in healthy bones, they could reverse the myeloma-associated bone loss.

In a mouse model, researchers revealed that an anti-sclerostin antibody therapy not only prevented further bone loss, it doubled bone volume in some mice.

Dr McDonald, who co-led the research with Professor Peter Croucher, says, “Before and after treatment, the difference was remarkable – we saw fewer lesions or ‘holes’ in the bones. These lesions are the primary cause of bone pain, so this is an extremely important result.”

McDonald et al., *Blood* 2017; 129:3452-3464. DOI: 10.1182/blood-2017-03-773341

Research highlight

Proteins on the loose in a debilitating childhood disease

Professor Mike Rogers, Head of the Bone Therapeutics Laboratory, and his team have shown that a family of untethered proteins builds up in the cells of those with the rare genetic condition mevalonate kinase deficiency (MKD). Those with MKD experience repeated and frequent inflammatory ‘flares’, which cause severe bone and joint pain, can last for days and are accompanied by a wide range of other symptoms. These usually begin in infancy.

The team showed that, within blood cells of people with MKD, proteins from the Rab family had no isoprenoid ‘tail’. Without this, the proteins are free to move into other parts of the cell, which could set off the disease process, triggering inflammation and causing joint pain. This feature could be used to fast-track diagnosis – a process that is often protracted.

Munoz et al., *J Allergy Clin Immunol* 2017; 140:873–875. DOI: 10.1016/j.jaci.2017.02.033

News highlight

Autoinflammatory diseases workshop

When is a rare disease not rare? When one room contains many of Australia's known cases, plus their families and doctors, and the clinical experts and researchers who are working towards a better understanding of their condition. Such was the case at Garvan's Autoinflammatory Diseases Workshop.

While inflammation is a normal immune response, in some people this malfunctions and causes damage to the body, including bones and joints. Professor Mike Rogers, along with Dr Marcia Munoz and Associate Professor Tri Phan, created the workshop to connect professionals in this area with people who live with autoinflammatory disease. A follow-up is planned for 2019.

Research Laboratories and Groups

Bone Biology Lab Head:
Prof Peter Croucher

Bone Microenvironment Group
Leader: Dr Michelle McDonald

Bone Therapeutics Lab
Head: Prof Mike Rogers

Clinical Studies and Epidemiology
Lab Head: Prof Jacqueline Center

Genetic Epidemiology of
Osteoporosis Lab Head:
Prof Tuan Nguyen

Osteoporosis and
Translational Research Lab
Head: Prof John Eisman

Skeletal Metabolism Lab
Head: A/Prof Paul Baldock

Celebrating giving

David and Dulcie Henshall, of the David and Dulcie Henshall Foundation, have been major Garvan donors since 2016. They have funded cutting edge technologies that have enabled highly detailed analysis of bone and body composition in live mice, through processes identical to those used in the clinic to assess human disease.

What does medical research mean to you?

Improving the health of the nation.

What inspired your first gift to Garvan?

We received a *Breakthrough* magazine a couple of years ago, which described genome sequencing, and found it intensely interesting.

What's been the biggest reward?

Seeing reports outlining the painstaking yet methodical approach by scientists in chasing down the mysteries of bone cancer.

What's your dream for healthcare in the future?

Quicker and less expensive diagnosis of disease and a greater number of efficient treatments available.

A family philosophy of philanthropy

Well-known in Sydney and NSW for their role in the motor industry, the Sutton family were supporters of St Vincent's Hospital for many years. They became supporters of Garvan in 1997.

"After the diagnosis of my mother Barbara with pancreatic cancer, we realised how important the research conducted by Garvan is," says Lauren Sutton, Manager of Charity Partnerships for Sutttons.

The Sutton family requested that, in lieu of flowers at Barbara's funeral, donations be made to Garvan. Laurie Sutton, Managing Director of Sutttons, then proudly joined the Garvan Research Foundation board.

"My father has continued to support Garvan since 1997. He is a philanthropic visionary of The Kinghorn Cancer Centre and the Garvan-Weizmann Centre for

Cellular Genomics," Lauren explains, adding, "And, as a result of my exposure to the incredible staff at Garvan, I became involved in the establishment of Young Garvan." Young Garvan is a volunteer group of young professionals who support and raise awareness of Garvan's work as well as raise funds to support Garvan's young scientists.

Sutttons has also become a corporate sponsor of Garvan. "Our staff are very proud of the partnership we have with Garvan," says Lauren. "It was a privilege to recently take 35 of our executive staff on a tour of the facility – showing them firsthand the incredible work being done and allowing them to meet the amazing Garvan staff."

Sutttons is now providing two vehicles to Garvan as part of their corporate partnership. The disability-accessible Honda Odyssey provided by Sutttons City Honda will help The

Kinghorn Cancer Centre provide a transport service to make it easier for patients to attend appointments.

Of his role in assisting the Garvan and Weizmann Institutes to establish the joint Centre, Laurie says, "Such a cutting-edge centre right here in Sydney, and consequent expansion in Garvan's research capabilities is very exciting."

The Centre houses a range of new technologies that can look more closely at a cell than ever before, helping researchers to understand what makes each unique and exploring how it functions in health and disease.

To describe the Sutton's longstanding connection with Garvan, Lauren explains, "Medical research is all about a better life for future generations. Any time spent at Garvan with the wonderful staff is motivational and inspirational."

Below: the vehicle provided by Sutttons City Honda for TKCC patient transport is officially handed to Andrew Giles, CEO of Garvan Research Foundation (centre), by two generations of the Sutton family. From left Lauren Sutton, Craig Sutton, Laurie Sutton and Ryan Sutton.



Division Report: Cancer



Professor David Thomas

From the Head

Describe your Division's goal.

To understand cancer and pioneer personalised screening and treatments.

What's your Division's main research focus?

We research common as well as rare and uncommon cancers. We have a strong focus on innovative genomic approaches and imaging technologies.

Which Divisions within Garvan do you work most closely with?

We're housed within The Kinghorn Cancer Centre and we work closely with St Vincent's Hospital oncologists and nurses. Because cancer can hide in bone, we collaborate closely with the Bone Biology Division. Immunotherapy has huge potential for cancer research so we work closely with the Immunology Division. Due to the role of genomics, the Garvan-Weizmann Centre for Cellular Genomics and the Kinghorn Centre for Clinical Genomics are key partners.

Where do you see the Cancer Division's research heading?

Our research continues to improve our understanding of the genetic drivers of cancers and the development of personalised medicine and precision healthcare.

Research highlight

Long-term survivors have 'built-in immunotherapy'

Pancreatic cancer has a dismal five-year survival of just 7% – but a select few patients go on to live healthy lives. New research has shown that, in these people, the immune system sees the tumour as a kind of infectious disease – prompting it to attack and destroy cancer cells.

The study included clinical and genomic analysis of 150 Australian patients, contributed through the Garvan-based Australian Pancreatic Cancer Genome Initiative (APGI). Garvan's Professor Anthony Gill says, "The APGI is an incredibly rich and detailed clinical and genomic resource of hundreds of pancreatic cancer patients – we're able to go back, years later, to the genome sequence of tumours in people who are now well, and to look in detail at exactly what is different about them."

The findings will help researchers understand how the body defends itself against pancreatic cancer, and will drive new work on immunotherapy for pancreatic cancer.

Balachandran et al., *Nature* 2017; 551:512-16. DOI: 10.1038/nature24462

Research highlight

Breast cancer drug could work in pancreatic cancer

A breakthrough breast cancer drug might also be effective against some forms of pancreatic cancer, including metastatic cancer, Dr Marina Pajic and her team have found.

In a study of 550 patient biopsies, the researchers found that a cellular pathway (Cdk4/6) was 'switched on' in two-thirds of pancreatic tumours, driving them to grow and divide. The drug palbociclib switches off the Cdk4/6 protein, so the researchers tested its effects on Cdk4/6-driven pancreatic tumours in mice. They also devised a straightforward way to identify which tumours were likely to respond to palbociclib treatment.

The researchers saw dramatic effects on mouse lifespan at all stages of cancer progression, including metastatic cancer, and showed how palbociclib could also inhibit the spread of pancreatic cancer to distant tissues.

The findings could lead to a new personalised treatment approach for many pancreatic cancers. Clinical trials to assess the effects of palbociclib on pancreatic cancer are now underway.

Chou et al., *Gut* 2017; 0:1-14; DOI: 10.1136/gutjnl-2017-315144

Celebrating giving

Paspaley's gift

Garvan's valued partner, the iconic pearling company Paspaley, has created the 'Kimberley Bracelet' to support Garvan and cancer research. From each bracelet purchased, 25% is donated to Garvan's Australian Genomic Cancer Medicine Program. In 2017, the bracelet generated more than \$200,000 in donations.

The design comprises natural elements unique to WA's Kimberley region – sandalwood from the Kununurra and luminous Paspaley pearls. Paspaley has supported Garvan for many years, and this exclusive design is an innovative way the company is introducing their clients to Garvan. The Kimberley Bracelet is a unisex accessory, and is available at all Paspaley boutiques and online at paspaley.com.



Associate Professor Paul Timpson, Invasion and Metastasis Lab Head, with Janett Stoehr, Invasion and Metastasis Research Assistant.

Research highlight

Top-to-toe MRI finds curable cancers

A major study has shown that whole-body MRI detects tumours in people with a high genetic risk of cancer at an early and curable stage. Researchers worked with people with Li-Fraumeni, almost all of whom will have cancer in their lifetime.

The whole-body MRI screening program detected cancers at a high rate: approximately one cancer per 10 individuals tested. The researchers will next explore whether whole-body MRI is effective as a screening tool in other groups with a high genetic cancer risk.

Professor David Thomas co-led the study with Dr Mandy Ballinger (Garvan) and National Cancer Institute (USA) colleagues. "What we have found – conclusively – is that whole-body screening of individuals at high genetic cancer risk really works in the clinic," says Professor Thomas. "We're fast approaching a point at which an individual's personalised risk of cancer will be determinable by investigating their genome. We look forward to assessing the power of whole-body MRI to pick up cancers early in a range of high-risk individuals."

Ballinger et al., *JAMA Oncol* 2017; 3:1634-9. DOI: 10.1001/jamaoncol.2017.1968

Research highlight

A one-two punch for pancreatic cancer

Garvan researchers have uncovered a promising new approach for treating pancreatic cancer, by 'softening' the tissue around the tumour before chemotherapy. This sequential two-step approach doubled survival time in mice and impaired the spread of cancer to other tissues.

Combination chemotherapy is the standard of care for pancreatic cancer, but it is only moderately effective. To address this, Associate Professor Paul

Research Laboratories and Groups

Clinical Cancer Research

Coordinated by Prof David Thomas and A/Prof Elgene Lim

Connie Johnson Breast Cancer Research Lab Head: A/Prof Elgene Lim

Genomic Cancer Medicine Lab Head: Prof David Thomas

Immunobiology of Cancer Group Leader: Dr Maya Kansara

Molecular Screening and Therapeutics Program Manager: Dr Dominique Hess

Genetic Cancer Risk Group Leader: Dr Mandy Ballinger

Ovarian Cancer Research Lab Head: Prof David Bowtell

Australian Pancreatic Cancer Genome Initiative Head: Prof Anthony Gill

Clinical Prostate Cancer Research Group Leader: Prof Lisa Horvath

Hormones and Cancer Group Leader: Dr Ann McCormack

Translational Cancer Research

Coordinated by Dr Alex Swarbrick and Prof Sandra O'Toole

Colon and Lung Cancer Research Lab Head: A/Prof Maija Kohonen-Corish

Tumour Progression Lab Head: Dr Alex Swarbrick

Translational Breast Cancer Research Group Leader: Prof Sandra O'Toole

Cancer Biology Research

Coordinated by Prof Chris Ormandy

Cancer Biology Lab Head: Prof Chris Ormandy

Cell Survival Group Leader: Dr Samantha Oakes

Replication and Genome Stability Group Leader: Dr Liz Caldon

Tumour Development Group Leader: Dr David Gallego-Ortega

Cancer Cell Plasticity Lab Head: Dr Christine Chaffer

Cancer Developmental Biology Lab Head: Prof Neil Watkins

Network Biology Group Leader: Dr David Croucher

Cell Division Lab Head: Dr Andrew Burgess

Invasion and Metastasis Lab Head: A/Prof Paul Timpson

Matrix and Metastasis Group Leader: Dr Thomas Cox

Personalised Cancer Therapeutics Group Leader: Dr Marina Pajic

Timpson and Dr Marina Pajic, who co-led the study, softened the surrounding tissue (known as 'stroma') with an existing drug before chemotherapy.

Using cutting-edge intravital microscopy techniques to peer directly into pancreatic tumours inside a living animal, and to watch how the approach affected tumours, the team was able to show for the first time that targeting the stroma can make pancreatic tumours more susceptible to therapy.

"We've been able to show that it's crucial to treat the stroma first and the tumour second, and to fine-tune the treatment timing to maximise efficacy," says Associate Professor Timpson.

The research team will now work closely with clinician-scientists to translate the findings into an early-stage clinical study.

Vennin et al., *Sci Transl Med* 2017; 9-eaai8504. DOI: 10.1126/scitranslmed.aai8504

For the love of Connie

In 2017, tragically after Connie Johnson OAM had passed away, the large-scale artwork 'Connie's Heart' was unveiled at Garvan by Samuel Johnson OAM. The artwork was a labour of love for Marie Ramos, who took a year to create the artwork. It contains 2,000 small ceramic tiles, each with a heart-shaped pair of thumbprints from one person, many of whom have been directly affected by cancer.

At its centre are the thumbprints of the late Connie Johnson, which together form the sole red heart in a surrounding sea of white.

In making the artwork, Marie raised more than \$110,000 in donations. The funds will support Garvan's research into cancer, and particularly breast cancer. The donations provide a crucial boost to the Institute's efforts to bring about real change in clinical practice through research.

"I wanted to join in the fight, but I also had the desire to celebrate the beautiful soul driving the charity, to give Connie a small gift, a legacy if you may, for all the love and sacrifices she and her family made so that no other family would have to experience losing a family member to cancer ever again," says Marie.

"The part about my project which didn't go to plan however was the death of Connie on the eighth of September. She would only see the finished product from the heavens, which would have been the best view in the house anyway."

From left: Samuel Johnson, Marie Ramos and her husband Andrew with their daughters at the artwork's unveiling.



Genomic cancer medicine now a reality

Five years after the opening of The Kinghorn Cancer Centre (TKCC), one of the ambitious visions for this joint Garvan and St Vincent's Hospital facility – that of personalised genomic cancer medicine – has come to fruition.

The Australian Genomic Cancer Medicine Program (AGCMP) was developed by Garvan and is led by Professor David Thomas, Head of Garvan's Cancer Division and Director of The Kinghorn Cancer Centre, in collaboration with the NHMRC Clinical Trials Centre.

The groundbreaking trial uses genomic medicine to personalise therapies and prevention and screening methods for those with rare cancers. It is a nationally available program with two main areas of focus – clinical trials matching patients to therapies, and a risk-management program for families with an inherited high risk of cancer.

“Through our new understanding of the genomic basis of cancer, we can, for the first time, match patients with therapies on the basis of their, and their cancer's, genetic profile – instead of treating cancer according to where in the body it occurs,” says Professor Thomas.

When the glass doors of 370 Victoria Street slid open on 28 August 2012, it marked a new era in cancer treatment. TKCC launched its mission to bring leading-edge science into the heart of the clinic.

Realising such a vision was only possible thanks to significant investment from the philanthropic community. Each gift made by our visionaries has proved a critical building block in the development of the AGCMP and TKCC.

The Kinghorn Cancer Centre in Sydney.



Childhood cancer clinical trial goes national

The Zero Childhood Cancer national child cancer personalised medicine program is the most ambitious childhood cancer initiative ever undertaken in Australia. This program is led by Children's Cancer Institute and the Kids Cancer Centre at Sydney Children's Hospital, Randwick, which is a part of the Sydney Children's Hospitals Network. Garvan and Lions Clubs are two of the partners of the program.

The program's national clinical trial, launched in September, will enrol more than 400 children with high-risk or relapsed cancer over the next three years.

The Lions Kids Cancer Genome Project (Genome Power) forms the contribution of Garvan and Lions to the Zero Childhood Cancer program. Through Genome Power, Garvan will sequence and analyse the cancer and normal genome of every child enrolled in Zero Childhood Cancer – and uncover changes that could help guide personalised treatment approaches.

The visionary support of Lions, and the critical work being done through Zero Childhood Cancer, inspired the John Brown Cook Foundation to support Genome Power. Mrs Wallis Cook Graham, a trustee of the Foundation, says, "We're proud to be in a position to be able to invest in this groundbreaking collaborative initiative that will not only benefit Australian children but also, in the longer term, improve outcomes for childhood cancers across the world."

Garvan and Lions warmly acknowledge the support of the John Brown Cook Foundation. "It's exciting and inspiring when philanthropists and fundraisers come together behind a common cause," says Dr Joe Collins, Founding Chairman of Australian Lions Childhood Cancer Research Foundation. We are all motivated by the strong belief that every child deserves a chance at a healthy life."



Little Ava is now in remission from a neuroblastoma in her chest that she suffered when she was just six months old.

Division Report: Diabetes and Metabolism



Professor Mark Febbraio

From the Head

Describe your Division's goal.

Preventing death and disability from obesity and type 2 diabetes.

What's your Division's main research focus?

Type 2 diabetes is a global epidemic. Our research is directed to understanding the relationships between genetics, the environment and type 2 diabetes and obesity, then developing personalised approaches to treatment. A high proportion of our researchers are also clinicians, ensuring our work is always focused on health outcomes. We have a particular interest in understanding the basis of the positive health effects of exercise.

Which Divisions within Garvan do you work most closely with?

We're using whole genome sequencing and other analyses to explore personalised approaches to treating prediabetes, and this sees us working closely with the Garvan-Weizmann Centre for Cellular Genomics, through the Garvan-Weizmann partnership. We collaborate with the Neuroscience Division on zebrafish models of disease, the Cancer Division in our investigation of the impacts of exercise, and with St Vincent's Hospital in our clinical trials and investigations.

Where do you see Diabetes and Metabolism's research heading?

We're working toward the prevention of type 2 diabetes through a better understanding of prediabetes, the body's relationship with insulin and the effects of exercise on the body. We'll also continue to research rarer metabolic diseases to identify new treatment opportunities.

Research highlight

New exercise-induced molecules on the radar

When we exercise, our muscles produce molecules called 'myokines', which signal to other tissues and may be the underlying cause of the positive health effects of physical activity.

More than 100 myokines have been identified so far in various studies, but these techniques haven't yet detected them all.

In a recent study involving Garvan researchers, published in the journal *Molecular Metabolism*, researchers went looking for additional myokines in people. The researchers worked with 26 middle-aged men who combined endurance and strength training for 12 weeks.

The study used blood samples and muscle biopsies taken both before and after exercise. The researchers compared the samples to identify genes whose expression increased markedly after exercise: these are possible myokines.

"We identified 17 new proteins that are candidate myokines whose expression increased in response to exercise," says Dr Marit Hjorth, Research Officer in Garvan's Cellular and Molecular Metabolism team. "Now that we know about these possible myokines, we can study

them further and gain a better understanding of the beneficial health effects of physical activity."

Pourteymour et al., *Mol Met* 2017; 6:352-365. DOI: 10.1016/j.molmet.2017.01.007

Research highlight

Diabetes-related bone fracture risk

The association between obesity, type 2 diabetes and osteoporosis is complex. Obese individuals have a strong, dense bone structure yet, paradoxically, those who also have type 2 diabetes are nonetheless at high risk of breaking a bone.

Dr Katherine Tonks and her colleagues explored whether changes in bone turnover (in which old bone is removed and new bone introduced) could be the underlying cause of high fracture risk.

They found that bone turnover is slowed in obese people who also have insulin resistance (diabetes), but not in obese people who are insulin sensitive (not diabetic), and that the higher insulin levels in the blood associated with insulin resistance is what is responsible for this suppression in bone turnover.

"Low bone turnover might be a marker for, if not the cause of, the fracture risk found in those with type 2 diabetes as well as obesity when coupled with insulin resistance," says Dr Tonks.

Dr Tonks' findings could lead to changes in the clinical management of diabetes. In future, clinicians might, for instance, examine markers of bone turnover alongside investigations into bone mineral density. Determining an individual's risk of fracture could, in turn, inform treatment choices.

Tonks et al., *J Clin Endocrinol Metab* 2017; 102:1112-1121. DOI: 10.1210/jc.2016-3282



Dr Marit Hjorth, Cellular and Molecular
Metabolism Research Officer.

Research highlight

'Fish with Parkinson's' reveal druggable pathway

Researchers have identified a new cellular target for the development of future Parkinson's therapies. Dr Daniel Hesselton and his colleagues simulated Parkinson's-like neurodegeneration in zebrafish using a combination of genetic and environmental factors – akin to how Parkinson's develops in people.

The team rapidly tested close to 1000 compounds to identify those that restored normal movement in zebrafish embryos, pinpointing a promising cellular pathway to target. Zebrafish are important tools for drug discovery because they have many genes similar to those in humans and can be used to test thousands of potential therapies at speed.

Zhang et al., *Cell Chem Biol* 2017; 24:471-480. DOI: 10.1016/j.chembiol.2017.03.005

News highlight

Bridging the interdisciplinary gap in chronic disease

Researchers from across the world gathered in Fiji in August, at the inaugural Immunometabolism and Chronic Disease Conference. Chaired by Professor Mark Febbraio, the meeting was designed to maximise cross-fertilisation between the fields of immunology (the study of the immune system) and metabolism (the study of the chemical reactions within our bodies that collectively keep us alive).

Researchers are now beginning to understand how these two once-distant disciplines are interconnected and can help us understand and treat diseases such as cancer, type 2 diabetes and immune disorders. The next Immunometabolism and Chronic Disease Conference is being planned for 2020.

News highlight

Major prediabetes study launches

Can the gut microbiome tell us how to treat prediabetes? This is one of the questions that Garvan researchers will look to answer in the Predict study.

There's no doubt that weight loss and exercise bring multiple health benefits. But in clinical research at Garvan, in about a quarter of people who maintain a strict 'healthy' diet leading to weight loss, this does not change the body's insulin resistance. And, unfortunately, almost 80% of people put the weight back on within five years. This means, as a long-term approach, weight loss by itself isn't the whole story in battling the prediabetes epidemic.

In a three-year project with the Weizmann Institute in Israel, through the Garvan-Weizmann partnership, the clinical team will sequence the many genomes of participants' gut microbiome.

In a six-month intervention, participants will have the composition of their microbiome and genome aligned with lifestyle data like diet, stress and activity. This lifestyle data will be entered daily into a sophisticated yet simple-to-use smartphone app.

Information about participants' blood sugar levels will be monitored through a device that each will wear for periods of two weeks before, during and after treatment. The Predict study will help unravel why some people respond to common treatments and others do not.

Celebrating giving

Garvan has been a beneficiary of Mr Joseph Skrzynski AO and The Sky Foundation's philanthropy for almost two decades. Their investment in the Diabetes and Metabolism Division has supported the Division's efforts to understand the relationships between genetics, the environment and type 2 diabetes and obesity, and the development of personalised approaches to treatment.

Research Laboratories and Groups

Beta Cell Regeneration Lab
Head: Dr Daniel Hesselton

Beta Cell Signalling Lab
Head: Prof Trevor Biden

Cellular and Molecular Metabolism Lab
Head: Prof Mark Febbraio

Myokine Biology Group
Leader: Dr Martin Whitham

Mitochondrial Metabolism and Ageing Group
Leader: Dr Andy Philp

Clinical Diabetes, Appetite and Metabolism Lab
Heads: Prof Lesley Campbell and Prof Jerry Greenfield

Clinical Insulin Resistance Group
Leader: Dr Dorit Samocha-Bonet

Prader-Willi Syndrome and Genetic Forms of Diabetes Group
Leader: Dr Alexander Viardot

Clinical Obesity, Nutrition and Adipose Biology Lab
Head: Prof Katherine Samaras

Insulin Signalling Lab
Head: A/Prof Carsten Schmitz-Peiffer

Islet Biology Lab
Head: A/Prof Ross Laybutt

What does medical research mean to you?

It is essential for improving the quality of life.

What inspired your first gift to Garvan?

Coming to a meeting at Garvan and meeting with researchers.

What's been the biggest reward?

Receiving the briefings from researchers and seeing the progress they are making.

What's your dream for healthcare in the future?

Individualised lifelong healthcare programs.

Smart power for cancer research

Medical research is the key to solving cancer, but progress is limited by the staggering amounts of computing power needed to process the complex information presented by cancer data.

Every smartphone is a powerful computer, with smartphones in Australia collectively having 90 times the processing power of a supercomputer. When smartphones are idle – like when the owner is asleep at night – DreamLab can put that supercomputing power to work, by solving tiny research problems and sending the results back to Garvan. Each piece of the puzzle helps speed up the Institute’s research.

DreamLab, which was created by The Vodafone Foundation and Garvan Institute, works by combining the processing power of mobile devices to create the world’s first distributed smartphone supercomputer for cancer research. DreamLab is free to download for Android and iPhone, and incredibly easy to use.

To inspire participation, the relaunch in October 2017 encouraged job title changes on LinkedIn to ‘Cancer Researcher at DreamLab App’ – including by Iñaki Berroeta, the Chief Executive Officer at Vodafone. This helped spread awareness to the more than 120,000 people now taking part.

“Powering the DreamLab app each night gives me a sense of contributing to the research,” says Sarah McGoram, a mum and cancer patient.

The more people who use DreamLab, the faster data for cancer research can be processed. “DreamLab is helping us tackle the huge amount of data that we’re producing by sequencing the DNA of cancer patients,” says Professor David Thomas, head of Garvan’s Cancer Division. “By analysing this data, we hope to understand more about how to detect, diagnose and treat it better.”



Artwork courtesy of Sarah Hankinson.

Division Report: Genomics and Epigenetics



Professor Susan Clark FAA

From the Head

Describe your Division's goal.

To make sense of how the information encoded in, and above, the genome controls human development and how mistakes in this information can cause disease.

What's your Division's main research focus?

We explore both the genetic information encoded in our DNA as well as the epigenetic information that sits 'above' our DNA and the 'readouts' from DNA (called RNA) – with the ultimate aim of uncovering their combined contributions to health and disease.

We have a particular interest in new sequencing and mapping technologies that allow us to explore the intricate relationship between the genome and the epigenome and address how both are disrupted in cancer and other diseases. We work actively to translate our knowledge to improve health outcomes through the development of biomarkers and therapeutic targets.

Which Divisions within Garvan do you work most closely with?

We aim to facilitate collaboration and foster innovation across all Garvan's Divisions as the study of genomics and epigenetics spans Garvan's

research portfolio. Our Division has a unique set of skills – including data visualisation and big data analysis – that are critical for innovative research across many disease areas. We work particularly closely with the Bone and Cancer Divisions, and with the Kinghorn Centre for Clinical Genomics and the Garvan-Weizmann Centre for Cellular Genomics.

Where do you see Genomics and Epigenetics' research heading?

We are using and developing a wide array of genomic technologies that will speed discovery, and we are driving the development of computational methods to make sense of the remarkable new datasets that are emerging from whole genome mapping to whole genome sequencing.

Most importantly, we have moved beyond looking at DNA in two dimensions and have embarked on novel sequencing and visualisation technologies to study the 3D genome and epigenome.

The next frontier is to determine what information controls the 3D organisation of DNA inside the nucleus that gives each cell-type its own identity. We predict that sequences in the so-called 'junk DNA' are critical in controlling the genomic and epigenetic architecture and ultimately gene expression.

Another aim is to understand the role of each of the six billion bases (or letters) in our DNA sequence, not just in encoding genes but also in determining the 3D blueprint of human life.

Research highlight

DNA packaging driver in prostate cancer

A unique protein, H2A.Z, which packages DNA in cells, may drive

the progression of prostate cancer, Garvan researchers have shown.

In a study published in *Nature Communications*, led by Professor Susan Clark and Dr Fatima Valdés Mora, the researchers investigated whether histones – proteins that package DNA in the nucleus of every cell – might be playing a key role. In the investigation, they found a chemical modification or tagging, called acetylation, of H2A.Z was prominent in prostate cancer cells.

"Our work provides a deeper level of understanding of what drives prostate cancer progression," says Professor Clark. "Deciphering this extra layer of epigenetic information is vital if we are to fully comprehend the complexity of gene control and how it is disrupted in cancer."

Valdés Mora et al., *Nat Commun* 2017; 8: 1346, DOI: 10.1038/s41467-017-01393-8

Research highlight

Genomics reveals African prehistory

The first large-scale study of ancient human DNA from sub-Saharan Africa opens a long-awaited window into the identity of prehistoric populations, with implications for their modern descendants.

The findings by an international research team, including Garvan's Professor Vanessa Hayes, uncover surprising details about sub-Saharan African ancestry. This included genetic adaptations for a hunter-gatherer lifestyle and the first glimpses of population distribution before farmers and animal herders swept across the continent about 3000 years ago.

"Ancient DNA is the only tool we have for characterising past genomic



Bindu Kanakamedala, Transcriptomic
Research Laboratory Manager.

diversity,” says Dr Pontus Skoglund (Harvard), the study’s first author.

“We need to ensure we use it for the benefit of all populations around the world, perhaps especially Africa, which contains the greatest human genetic diversity in the world but has been underserved [by the genomics community].”

Skoglund et al., *Cell* 2017; 171(1):59-71.e21. DOI: 10.1016/j.cell.2017.08.049

Research highlight

An intricate roadmap for cell division

Dr Andrew Burgess and Professor Seán O’Donoghue have brought Garvan and CSIRO researchers and biodata visualisation specialists together to produce an interactive graphical representation of how a cell divides.

The intricacies of cell division, and how it is disordered in disease, are the research focus of Dr Andrew Burgess from Garvan’s Cancer Division.

Dr Burgess worked with Professor O’Donoghue, who leads the Biodata Visualisation team in the Genomics and Epigenetics Division and is the Science Leader at CSIRO’s Data61, to illustrate the complex biology of cell division in an entirely new way.

Together they have produced an interactive graphical representation of cell division that has been published online in the journal *Cell*. The interactive website-hosted graphic takes the viewer on a journey through ‘mitosis,’ the phase of a cell’s life cycle where the chromosomes are split in two before a single cell splits into two genetically identical daughter cells.

With this tool, researchers can, at a glance, follow along biological pathways, observing where in the cell the proteins are active, which other proteins they interact with, and see whole chains of events that are set in motion as protein switches turn events on or off.

Research highlight

Prostate cancer map reveals a new world of DNA changes

In a world first, Garvan researchers led by Professor Vanessa Hayes have developed a next-generation ‘map’ of a prostate cancer genome. In mapping the entire genome of a prostate tumour, the researchers uncovered 10 times more large-scale DNA rearrangements than previously detected in the disease.

“We know that prostate cancer is more likely driven by large, complex rearrangements of DNA. This is different to most cancers, which are driven by small DNA mutations in a number of key genes,” says Professor Hayes, noting that the team identified 15 new potential drivers of prostate cancer.

Whole genome sequencing is invaluable in identifying small DNA mutations, but it may not detect when a gene has been completely deleted, transferred to another chromosome, or multiplied many times.

“Using next-generation mapping, we saw huge amounts of large-scale rearrangements, and genome sequencing then enabled us to identify the genes affected by these rearrangements,” says Professor Hayes.

The study provides proof of principle that next-generation mapping can provide insights into prostate cancer, and has future clinical potential for determining the prognosis for an individual, diagnosing prostate cancer subtypes or selecting targeted therapies.

The findings could one day be used to help characterise an individual’s prostate tumour and reveal previously unrecognised information that could influence clinical treatment.

Jaratlerdsiri et al., *Oncotarget* 2017; 8:23588-23602. DOI: 10.18632/oncotarget.15802

Research Laboratories and Groups

Epigenetics Research Lab
Head: Prof Susan Clark

Epigenetic Deregulation Group
Leader: Dr Clare Stirzaker

Histone Variants Group Leader:
Dr Fatima Valdés Mora

Genome Informatics Lab
Head: A/Prof Marcel Dinger

Human Comparative and Prostate Cancer Genomics Lab
Head: Prof Vanessa Hayes

Transcriptomic Research Lab
Head: Dr Timothy Mercer

Biodata Visualisation Lab
Head: Dr Seán O’Donoghue

Developmental Epigenomics Lab
Head: Dr Ozren Bogdanovic

Molecular Genetics of Inherited Kidney Disorders
Lab Head: Prof John Shine

Celebrating giving

The Ian Potter Foundation provides essential tech

Cutting-edge technology, expertise and determination are central to successful research. Professor Vanessa Hayes has an ambitious goal – to identify the key genetic factors driving prostate cancer. To achieve this, Professor Hayes and her team needed a next-generation mapping system called Bionano Saphyr.

Garvan has been able to purchase the equipment thanks to the generosity of The Ian Potter Foundation, an Australian philanthropic organisation that has been contributing to Garvan since 1998. The Bionano Saphyr has given Hayes’ team the ability to determine the full spectrum of genetic variants in prostate cancer patients with metastatic disease.

Finding answers to autoimmune disease

In autoimmune disease, the body becomes its own assailant. The immune system, normally the body's defender, directs 'friendly fire' at healthy cells, organs or tissues. Symptoms vary from person to person, and account for more than 100 diseases including type 1 diabetes, lupus, multiple sclerosis, coeliac disease, rheumatoid arthritis and a wide range of rare disorders. Autoimmune diseases are daily afflictions and last a lifetime.

Autoimmune diseases are on the rise in Australia. One in eight people will be affected by an autoimmune disease in their life. These conditions can have a devastating effect, not just on patients, but on their family members and friends as well. Lacking cures, these diseases last a lifetime.

Now, there is potential to change this, thanks to the joint goals of researchers from both the Garvan and Weizmann Institutes and The Bill and Patricia Ritchie Foundation.

Appropriately titled Hope Research, the project seeks to pinpoint the 'rogue' immune cells that attack the body, and to develop targeted therapies.

Hope Research is the most recent instalment in a longstanding relationship between Garvan and The Bill and Patricia Ritchie Foundation, now represented by sisters Julia and Ruth Ritchie on behalf of the family.

In the early 1990s, the Foundation set up The Bill Ritchie Post Doctoral Research Fellowship, which financed the early careers of many researchers over more than two decades. In 2014, it increased its support to establish The Bill and Patricia Ritchie Foundation Chair, of which Professor Chris Goodnow, Garvan's Deputy Director and Hope Research Leader, is its inaugural holder.

"Our parents were great believers in giving back to the country that afforded our family a wonderful quality of life," says Julia. "Our mother always found the Garvan story inspiring

and visionary, and these reasons are unchanged in the Foundation's ongoing support. Garvan's core values are a great fit for us; we both keep looking to new horizons to conquer with fresh eyes," she says.

"Somebody in your family has, or will have, a mystery disease with no answer," Ruth says. "We've chosen to support a coordinated, comprehensive study that has the potential to unlock the mystery of all autoimmune diseases." Ruth comments from personal experience, as she and her family know its impacts firsthand.

This undertaking from The Bill and Patricia Ritchie Foundation aims to pave the way for the additional community funding needed to realise the project's promise. "We hope that our backing will encourage other people who have family and friends who live with autoimmune diseases to follow our example and participate in Garvan's groundbreaking research," says Ruth.

From left: Ruth Ritchie's younger son Patrick Blampied, Julia Ritchie, Garvan's Professor Chris Goodnow, Ruth's elder son Bill Blampied and Ruth Ritchie.



Division Report: Immunology



Professor Stuart Tangye

From the Head

Describe your Division's goal.

Determining how the immune system works, how it can fail and how best to treat immune disease.

What's your Division's main research focus?

The immune system is extremely adept at identifying threats, but it can become overactive and attack the body, causing autoimmune diseases like rheumatoid arthritis and type 1 diabetes. It can also be underactive, leading to immunodeficiencies and infectious disease. We study the wide range of immune responses and the processes that underpin them. We also work at the intersection between the immune system and cancer – such as treatments that stimulate the immune system to attack cancer cells. We are exploring the immune system's response to transplantation in an effort to improve the outlook for those with type 1 diabetes and other disorders.

Which Divisions within Garvan do you work most closely with?

We collaborate widely within Garvan. We work on immunotherapy approaches with the Cancer Division and on inflammation with the Bone Biology and the Diabetes and Metabolism Divisions. Understanding

how changes across the genome can lead to immune diseases is key to our work, so we have close relationships with the Kinghorn Centre for Clinical Genomics, Genome.One and the Garvan-Weizmann Centre for Cellular Genomics. We also work with a wide group of clinicians at major hospitals across Sydney and interstate to assist in diagnosis and development of treatments.

We also coordinate Clinical Immunogenomics Research Consortium Australia (CIRCA), a major collaborative project involving researchers and clinicians that works with patients to explore the genetic changes underlying their disease.

Where do you see Immunology's research heading?

It is an incredibly exciting time because immune research can rapidly impact on clinical medicine. We have developed several large-scale research programs that work directly with clinicians and people with immune diseases. The Hope Research project is a major study to determine the cause of 36 autoimmune diseases such as multiple sclerosis, rheumatoid arthritis and type 1 diabetes. Our research into the potential for islet transplants could see people with type 1 diabetes being able to produce insulin again.

Research highlight

How B cells go 'rogue'

Garvan researchers, with colleagues from the Australian National University, have shed new light on how immune B cells 'go rogue' and then multiply, and how this can kickstart lymphoma, other blood cancers and autoimmune diseases.

The research shows how two DNA mutations work as 'partners in crime' to drive abnormal activity. Unlike other cells in the body, immune cells undergo

rapid changes to their DNA. This is critical for our immune system to keep up with rapidly changing threats from invading viruses and bacteria. As their DNA is altered, some B cells will acquire destructive mutations.

"One of the great challenges is to find approaches to uncover which mutations drive the cell to go rogue, and which mutations associate with which disease. If we can do that, we have a starting point for the development of new therapies," says Professor Chris Goodnow, who co-led the research.

Wang et al., *J Exp Med* 2017; 214:2759.

DOI: 10.1084/jem.20161454

Research highlight

Encouraging IL-2 to attack tumours

Interleukin-2 immunotherapy is commonly being used to activate the immune system against cancer, but is so toxic that it is currently only prescribed in a very limited number of late-stage cancers.

Associate Professor Daniel Christ and his team have explored ways to make interleukin-2 immunotherapy less toxic and more effective against cancer. In doing so, the team uncovered surprising new information about how to enhance interleukin's 'tumour attacking' activity.

The team found that regulatory T cells tend to dampen immune responses against a tumour, but a molecule called IL-2-Fc is able to reduce the number of these cells, so helping to overcome the immune system's 'reluctance' to attack cancer. The findings provide important guidance for developing future interleukin-2-based therapies.

Vazquez-Lombardi et al., *Nat Commun* 2017; 8:15373. DOI: 10.1038/ncomms15373



Angelica Lau, B Cell Biology PhD student.

Research highlight

Tumour-trained T cells go on patrol

'Tumour-trained' immune cells – which have the potential to kill cancer cells – have been seen moving from one tumour to another for the first time.

Dr Tatyana Chtanova and her team used an innovative 'photoconversion' strategy, in which all the cells in a mouse are labelled with a green fluorescent compound, and only those within a tumour, including immune cells, are turned to red.

"We found, unexpectedly, that T cells were the main immune cells to exit tumours and move to lymph nodes and other tumours – even though they represent only a fraction of the immune cells that enter tumours," says Dr Chtanova.

"What we suspect is happening is that, within the tumour, these T cells are acquiring knowledge about the cancer that helps them to seek and destroy cells in a second tumour."

"We're working to understand more deeply the relationships between immune and cancer cells, so that we can design approaches to empower the immune system to destroy cancer," Dr Chtanova says.

Torcellan et al., *Proc Natl Acad Sci USA* 2017; 114:5677-5682. DOI: 10.1073/pnas.1618446114

Research highlight

The immune system makes 'memories'

As well as defending our bodies at the moment of infection, our immune system gives us long-term protection against the same invader – so we usually catch a given disease only once.

New research from Professor Robert Brink and colleagues has now solved a key piece of the puzzle of how the immune system 'remembers' past infection.

Research Laboratories and Groups

Antibody Therapeutics Lab
Head: A/Prof Daniel Christ

B Cell Biology Lab Head:
Prof Robert Brink

Genomic Engineering Group
Leader: Dr David Zahra

Cellular Immunity Lab Head:
Prof Jonathan Sprent

Immune Tolerance Group
Leader: Dr Kylie Webster

Immunobiology of Cytokines
Lab Head: Dr Marcel Batten

Immunogenomics Lab Head:
Prof Chris Goodnow

Immunology and Immunodeficiency
Lab Head: Prof Stuart Tangye

Human Immune Disorders
Group Leader: Dr Cindy Ma

Innate and Tumour Immunology
Lab Head: Dr Tatyana Chtanova

Intravital Microscopy Lab
Head: Dr Tri Phan

Lymphocyte Signalling and Activation
Lab Head: Dr Elissa Deenick

Mucosal Autoimmunity Lab
Head: A/Prof Cecile King

Transplantation Immunology
Lab Head: A/Prof Shane Grey

Immunopathology Group Leader:
A/Prof William Sewell

The researchers devised a new way to track cells called memory B cells – which attack disease that the body has tackled before.

They observed, for the first time, the early development of memory B cells in the germinal centre – "a kind of training camp where B cells go to learn their craft," as Professor Brink puts it. This provides evidence that memory B cells give us protection against versions of a disease – such as flu strains that change year on year.

The new findings could aid the rapid development of new vaccines against emerging diseases.

Suan et al., *Immunity* 2017; 47:1142-1153.
DOI: 10.1016/j.immuni.2017.11.022

Celebrating giving

The John Brown Cook Foundation made its first philanthropic investment in Garvan's work in 2015. The Foundation has focused on supporting innovative research to help solve complex and previously unanswered questions about diseases, such as childhood immunodeficiencies and cancer. Mrs Wallis Cook Graham, a trustee of the Foundation, discusses what the connection has meant.

What does medical research mean to you?

The means to unlock the future of data-driven medicine.

What inspired your first gift to Garvan?

My husband and I attended a tour of the genomics centre at Garvan several years ago and were amazed at the world-class calibre of researchers and facilities. I am a huge believer in the power of genetic research and feel that enormous strides will be made in the near-term, particularly around sequencing's application to medical conditions. Garvan's entrepreneurial and innovative approach resonated with the John Brown Cook Foundation.

What's been the biggest reward?

To know we are accelerating the fantastic work being done by Garvan's teams, which will have a global impact.

What's your dream for healthcare in the future?

That we can use today's technological advances to accelerate the path of medical research. There is huge opportunity to capitalise on improved data processing and decreasing sequencing costs to find the answers to previously unsolvable puzzles. We believe in the power of collaborative and creative initiatives to further this goal.

Accelerating single-cell understanding

Together with the Weizmann Institute of Science in Israel, Garvan officially opened the Garvan-Weizmann Centre for Cellular Genomics in 2017. Located within Garvan, the Centre is the only one of its kind in Australia and houses a range of new and cutting-edge technologies that can look more closely at a cell than ever before. Researchers are able to explore thousands of individual cells simultaneously: uncovering each cell's genetic signature, understanding what makes it unique and exploring how it functions in health and disease.

"We've brought together key intersecting technologies that together make cellular genomics a reality," says Professor Chris Goodnow. "When these technologies and the people who can use them to best advantage are available under one roof, we can accelerate the process of biomedical research."

The Garvan and Weizmann Institutes established the Centre as part of a broader partnership that aims to advance biomedical research, genomic medicine and genomic education. "What makes the partnership even more momentous is that the Weizmann Institute is a global leader in multidisciplinary basic research, whereas Garvan's focus is on translational research. Together, we are answering some of science and medicine's greatest questions," says Professor Goodnow.

Through joint programs, staff and student exchange and cutting-edge technologies, Garvan and Weizmann scientists are uncovering entirely new insights into cancer, immune diseases, metabolic diseases and other conditions.

The construction of the Centre was made possible through visionary philanthropic support from Mr John Roth and Ms Jillian Segal AM, Mr and Mrs Laurie and Di Sutton and The Johnny Kahlbetzer Family, as well as a grant from the government of New South Wales.



Wenyan Li, Garvan Flow Cytometry
Development Cytometrist.

Division Report: Neuroscience



Associate Professor Antony Cooper

From the Head

Describe your Division's goal.

Understanding how the human brain and nervous system influence disease.

What's your Division's main research focus?

We study the changes in the brain and nervous system associated with disorders such as Parkinson's and Alzheimer's disease, bipolar disorder, hearing loss, mental health and eating disorders. We also study the regulation of energy balance that affects mood, weight gain and physical fitness.

Through these new understandings, we seek to uncover new approaches to the diagnosis, treatment and prevention of neurological diseases.

Which Divisions within Garvan do you work most closely with?

As we look more closely at both DNA and the molecules that are 'read' from DNA (called RNA), we continue to work with the whole genome sequencing technology and experts in Garvan's Kinghorn Centre for Clinical Genomics, and with the Garvan-Weizmann Centre for Cellular Genomics. We also work with the Immunology, Diabetes and Metabolism Division and the Bone Biology Divisions to explore how the nervous system and other bodily systems influence one another.

Where do you see Neuroscience's research heading?

For many diseases we have a two-pronged approach – finding ways to diagnose before the onset of symptoms, and developing treatments that are effective after symptoms develop. We see a future of pre-symptomatic testing for many of the disorders we study so that treatments can start much earlier in the disease course and potentially avoid the subsequent development of symptoms.

Research highlight

Releasing the 'insulin handbrake' to benefit type 1 diabetes

A molecule that affects appetite might one day help transform the outlook for children with type 1 diabetes. The researchers, led by Professor Herbert Herzog and Associate Professor Shane Grey (Immunology Division) found a new way to boost insulin production in the pancreas. They showed that the Y1 receptor – which regulates appetite and energy expenditure in the body – also helps control blood sugar, by acting as an 'insulin handbrake' and switching off insulin release. The findings could help transform success rates for transplants in which people with type 1 diabetes receive donor insulin-producing cells to replace the cells they have lost.

The researchers showed that switching off the Y1 receptor meant more successful islet transplants, even with fewer cells transplanted – which could make islet transplants a far more realistic treatment option for millions of people living with type 1 diabetes. It could also help extend the 'honeymoon period' experienced when people first develop type 1 diabetes.

Loh et al., *Nat Commun* 2017; 8:490.
DOI:10.1038/s41467-017-00624-2

Research highlight

How the brain is wired for sound

Hearing is a remarkably complex process. When we hear, we are not merely detecting sounds (vibrations in air), we process it through a series of brain circuits that locate, amplify and process what we detect. The processes result in our perception of sound.

To shed light on the cellular circuitry of the hearing process and to understand the difficulties faced when individuals have hearing loss, Garvan researchers, led by Professor David Ryugo, explored the physical layout of connections between cells in the brain and study how these connections are affected by hearing loss. The key problem with hearing loss is a decreased ability to distinguish different sounds so that understanding speech becomes near impossible, especially in noisy conditions.

"Experts thought information travelled in only one direction when we hear – upwards, from the ear to the cortex," says Professor Ryugo. "However, we looked to demonstrate that information flows the other way. This raises the possibility of a feedback loop between regions of the brain involved in hearing." The feedback loops 'sharpen' sounds of interest by suppressing sounds that are deemed unimportant.

The researchers used light and electron microscopy to visualise connections between auditory structures. These showed that the descending projections are indeed part of a feedback loop and that they become 'sloppy' with hearing loss. Such loops could be a way for our brains to ensure that important sounds are not lost in the 'noise'.

Milinkeviciute et al., *J Comp Neurol* 2017; 525:773-793. DOI: 10.1002/cne.24095



Kathryn Hill, Parkinson's Disease and Neurodegeneration Senior Research Officer.

Research highlight

Making sense of PWS progression

Prader-Willi syndrome (PWS) is a relatively rare disease but the most common genetic form of obesity. It is characterised by intellectual disability, insatiable hunger and other physical disorders, making it a very challenging condition.

The Snord116 gene cluster has been recognised as a critical contributor to PWS, with mice lacking Snord116 displaying many classical PWS phenotypes, including low postnatal body weight, reduced bone mass and increased food intake. To understand the physiological function of Snord116 better, Garvan scientists reintroduced the product of the Snord116 gene into mice lacking the gene cluster at different ages.

Importantly, the study showed that, as the mice aged, the positive effects of reintroducing energy expenditure diminished. This indicates that the symptoms of PWS develop gradually and the Snord116 gene cluster plays a critical role during this process.

It revealed there is potential to rescue the altered metabolism in those with PWS due to Snord116 deficiency, at a young age, opening the door to potential virus-mediated genetic therapy in PWS.

Qi et al., *J Neuroendocrinol* 2017; 29. DOI: 10.1111/jne.12457

Research highlight

What is our RNA really up to?

Ribonucleic acids (RNA) are a class of molecules responsible for the expression of our genes and encompass a broad range of functions. A subset of RNA, long noncoding RNA (lncRNA) are the most diverse class of RNA molecules and do not encode proteins, but there is limited understanding of the biological functions of lncRNA.

“One of the next great challenges of modern genome biology will be to investigate and document the function of long noncoding RNAs,” says RNA Biology and Plasticity Lab Head Professor John Mattick.

The accessibility of affordable high-throughput sequencing is now generating a wealth of information on these RNAs. In their study, Professor Mattick and Dr Martin Smith, Head of Genomic Technologies (Kinghorn Centre for Clinical Genomics), developed computational methods for the identification of structures in lncRNAs.

“We established a method that identifies the molecular functions of RNA structures using machine learning,” says Dr Smith. “This allows us to determine the specific biological functions of a vast repertoire of RNA molecules that were previously not understood. We are thus reaching a new era in understanding the functions of RNAs and their effects on our health.”

Smith et al. *Genome Biol* 2017; 18:244.

DOI: 10.1186/s13059-017-1371-3

News highlight

200th anniversary of Parkinson's disease

In 2017, World Parkinson's Day marked 200 years since the disease was first identified by Dr James Parkinson. Despite ongoing research, it is still not known what causes most cases of Parkinson's and there is no cure. The treatments available only address the symptoms, not the progression of the disease.

Garvan hosted a two-day meeting to discuss Parkinson's disease research, including an initiative to conduct clinical trials in Australia. The meeting was attended by patients, researchers, neurologists, neurosurgeons, Cure Parkinson's Trust, Shake It Up Foundation Australia (partner of The Michael J Fox Foundation for Parkinson's Research) and Parkinson's Australia. Garvan is committed to making a difference for the 80,000 Australians diagnosed with Parkinson's.

Research Laboratories and Groups

Eating Disorders Lab Head:
Prof Herbert Herzog

Energy Expenditure Group
Leader: Dr Lei Zhang

Neuroendocrinology Group
Leader: Dr Yanchuan Shi

Hearing Research Lab
Head: Prof David Ryugo

Brain Circuits for Hearing Group
Leader: Dr Michael Muniak

Parkinson's Disease and
Neurogenomics Lab Head:
A/Prof Antony Cooper

RNA Biology and Plasticity Lab
Head: Prof John Mattick

Epitranscriptomics and RNA
Dynamics Visiting Group Leader:
Eva Maria Novoa Pardo

Celebrating giving

Geoff Dixon, outgoing Chair of the Garvan Research Foundation Board, and his wife Dawn have supported the work of the Neuroscience Division for many years, partially due to the impact that Parkinson's disease has had on their lives.

What does medical research mean to you?

The offer of hope to so many, often long-suffering, people.

What inspired your first gift to Garvan?

Dawn's long, difficult and very personal battle with Parkinson's disease.

What's been the biggest reward?

Observing the skill and dedication of the medical research community.

What's your dream for healthcare in the future?

To find a cure would be absolutely marvellous, but just as important is the research being done to provide a better quality of life and to slow the progression of Parkinson's.

Supporting career goals

This year, Garvan researchers took part – both as mentees and mentors – in a new mentoring program for women in health and medical research, established by Franklin Women and Serendis leadership facilitators.

Dr Marie Dziadek (Chief Scientific Officer, Garvan) coordinated Garvan’s participation in the mentoring program. “Women are under-represented in senior positions in the health and medical research sector,” she says. “The mentoring program aims to help shift that gender imbalance by supporting women to achieve their professional goals.”

In total, the innovative new program involved 54 researchers across 12 health and medical research organisations throughout Sydney and NSW, with 27 women mentees and 27 mentors, both women and men.

Garvan’s Dr Liz Caldon and Dr Tatyana Chtanova were mentored in 2017. Both already lead research teams, in the Cancer and Immunology Divisions respectively, and both aspire to senior positions in the sector.

“I think that, for me, the most important aspect of the mentoring program was that it made me consider the long-term outlook for my research career,” says Dr Chtanova. “In science we often live from grant to grant without stopping to consider the bigger picture. I found myself focusing on questions like where I want to be in five or 10 years, what my ambitions and aspirations are and how I can work towards these goals now.”

Two senior research leaders from Garvan participated as mentors: Professor Peter Croucher and Professor Chris Goodnow. These highly experienced researchers bring substantial leadership skills to the mentoring process.

Professor Croucher reflects on the Institute-wide benefits of Garvan’s participation. “It is not only about supporting female leaders of the future, which is of huge benefit in itself, but it has initiated a whole dialogue about diversity and engagement in leadership across Garvan.”

From left: Dr Liz Caldon and Dr Tatyana Chtanova.



Centre Report: Kinghorn Centre for Clinical Genomics



Associate Professor Marcel Dinger

From the Head

Describe your Division's goal.

Realising the clinical value of the genome.

What's your Division's main research focus?

KCCG now has six teams, each tackling major challenges in genomics to advance the translation of genomic information in healthcare. We implement the most advanced genomic technologies and mine genomic data at a population-scale to search for important changes across the genome. We also establish genomic tests for cancer diagnosis, prognosis and risk prediction. We also develop targeted education for health professionals, patients and communities.

Which Divisions within Garvan do you work most closely with?

We work closely with many divisions in Garvan, including the Immunology, Genomics and Epigenetics, and Cancer Divisions.

Where do you see KCCG's research heading?

In 2017, KCCG's mission was redefined to focus on realising the clinical value of the genome to enable precision healthcare.

Research highlight

New specialist software for genomic research

The KCCG Phenomics program has developed Patient Archive, specialised software that allows the secure storage, use and sharing of patients' genomic and phenomic data.

Patient Archive helps address a key challenge of genomic medicine: determining the relationship between an individual's genotype and phenotype (their observable characteristics such as blood type and disease symptoms).

"By harmonising phenomic information, Patient Archive enables the accelerated application of genomic technologies to translational research and patient care," says Dr Tudor Groza, Phenomics Team Leader.

Patient Archive converts clinicians' notes (phenotype) into standardised language. This allows the program to match patients who have the same or related conditions, using their genotype and phenotype. This is especially important for rare diseases, where there may only be a handful of known cases worldwide.

The KCCG Cohort Informatics program is supporting genomic discovery through two platforms, Vectis and Dnaerys, which allow researchers and clinicians to explore patient groups.

"Data from large patient cohorts helps us understand how many thousands of people's genotypes connect to their phenotypes, like whether they develop cancer or heart disease," says Dr Warren Kaplan, Informatics Program Leader.

Vectis and Dnaerys allow researchers to filter by and search for variants, genes and genomic locations in cohorts, including the Sydney Genomics Collaborative's Medical Genome Reference Bank (MGRB) and the Australian Genomics Health Alliance's (AGHA) flagships. These cohorts provide the large-scale data that power research into the genomic basis of health and disease.



The Vectis interactive dashboard.

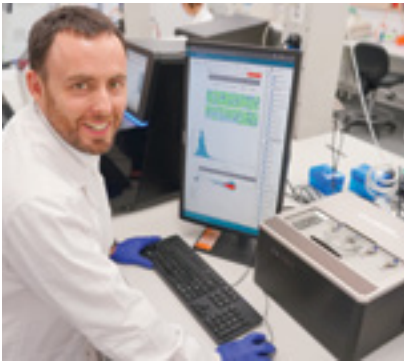
Research highlight

Long-read sequencing: expanding possibilities

KCCG's new nanopore sequencing capability has opened up new possibilities for research and insights into the genetics of health and disease.

Garvan was one of the first two facilities worldwide to achieve certification to provide nanopore sequencing as a service, following KCCG's acquisition of Oxford Nanopore Technologies' GridION sequencer.

Nanopore sequencing can read very long DNA and RNA molecules, including epigenetic marks. This technology also allows researchers to watch DNA and RNA being sequenced in real-time, and even interact with their experiments while they are running.



Dr Martin Smith monitors GridION technology, which reads DNA in real time.

“Nanopore sequencing provides alternative yet complementary capabilities to our short-read technologies, allowing us to rapidly identify genetic features,” says Dr Martin Smith, Genomic Technologies Program Leader.

The Genomic Technologies team, who configured and now run the GridION, recently claimed the record for the longest-ever read (1.015Mb). This was also the world’s first continuous DNA sequence of more than a million bases.

News highlight

Annual Australian Clinical Genomics Symposium

The second year of the symposium brought together a vibrant community of more than 170 clinicians and researchers from across Australia to discuss the role of genomics in healthcare.

Associate Professor Marcel Dinger outlined his vision for making genomic information accessible so as to link clinical practice with research and enable genomic information to inform people’s healthcare throughout their lifetime.

Talks from clinicians showed how genomics has already found its place in many areas of healthcare. Other speakers explored the potential of genomics for prediction and personalised prevention, discussed rapid turnaround testing, and introduced new initiatives linking research and clinical care.

KCCG organised this event along with the Australian Genomics Health Alliance. The KCCG Education and Communication team ran or collaborated on a range of other events in 2017, including screening the sci-fi film *Gattaca* across Australia as part of National Science Week in partnership with Sydney Health Ethics at the University of Sydney to encourage public conversations about genomics, science and ethics.

News highlight

Garvan reaches 15,000 genomes

A major milestone for KCCG and Garvan’s wholly owned subsidiary Genome.One was in sequencing more than 15,000 whole genomes.

The achievement coincided with the first anniversary of the launch of Genome.One, a pioneering health information company providing genetic answers to health questions through clinical genome sequencing and analysis.

KCCG and Genome.One have been at the forefront of clinical genomics, winning an award for precision analysis, building a reference bank of more than 3000 genomes, contributing to the development of new clinical tests and helping to make life-changing diagnoses.

These achievements have been made possible by bringing together clinical and research expertise as part of a broader campus-wide initiative to enable precision healthcare.



Genome sequencing process on Illumina HiSeq X.

Teams

Tumour Genomics Program leader and Translational Genome Informatics Program Co-leader: Dr Mark Cowley

Head of KCCG and Translational Genome Informatics Co-leader: A/Prof Marcel Dinger

Phenomics Program Leader: Dr Tudor Groza

Informatics Program Leader: Dr Warren Kaplan

Genomic Technologies Program Leader: Dr Martin Smith

Education and Communication Program Leader: Bronwyn Terrill

Celebrating giving

The vision and commitment of The Kinghorn Foundation made possible the creation of both The Kinghorn Cancer Centre (TKCC) and the Kinghorn Centre for Clinical Genomics (KCCG). The Foundation’s generous donations have enabled Garvan to become the southern hemisphere’s largest genomics facility. Jill Kinghorn, Co-founder of the Foundation, describes her motivations.

What does medical research mean to you?

Extending and improving the quality of life.

What inspired your first gift to Garvan?

The hope that, within our lifetime, people might die with cancer but no one will die of cancer. We believe in medical research’s ability to improve health outcomes for all Australians.

What’s been the biggest reward?

The skill, enthusiasm and dedication of the Garvan team.

What’s your dream for healthcare in the future?

Personalised, precision and targeted medicine is the future of healthcare, enabling researchers and clinicians to work together for the treatment and, hopefully, eradication of cancer.

The frontier of precision medicine

Genome.One's services and partnerships have grown and diversified.

The launch of Genome.One in 2016 marked a turning point in disease diagnosis and healthcare in Australia.

The country's first clinical whole-genome sequencing service, owned by and based at Garvan, is extending cutting-edge genomic technology beyond the laboratory, to provide answers to the hundreds of thousands of people affected by genetic disease.

This year, Genome.One developed new partnerships and diversified beyond diagnostics. We have grown to four Divisions – Personal Health Genomics, Disease Diagnostics, Discovery Genomics and Precision Health Applications. Each Division is supporting the global need to provide increasingly individualised approaches to patient care.

Personal genomic information not only empowers individuals to manage health risks and potentially prevent disease, it can also optimise their treatment in the clinic and drive improvements across healthcare systems.

In June, Genome.One released the country's first clinical service offering people whole genome sequencing together with a comprehensive health assessment. The new service is now providing valuable insights to help inform individuals' future health decisions.

The Disease Diagnostics Division has developed new genetic tests for kidney and cardiac conditions that are now available to patients, while the use of genomics and large-scale data analysis across a wide range of research and industry projects is the focus of the Discovery Division.

Meanwhile, those working in the Precision Health Applications Division are developing novel software that will integrate clinical and genomic information, to reduce healthcare costs and improve patient outcomes.

A pioneering service

The launch of Genome.One's new personal health management service is allowing individuals to access new genetic information and take a more proactive approach to managing their health.

Offered with precinct partners Life First out of the St Vincent's clinic, the GoNavigate™ service offers genomic testing in tandem with health and lifestyle assessments. This means it can give people a comprehensive picture of their health today, together with insights into their future health risks.

The test can identify genetic risk for 49 conditions – including 31 types of cancer and 13 heart conditions – as well as the body's likely response to more than 220 medications. This information can help guide people in their future health management decisions.

ABC TV's *Ask the Doctor* series was among the national media outlets that highlighted the new service, with co-host Dr Shalin Naik giving a firsthand report on the genomic testing process.

People who take up the Genome.One test can also choose to share their data for ongoing research. As more genomic data is collected and analysed, researchers will gain even greater understanding of how each person's unique genome can give insights into health.

Initiative to support rare disease diagnosis

Genome.One has committed 5% of revenue from the GoNavigate service to support Australian families seeking diagnoses for rare and genetic conditions through the iHope network. The initiative aims to provide whole genome sequencing to under-served families, helping to end what is often a years-long search for a diagnosis.

Precision healthcare partnership

The way in which every person's body responds to medication is influenced by many factors, but the largest is thought to be our individual genetic make-up.

Genome.One partnered with US-based company OneOme to offer pharmacogenomic testing. This can unlock information about how specific drugs will affect individuals, based on their DNA.

Genome.One is offering the pharmacogenomic test to predict how an individual's DNA will affect their response to 220 different medications, many of which are commonly prescribed to Australian patients.

This information is helping patients and their doctors consider which medication may work best for them.

Joining the dots between clinical and genetic information

Genome.One is helping to join the dots between patient information and genetic data in a partnership with Sanford Health, one of the biggest health networks in the US, to pioneer novel health information technology.

Sanford Health spans 45 hospitals, nearly 300 clinics and more than 1300 physicians in 80 specialty areas of medicine. The partnership is driving the development of new technology that can translate information from patient questionnaires, doctors' clinical notes and other sources into a common language, so it can be analysed.

The project will combine this comprehensive patient information with the most up-to-date genetic knowledge to assist doctors in diagnosing rare diseases and help them tailor treatments and interventions, leading to better healthcare outcomes for patients.



Genome.One Laboratory Technicians
Dilshan Kalpage and Sam Barton.

Driving change through collaboration

The more productively we work with others, the better placed we are to enable change. These are some of our key partnerships.

Garvan-Weizmann partnership

One of our most significant global endeavours, the Garvan-Weizmann partnership is featured on page 33.

Clinical work with St Vincent's

Garvan enjoys a particularly strong relationship with St Vincent's Hospital, our close neighbour on the St Vincent's Campus. More than 30 of Garvan's researchers are also clinicians at St Vincent's, treating patients with cancer, metabolic disorders such as type 2 diabetes and bone disorders. Our strong links to St Vincent's ensure that we focus on maximising the clinical impact of our research.

Several of Garvan's research and clinical leaders were closely involved in the development of the *Clinical Services Strategy – 2027* for the St Vincent's Campus, particularly the 'Precision Medicine Strategy' enabled by genomics and other technologies.

In September, we celebrated the 25th annual St Vincent's Campus Research Symposium – an opportunity to forge stronger links between St Vincent's Hospital and the research institutes across the Campus.

Partnership for health

Garvan is proud to be an active member of SPHERE (Sydney Partnership for Health, Education, Research and Enterprise), which launched in March.

In order to reflect the culturally diverse nature of the partnership and to acknowledge our commitment to the Aboriginal community, SPHERE has been gifted the Dharug name *Maridulu Budyari Gumal*, meaning 'Working together for good health and wellbeing'.

Brought into being by Professor Ian Jacobs (President and Vice-

Chancellor, UNSW Sydney and inaugural SPHERE Council Chair), SPHERE comprises 14 NSW organisations – four health services, three universities and seven medical research institutes – committed to deep cooperation to deliver better healthcare for Sydney and beyond.

Garvan is actively involved in five of SPHERE's 12 Clinical Academic Groups: the Triple I Partnership (Infection, Immunology and Inflammation); Stemming the Tide (diabetes, obesity and metabolic disease); One Genome (translating genomic medicine into clinical care); STREAM Health (musculoskeletal health); and Cancer.

Professor John Mattick was a keynote speaker and panellist at the inaugural SPHERE 2017 Symposium, and Professor Peter Croucher, who heads Garvan's Bone Biology Division, sits on the SPHERE Council. "I see SPHERE as an unparalleled opportunity to leverage the amazing opportunities that exist across its breadth," says Professor Croucher. "Together, we are actively working to speed the translation of medical research to address real-world health problems."

Machine learning and AI

In March, Garvan joined forces with Deakin University's Centre for Pattern Recognition and Data Analytics (PRaDA) to accelerate precision medicine through machine learning and artificial intelligence. The Garvan-Deakin Program for Advanced Genomic Analysis will use machine learning to uncover more from the vast amounts of genomic information that are being generated worldwide, and to inform new precision medicine approaches.

The amount of information in genomic datasets is almost unimaginable, and we have only scratched the surface of

what it can tell us. Machine learning makes it possible to detect patterns within the data, and make connections that have previously been invisible.

Garvan joins EMBL Australia

EMBL Australia is a local life sciences organisation modelled on the European Molecular Biology Laboratory (EMBL), Europe's flagship intergovernmental research organisation for the life sciences. In June, Garvan became a member of the EMBL Australia Partner Laboratory Network. As one of five in the Network, Garvan will be a central contributor to EMBL Australia.

Garvan hosted the first Australian EMBL Alumni event as well as the very successful EMBL Australia Postgraduate Symposium, which was attended by 126 postgraduate students from 28 Australian universities and institutes. Garvan worked with EMBL Australia to recruit our first EMBL Australia Group Leader, in Neurogenomics. Dr Robert Weatheritt will join Garvan from Toronto, Canada, in mid-2018.

Securing genomic records

In October, Garvan signed a memorandum of understanding with Australian start-up E-Nome. E-Nome is developing a blockchain-enabled platform for secure storage and management of health records.

Together, Garvan and E-Nome will explore its application to the collection and management of Garvan's research data. "In this era of precision health, the security and privacy of an individual's health information must remain paramount," says Professor John Mattick. "It is our responsibility to actively pursue approaches that can safeguard the genomic information of individuals while making it available for research to improve healthcare."

Aerial view of the St Vincent's Integrated Healthcare Campus in Darlinghurst, Sydney.



Garvan Institute of Medical Research

Board of Directors 2017



John Schubert AO Chair

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 AO SC

The Hon Dr Annabelle Bennett was until recently a Judge of the Federal

Court of Australia. She is presently Chancellor of Bond University, President of the Anti-Discrimination Board of NSW, Chair of Landservices SA, Arbitrator with the Court of Arbitration for Sport, and on the Advisory Council for Questacon. 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

Sister Annette was the Sisters of Charity Congregational Leader. She has been

President of the Conference of Leaders of Religious Institutes, President of Catholic Religious Australia, Inaugural Chair of the Stewardship Board of Catholic Health Australia, and a Senior Lecturer at the Australian Catholic University. She is one of two Executive Officers of the National Committee for Professional Standards of the Catholic Church in Australia.



Geoff Dixon

Mr Dixon was the Chair of the Garvan Research Foundation until December.

He sits on the boards of Crown Resorts Limited, Adslot Limited and the Museum of Contemporary Art Australia, and is an Ambassador to the Australian Indigenous Education Foundation. He has worked in the media, mining and aviation industries, and was Chief Executive of Qantas Airways from 2001 to 2008 and Chairman of Tourism Australia from 2009 to 2015.



Stephen Johns

Mr Johns is Chairman of Brambles Limited and Non-executive Director of Goodman Group. He is a former

Chairman and Non-executive Director of Leighton Holdings Limited and Spark Infrastructure Group, and former 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 Institute of Company Directors.



Anne Keating

Ms Keating is the Chairman of Houlihan Lokey, Australia, an investment bank, and a Governor of the

Cerebral Palsy Research Foundation. She has served on many public company boards in various sectors over the last 23 years including two medical device companies. She was an inaugural Director of the Victor Chang Cardiac Research Institute.



Anthony Kelleher

(from April)

Professor Kelleher is the Acting Dean of the Faculty of Medicine, UNSW.

In addition, he is the Head of the Immunovirology and Pathogenesis Laboratory of the Kirby Institute, Head of the Infection, Immunity and Inflammation Theme, UNSW Medicine and a Clinical Immunologist and Immunopathologist at St Vincent's Hospital, Sydney. He is a Fellow of the Australian Academy of Health and Medical Science, a member of The Australian Society of HIV Medicine, the International AIDS Society, and the Australian and American Societies of Immunology and has been Practitioner Fellow of the NHMRC since 2006.



Paul Kelly

Dr Kelly is a founding Managing Partner of One-Ventures, one of Australia's largest Venture Capital

firms investing in healthcare and life science companies. An Australian physician, serial entrepreneur and experienced biotechnology and life sciences executive, he has over 30 years of experience in clinical medicine and medical science and 20 years of experience in commercialising life science-related technologies in Australia, Europe and North America.



Thomas John (Jack) Martin AO FAA FRS

Emeritus Professor Martin is a John Holt Fellow, St Vincent's

Institute of Medical Research and Emeritus Professor of Medicine, University of Melbourne. He was previously the Director of St Vincent's Institute of Medical Research and the Chairman of the University of Melbourne Department of Medicine. A Fellow of the Royal Society and of the Australian Academy of Science, he was also President of the International Bone and Mineral Society.



Professor John Mattick AO FAA FTSE

Professor Mattick was appointed Executive Director

in 2012. He has a distinguished career in molecular biology, most recently as an NHMRC Australia Fellow and Director of the Institute for Molecular Bioscience, University of Queensland. He was awarded the 2011 IUBMB (International Union of Biochemistry and Molecular Biology Medal, the 2012 HUGO (Human Genome Organisation) Chen Medal, membership of the European Molecular Biology Organisation and Fellowship of the Australian Academy of Science, the Australian Academy of Technology & Engineering and the Australian Academy of Health and Medical Sciences.



Helen Nugent AO

Dr Nugent is the Chairman of the National Disability Insurance Agency, Ausgrid, and

Australian Rail Track Corporation and a Non-executive Director of Insurance Australia Group Limited. She has been the Chairman of Veda Group, Funds SA, Swiss Re (Australia) and Sydney Airport and a Non-executive Director of Macquarie Group, Origin Energy Limited, Mercantile Mutual and the State Bank of NSW, among others. She is an Officer of the Order of Australia and a recipient of the Australian Government Centenary Medal.



Patricia O'Rourke

Professor O'Rourke is the CEO of St Vincent's Health Australia's Public Hospitals Division. She also

serves on the board of the Aikenhead Centre for Medical Discovery. She is a graduate of the Australian Institute of Company Directors and a member of the Harvard Business Club of Australia.



Rodney Phillips

Professor Phillips, Dean of UNSW Medicine, is an immunologist whose research impacted

the world's understanding of HIV/AIDS and other infectious diseases. He described, for the first time, how HIV evades the body's immune defences. Previously, Professor Phillips was Vice-Dean of Medical Sciences at Oxford University and Director of the Peter Medawar Building for Pathogen Research.



Anthony M Schembri

A/Professor Schembri, CEO of St Vincent's Health Network,

holds academic appointments with the St Vincent's Clinical Schools of UNSW and Australian Catholic University. He is a director of the Central and Eastern Sydney Primary Health Network, St Vincent's Curran Foundation, National Centre for Clinical Research for Emerging Drugs and Co-chair of the Nursing Research Institute and a Trustee of the Peter Duncan Neurosciences Unit.



Russell Scrimshaw

Mr Scrimshaw is the Non-executive Chairman of Sirius Minerals and the

Executive Chairman of Torrus Capital, the Australian Philanthropic Fund, the Scrimshaw Foundation and Scrimshaw Nominees. 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 Genome.One, Commonwealth Properties, EDS Australia, Mobilesoft and Athletics Australia.



Jillian Segal AM

Ms Segal is the Deputy Chancellor of UNSW Sydney, Chairman of AICC (NSW), the General

Sir John Monash Foundation, and the Independent Parliamentary Expenses Authority (IPEA). She is a Trustee of the Sydney Opera House, a Director of the Grattan Institute, and a Director of Rabobank Australia Ltd, Rabobank New Zealand Ltd and Rabo Australia Ltd. She has been a senior regulator, lawyer and a director of other listed and government organisations.

Garvan Research Foundation Board of Directors 2017



Geoff Dixon
Chair (until Nov 2017)
Mr Dixon is the Chairman of the Garvan Research Foundation and

also sits on the boards of Crown Resorts Limited and the Museum of Contemporary Art Australia. He is an Ambassador to the Australian Indigenous Education Foundation. He has worked in the media, mining and aviation industries, and was Chief Executive of Qantas Airways from 2001 to 2008 and Chairman of Tourism Australia from 2009 to 2015.



Jane Allen
Ms Allen runs a Governance Advisory business. Previously she was a Managing Partner

at Egon Zehnder, 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 has also worked for Procter & Gamble in the US and Australia.



Michael Cannon-Brookes Sr
(From Mar 2017)
Mr Cannon-Brookes is a Director of Cannon-Brookes Consulting

Pty Ltd. He retired from IBM in July 2012, where he was IBM's Vice President, Global Strategy for Growth Markets, based in Shanghai, China. Mr Cannon-Brookes, a UK citizen, took Australian citizenship in 1994. He graduated with Honours in Law from Cambridge University. He was elected a Fellow of the Australian Institute of Company Directors in July 2013.



Gabriel Farago
Mr Farago practised as a solicitor and barrister for over 30 years, specialising in commercial

disputes in Australia and overseas, before becoming a full-time writer. His books – *The Empress Holds the Key* and *The Hidden Genes of Professor K* – were released in 2013 and 2016. In 1984, Mr Farago became a member of the Knightly Order of Vitez.



Mr Loftus Harris
Mr Harris is a professional Non-Executive Director and an advisor to industry and government. He

has been the Chair and a member of numerous national, state and industry bodies concerned with issues of economic development, international trade and investment, infrastructure, innovation and technology. He previously held various executive positions in the NSW, Queensland and Commonwealth public sectors.



Professor John Mattick
AO FAA FTSE
Professor Mattick was appointed Executive Director in 2012. He

has a distinguished career in molecular biology, most recently as an NHMRC Australia Fellow and Director of the Institute for Molecular Bioscience, University of Queensland. He was awarded the 2011 IUBMB (International Union of Biochemistry and Molecular Biology Medal, the 2012 HUGO (Human Genome Organisation) Chen Medal, membership of the European Molecular Biology Organisation and Fellowship of the Australian Academy of Science, the Australian Academy of Technology & Engineering and the Australian Academy of Health and Medical Sciences.



Helen McCabe
Ms McCabe is the Head of Lifestyle for Nine.com.au at Nine Entertainment Co. Prior to this

she was Editor-in-Chief at the *The Australian Women's Weekly*, Deputy Editor of *The Sunday Telegraph*, Night Editor of *The Australian* and held key roles on *The Daily Telegraph*. She is also on the board of the Australian Indigenous Education Fund and an Ambassador for Adopt Change.



Simon Mordant AM
Mr Mordant is Executive Co-chairman of Luminis Partners. He is also the Chair

of the Museum of Contemporary Art Australia and Lend Lease Barangaroo Public Art Committee, a board member of the Australian Broadcasting Corporation, MOMA PS1 in New York, Wharton Executive Board in Asia, a Trustee of the American Academy in Rome and a member of the Executive Committee of Tate International Council and a member of the International Council of the Museum of Modern Art in New York.



John Schubert AO
Dr Schubert is Chairman of the Garvan Institute of Medical Research

and Chairman of the Great Barrier Reef Foundation. 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.



Russell Scrimshaw

(From Nov 2017)
Mr Scrimshaw is the Non-executive Chairman of Sirius

Minerals Plc and the Executive Chairman of Torrus Capital, the Australian Philanthropic Fund, the Scrimshaw Foundation and Scrimshaw Nominees. Previously, he held executive positions at Fortescue Metals Group Ltd (FMG), Commonwealth Bank, Optus and IBM. He was also a Non-executive Director of Genome.One, Commonwealth Properties, EDS Australia, Mobilesoft Ltd, Telecom New Zealand Australia Pty Ltd and Athletics Australia. Mr Scrimshaw is a Non-executive Director of the Garvan Institute.



Jeanne-Claude Strong

Dr Strong graduated in medicine, and also has a BA (literature) and

a post-graduate degree in Applied Finance and Investment. She was on the Board of Bluearth, flew her Beechcraft Baron plane from California to Australia via Europe and races Etchells yachts including recent wins in Australasian, Queensland and Victorian championships.



Peter Young AM

Mr Young formally joined Standard Life Investments in 2013 as their Australasia Chairman. He is also

currently a Non-executive Director of the Sydney Theatre Company and a member of the Barangaroo Delivery Authority Board. He is a recipient of the Centenary Medal and, in 2008, was appointed a Member of the Order of Australia for his services to business and commerce.



Daniel Reed, Research Assistant,
Invasion and Metastasis.

Awards and achievements

This is just a selection of the honours received by Garvan researchers.

Marina Pajic named Outstanding Cancer Research Fellow

Dr Marina Pajic was named the Cancer Institute NSW Outstanding Cancer Research Fellow for 2017. Dr Pajic's work focuses on the development of new personalised therapies for pancreatic cancer. The awards, hosted by the Cancer Institute NSW, honour the achievements of the individuals and teams that work across cancer research, and celebrate excellence and innovation in the field.

'Father of gene cloning' to head Australian Academy Of Science

Professor John Shine AC has been elected President of the Australian Academy of Science. Professor Shine became world-renowned for a series of discoveries he made between 1975 to 1985 that furthered our understanding of genes, and was the first to clone human hormone genes that has helped transform the world of biotechnology. Professor Shine was Executive Director of Garvan from 1990 to 2012 and still runs his own lab, investigating gene mutations responsible for inherited kidney disorders.

Ramaciotti Medal: high honours for Professor Susan Clark

The Annual Ramaciotti Medal for Excellence in Biomedical Research has been awarded to Professor Susan Clark FAA, honouring her game-changing research in epigenetics and epigenomics. The Award, a grant of \$50,000, honours an individual who has made an outstanding discovery (or discoveries) in clinical or experimental biomedical research that has had an important impact on biomedical science, clinical science, or the way in which healthcare is delivered.

Professor John Mattick honoured

In 2017, Professor John Mattick received two prestigious recognitions. The Lemberg Medal from the Australian Society for Biochemistry and Molecular Biology honours Professor Mattick's significant contributions to



Dr Marina Pajic receives the NSW Outstanding Cancer Research Fellow award from Professor David Currow FAHMS, the Chief Cancer Officer of NSW and Chief Executive Officer of Cancer Institute NSW.

the scientific community, including his longstanding work to assign function to non-coding DNA, his scientific leadership and his status as a champion of genomics in Australia. He was also formally welcomed as a new Australian Academy of Technological Sciences and Engineering Fellow (FTSE).

Professor Tuan Nguyen receives UNSW's highest academic award

Professor Tuan Nguyen has been awarded a Doctorate of Science (DSc) from UNSW. Higher Doctorates are the highest academic award conferred by UNSW Sydney, and Professor Nguyen's award is testament to his outstanding contributions to our understanding of osteoporosis.

Top diabetes awards for Garvan leaders

Three prestigious awards from the Australian Diabetes Society commend the outstanding achievements of Professors Mark Febbraio, Jerry Greenfield and Don Chisholm AO. Professor Febbraio won the 2017 Australian Diabetes Society (ADS) Kellion Award. Professor Greenfield

won the 2017 Ranji and Amara Wikramanayake Clinical Diabetes Research Award, while Professor Chisholm was awarded the Inaugural ADS Lifetime Achievement Award.

Garvan breast cancer researcher awarded 10-year Endowed Chair

Associate Professor Elgene Lim, breast cancer researcher at the Garvan Institute of Medical Research, The Kinghorn Cancer Centre and medical oncologist at St Vincent's Hospital, Sydney, is one of two inaugural recipients of the National Breast Cancer Foundation Endowed Chair Program. A new and unique concept for breast cancer research in Australia, Endowed Chairs are designed to keep mid-career researchers in Australia and focused on research that will lead to the next major breakthrough.

Professor Jonathan Sprent elected to US National Academy of Sciences

Professor Sprent of the Immunology Division has been newly elected as a member of the US National Academy of Sciences. Membership

is considered one of the highest honours that a scientist can achieve. Professor Sprent is one of the most eminent immunologists of his generation. He is recognised in particular for his contributions to our understanding of T cells – blood cells that play a central role in defending the body against disease.

Success for Garvan researchers at key bone biology conference

Four members of the Bone Biology Division received awards at the joint annual scientific meeting of the Australian and New Zealand Bone and Mineral Society (ANZBMS) and the International Federation of Musculoskeletal Research Societies (IFMRS). Dr Michelle McDonald won an Amgen-ANZBMS Outstanding Abstract Award, for the third year in a row; Scott Youtlen received the Christopher and Margie Nordin Young Investigator Poster Award; Thao Ho-Le won the prestigious Sol Posen Research Award for the best first-author publication submitted in the previous 18 months; and Dr Weiwen Chen won the MSD ANZBMS Clinical Research Excellence Award.

Pathfinders award shines a light on DNA packaging in cancer

Katherine Giles and Qian Du have been announced as the joint winners of the inaugural Pathfinders Award. The award, a grant of \$10,000, was established by the collective giving group Pathfinders to help kickstart an early-stage cancer research project at Garvan.

Travel awards support conference attendances

The annual Stuart Furler Travel Awards have been awarded to Garvan PhD students Simon Hardwick and Deborah Burnett. The awards, presented to third-year PhD students at Garvan with outstanding research records and bright futures, provide \$5000 to support travel to attend a major international conference, as well as to visit labs of potential collaborators. Additionally, transplant researcher Dr Nathan Zammit received the Derek Gray Distinguished Travelling Scholarship Award from

the International Pancreas and Islet Transplant Association (IPITA). The competitive scholarship is awarded biennially to a research scientist in the field of islet or pancreas transplantation who has demonstrated outstanding research merit and future potential.

Young Garvan Edgy Ideas Awards

Dr Joanne Reed, of Garvan's Immunology Division, has been awarded the 2017 State Custodians Young Garvan 'Edgy Ideas' Award for her work on targeting rogue clones responsible for autoimmune disease. Three finalists are selected on scientific merit from all applications by members of Garvan's Executive Management Group. The program, sponsored by State Custodians, provides a unique forum for Garvan's young and early-mid career researchers to pitch an innovative idea to a crowd of young professionals, with the winner receiving a \$25,000 cash prize to investigate the idea.

Garvan genomic researchers shine

Five early-career researchers have received awards at the conference of Australasian Genomic Technologies Association (AGTA) and Epigenetics 2017, the meeting of the Australian Epigenetics Alliance. Congratulations to Dr Mark Pinese, Best Early Researcher Talk Award; Simon Hardwick, Best Student Talk Award; Clare Puttick, Best Student Poster Presentation Award; James Ferguson, Late-Breaking Poster Award; and Qian Du, winner of the Young Investigator Award at Epigenetics 2017.

CHAMP Young Pioneer Award

Presented annually by CHAMP Private Equity, this award aims to assist an early- or mid-career researcher to test an innovative research idea. Dr Simon Junankar, who received the 2017 Award, will use it to understand why some cancer patients experience accelerated tumour growth following immunotherapy treatment.

Ridley Ken Davies Award

Dr Thomas Cox was awarded the prize for his project that looks at

the level of two enzymes that have been linked to the development and progression of breast cancer, using 25 years of serum samples. The \$50,000 award is in honour of much-loved Ridley employee Ken Davies who passed away from cancer in 2015.

Palmer Innovation Prize

Joseph Palmer & Sons, Australia's oldest brokerage firm, and its philanthropic arm, the Joseph Palmer Foundation, awards an annual Palmer Innovation Prize of \$15,000 to a Garvan researcher or team for developing an innovative product, process or technology that has significant benefit to scientific research, clinical application or education. Dr Sean Warren was awarded the prize for the development of a new multichannel biosensor imaging system, which enables researchers to visualise and analyse the activity of multiple drug targets in live cells and tissues.

Heliflite Young Explorer Award

Each year, two researchers are awarded \$5,000 to facilitate international travel to conferences and laboratories to foster career development. Dr Liz Caldon will use the prize to attend the Gordon Research Conference – Hormone Dependent Cancers: Functional and Clinical Insight in Hormone Dependent Cancers in the US. Dr Ruth Pidsley will attend the Symposium on Proteases and the Tumour Microenvironment in Italy.

Done in 180 seconds: snappy science from precinct PhD students

Eight PhD students entertained and informed their audience at the 2017 St Vincent's Precinct Three Minute Thesis competition, held at Garvan. 3MT competitions are held around the globe, and all follow a specific format: PhD students are given just three minutes to explain their research in a compelling manner, easily understood by a non-specialist audience. The three winners were Dr Louis Wang (Victor Chang), Bethany Pillay (Immunology) and Etienne Masle-Farquhar (Immunology).

PhD completions

Congratulations to the students awarded PhDs in 2017.

At Garvan, we have close to 100 PhD 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.

Femi Ayeni

Supervised by Prof David Ryugo, Dr Michael Muniak, Prof Catherine McMahon.
"Hearing loss and sound amplification: effects on the central auditory system."

Laura Baker

Supervised by A/Prof Alex Swarbrick, Prof Susan Clark, Dr Jason Carroll.
"Inhibitor of Differentiation 4: a new player in the DNA damage repair pathway in basal-like breast cancer."

Mei Chan

Supervised by Prof Tuan Nguyen, Prof John Eisman.
"Contribution of quantitative ultrasound measurements to fracture risk assessment."

Venessa Chin

Supervised by Dr Marina Pajic, Prof Andrew Biankin, Prof Stephen Clarke.
"Preclinical testing of individualised therapy strategies for pancreatic cancer."

Angela Chou

Supervised by Dr Marina Pajic, A/Prof Anthony Gill, A/Prof Adrienne Morey, Prof Andrew Biankin.
"Novel therapeutic strategies for treatment of pancreatic cancer."

Ira Deveson

Supervised by Prof John Mattick, Dr Tim Mercer, Dr Michael Janitz.
"Three (largely unrelated) experiments in the age of next-generation sequencing."

Mun Hui

Supervised by A/Prof Alex Swarbrick, Prof Sandra O'Toole, Dr Aurelie Cazet.
"The hedgehog epithelial-stromal crosstalk in triple negative breast cancer."

Christoph Jandl

Supervised by A/Prof Cecile King.
"Cytokines in the germinal centre reaction to T-dependent antigen."

Anton Kalsbeek

Supervised by Prof Vanessa Hayes, A/Prof Phillip Stricker.
"The mitochondrial genome as a biomarker for prostate cancer."

Claudia Loetsch

Supervised by A/Prof Cecile King, Dr Tatyana Chtanova, A/Prof Mark Danta.
"The role of viral sensing in the development of autoimmunity."

Jesper Maag

Supervised by A/Prof Marcel Dinger, Dr Warren Kaplan.
"Computational analysis of ncRNA involved in cancer development and memory formation."

Lee Marshall

Supervised by A/Prof Antony Cooper.
"Identifying transcriptional changes contributing to the susceptibility and degeneration in idiopathic Parkinson's disease."

Christopher Meoli

Supervised by Prof David James, Prof Greg Cooney.
"Metabolic responses to high fat diet-induced obesity: the long and short of it."

Annabel Minard

Supervised by Prof David James, Dr Jacqueline Stoeckli, Prof Trevor Biden.
"Metabolic homeostasis in the adipocyte – a study on insulin-regulated proteostasis and FGF21 signalling."

Gary Morris

Supervised by Dr Bryce Vissel.
"Investigating the neuroprotective capabilities of glial-derived neurotrophic factor following intraluminal filament middle cerebral artery occlusion in mice."

Nancy Mourad

Supervised by Prof Peter Croucher, Dr Michelle McDonald.
"Defining the transcriptomic profile of dormant breast cancer cells in the skeleton."

Beverley Murrow

Supervised by Prof David James, Prof Greg Cooney.
"Role of guanine nucleotide exchange factors for Rab10 in insulin-regulated GLUT4 trafficking."

Adnan Nagrial

Supervised by Prof Andrew Biankin, Prof Lisa Horvath, Dr Marina Pajic.
"Investigation of predictive and prognostic biomarkers in pancreatic cancer."

Liam O'Rielly

Supervised by Prof Trevor Biden, A/Prof Carsten Schmitz-Peiffer.
"The role of macrophages in the regulation of β -cell function."

Xiu Cheng Quek

Supervised by A/Prof Marcel Dinger, Prof Richard Epstein.
"Computational characterisation of the transcriptional landscape and long non-coding RNAs in cancer."

Ksenia Skvortsova

Supervised by Dr Clare Stirzaker, Prof Susan Clark.
"DNA hypermethylation of promoter CpG islands in cancer."

Johana Susanto

Supervised by Prof Andrew Biankin.
"Investigating the use of retinoids and epigenetic modification agents as new therapeutic strategies for the treatment of pancreatic cancer."

Post-doc development

To come together, engage and collaborate.

Kirupa Suthakar

Supervised by Prof David Ryugo, Prof Catherine McMahon.
“Changes to the descending auditory system in hearing loss: focus on auditory efferents.”

Alice Tang

Supervised by Prof Jerry Greenfield, Dr Dorit Samocha-Bonet.
“Insulin-sensitive obesity: prospective and interventional studies.”

Tommaso Torcellan

Supervised by Dr Tatyana Chtanova, Prof Robert Brink.
“The fate of tumour-egressing T cells in tumour immune responses.”

Claire Vennin

Supervised by A/Prof Paul Timpson, Dr Marina Pajic.
“Fine-tuned ECM manipulation via Rho-kinase inhibition uncouples pancreatic cancer progression, sensitivity to chemotherapy and metastasis, as assessed by intravital imaging.”

Natalie Wee

Supervised by A/Prof Paul Baldock, Prof Herbert Herzog.
“Obesity-induced bone loss is regulated by a neuropeptide Y mechanism.”

Adelaide Young

Supervised by Prof Chris Ormandy, Dr Samantha Oakes, Dr David Gallego-Ortega.
“The role of MCL-1 in triple negative breast cancer.”

Mahdi Zeraati

Supervised by A/Prof Marcel Dinger, A/Prof Daniel Christ.
“Examination of the biological role of i-Motif and G-quadruplex nucleic acid structures.”



Dr Michael Bowen presents at the 2017 Annual Post Doc Symposium.

The Post-Doctoral Development Committee (PDDC) facilitates education and social events for post-docs and group leaders across the St. Vincent's Precinct.

Committee members represent each Research Division within Garvan, as well as the Victor Chang Cardiac Research Institute and St. Vincent's Centre for Applied Medical Research. In 2017, the Committee organised:

- 2017 Annual Post Doc Symposium (with the 25th St. Vincent's Campus Research Symposium), attended by more than 100 participants from across the precinct.
- 2017 Careers Forum with more than 100 student and post-doc attendees discussing different career paths available to scientists in current times.

- Six educational seminars showcasing new and existing facilities, expertise and knowledge in the precinct, and numerous social events.

2017 PDDC members:

Co-chairs

Emily Edwards (Garvan, Immunology) and David Herrmann (Garvan, Cancer)

Secretaries Marcia Munoz (Garvan, Bone) and Niall Byrne (Garvan, Bone)

Communications/Treasurer

Brigid O'Gorman (Garvan, Foundation)

Members Carole Ford (AMR), Gayathri Sundaram (AMR), Gonzalo del Monte (VCCRI), Jeng Yie Chan (Garvan, Diabetes and Metabolism), Nathan Zammit (Garvan, Immunology), Matthew Perry (VCCRI), Nenad Bartonicek (Garvan, Genomics and Epigenetics), Samantha Oakes (Garvan, Cancer), Simon Junankar (Garvan, Cancer).



Committee members, left to right: Dr Jeng Yie Chan, Dr Emily Edwards, Dr Niall Byrne, Dr Brigid O'Gorman, Dr David Herrmann, Dr Carole Ford, Dr Nathan Zammit, Dr Simon Junankar, Dr Nenad Bartonicek.

In memoriam

This year, Garvan mourned the passing of four of our inspirational Life Governors and one of our extraordinary researchers. We will miss them.

John Armati, 1940 – 2017

A philanthropic businessman who left his mark on the city of Dubbo and its people, John Armati is remembered for his drive and vision. He turned a small western NSW newspaper group into a publishing empire of 64 mastheads.

Embracing the new technology of the 1970s, he transformed his operations – becoming the first newspaper proprietor in Australia to use visual display terminals – and created a vast magazine business. Mr Armati was at the helm of Macquarie Publications for three decades, from 1962 to 1995.

Local newspapers were, in his words, the heart of their communities.

Lady Mary Fairfax AC OBE, 1922 – 2017

With the passing of Lady Mary Fairfax, Australia lost an iconic businesswoman, social influencer, charity worker and philanthropist. She left many good causes the better in her wake. Garvan is honoured to be among them. Lady Fairfax was one of Garvan's first major donors and without her generosity and commitment, the Institute would not be in the leading position it is today.

Notably, her support allowed Garvan to develop a successful hearing research program, which works towards understanding how the brain changes when hearing loss occurs, and how hearing might be restored.

Lady Fairfax appreciated the urgent need for researching this widespread and problematic affliction, which includes increased risk for dementia and depression.

We are incredibly grateful to Lady Fairfax for her generosity and foresight.

Pieter Huveneers, 1925 – 2017

Pieter Huveneers received his academic training in the Netherlands, graduating in four languages just after the completion of WWII.

Moving to the UK, he gained prominence designing posters for the British Post Office, alongside work for large companies including BOAC, British Railways, Schweppes, General Electric Company, ICI, British Aluminium and Pepsi Cola. He was also instrumental in forming a school for automotive design in England.

Intrigued by the Australian market, he established himself in Sydney in 1969, quickly gaining a reputation for his comprehensive identity programs.

Mr Huveneers was responsible for nearly 70 names and logos for Australian corporations, including such well known organisations as Westpac, Australia Post, Telecom, Dulux, Myer, ICI Australia (to name a few). Many of the original marks are still in use today, a testament to Huveneers' reductive design approach.

Constance (Connie) Johnson OAM, 1977 – 2017

It is impossible to overestimate Connie Johnson's impact on cancer research at Garvan, and as a beacon of inspiration for people with cancer and the general public in Australia.

Connie was diagnosed with cancer three times, at ages 11, 22 and finally at 33 in 2010, when she was given six to 12 months to live.

In defiance of her prognosis, she directed her energy into 'cancer vanquishment' and co-founded Love Your Sister with her brother, actor Samuel Johnson, in 2012.

Love Your Sister made significant contributions to Garvan, allowing the establishment of the Connie Johnson Breast Cancer Research Lab and appointment of Associate Professor Elgene Lim as its head in 2014.

The lab's researchers continue to work towards finding new treatments for breast cancer and to improve outcomes for patients, so that fewer people have to experience what Connie herself endured.

This sister, wife, mother and public heroine inspired so many.

Dr Paul Lee, 1977 – 2017

It was with great sadness to the people of Garvan that our friend and colleague Dr Paul Lee passed away unexpectedly.

Paul was a highly regarded member of Garvan's Diabetes and Metabolism Division, and a successful young scientist whose research was recognised by numerous awards and grants. His truly positive and friendly presence in the corridors of Garvan will be greatly missed.

Within St Vincent's hospital, Paul was a brilliant and talented endocrinologist who was immensely devoted to his patients.

As a member of the St Vincent's Endocrinology Department he was a valuable team player and a major contributor to the Department's status as a leader at the cutting edge of patient care; a clinician determined to see research breakthroughs make a swift transition to the patient bedside.

Paul was a loyal and supportive colleague and a mentor to all the junior members of his team and the wider hospital campus.

Leaders in Science and Society seminars

Thank you to those who presented at the Garvan Institute in 2017.

Garvan's Leaders in Science and Society seminars feature renowned Australian and international speakers from a variety of organisations to engage, educate and inspire our researchers.

JANUARY

Dr Mark Chee, Chief Executive Officer, Prognosis Biosciences

FEBRUARY

Professor Greg Gibson, Professor of Integrative Genomics, Georgia Institute of Technology

Professor Bruce Stillman, President, Cold Spring Harbor Laboratory, US

Dr Dinshaw J Patel, Abby Rockefeller Mauze Chair in Experimental Therapeutics, Memorial Sloan Kettering Cancer Center, US

MARCH

Professor Wieland Huttner, Managing Director, Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany

Professor Mark Smyth, QIMR Berghofer Medical Research Institute

Professor Ingrid Scheffer, Epilepsy Research Centre, University of Melbourne, Melbourne Brain Centre

Professor David Cooper, Director, The Kirby Institute, Sydney

APRIL

Mr Thomas Barlow, Barlow Advisory

Professor Matt Cooper, Institute for Molecular Bioscience, The University of Queensland

MAY

Professor Glenn Marshall, Kids Cancer Centre, Sydney Children's Hospital Sydney

Dr Elissa Deenick, Laboratory Head, Lymphocyte Signalling and Activation, Garvan Institute

Professor John Hopper, NHMRC Senior Principal Research Fellow, Director of Twins Research Australia, University of Melbourne

JUNE

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Professor Peter Croucher, Head – Bone Biology, Garvan Institute

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Give to others, eat good food...

And walk every day. These are the tips Vicki Graham gives for those seeking longevity. About to celebrate her 90th birthday, she knows. Vicki sailed from Malta in 1950. Her first job in Australia was in a Melbourne hospital, which was the start of her love of “anything medical”. Combined with her enormous compassion, this led to her multiple volunteer roles over 40 years. She worked as a manager in St George Hospital and volunteered in carer roles.

Vicki first heard of Garvan’s seminars when she was volunteering on a community service committee about 14 years ago, and she booked a group to attend. Following that, Vicki became a ‘Garvan Ambassador’ and has brought many more groups to attend tours, open days and seminars. “People love Garvan. We asked a researcher to come to the war widows meeting and Dr David Croucher (from the Cancer Division) came to speak. Everyone found it fascinating.”

Vicki’s beloved husband, Kevin, came along with her to events and they decided together to give gifts to Garvan in both of their Wills. Kevin’s bequest has since come to Garvan, and Vicki now spreads the word to others. “I think flowers are a waste. Flowers should go to the living, not the dead. When Kevin passed, we asked people to give donations to Garvan instead.”

Vicki’s daughter Kerin is supportive of Vicki’s wishes, has visited Garvan and is a donor herself. “I know that my daughter will know exactly what I wanted, when I ‘fall off the branch,’ as Kevin used to say.” She adds, “Family comes first, of course. You need to look after them. But if you have enough to go further you should talk with your family about leaving a gift in your Will. To me, medical research is of so much value.”



Partner for the Future Vicki Graham
with her daughter Kerin Wood.

Garvan community

Our heartfelt appreciation goes to all those who supported Garvan in 2017.

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Mr Glenn Wilkinson

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Dr Elissa Deenick
Miss Georgina Dwyer
Mr Gordon Eckel
Ms Georgie Harrowell
Mr Alex Henson

Mr Lindsay Leeser
Mr Dan Morahan
Mr Tom Morgan
Mr Chris Nasser
Miss Lucia Robson
Mr James Wilkinson

ESTATES

Estate of the late John Ball
Estate of the late Joan Barry
Estate of the late
Andrew Bennie
Estate of the late Peter
and Pamela Binnie
Estate of the late Peter Boulken
Estate of the late
Margaret Briggs
Estate of the late Kenneth
and Betty Brown
Estate of the late Jens
Christophersen
Estate of the late Peter Clarke
Estate of the late Alan Crook
Estate of the late
Marie Dalkeith
Estate of the late Helen Dovník
Estate of the late
Florrie Fernihough
Estate of the late
Wallis Fletcher
Estate of the late
Lynette Forbes
Estate of the late Sylvia Francis
Estate of the late Barbara Giblin
Estate of the late
Mackersey Gibson
Estate of the late Fay Harris
Estate of the late Alan Hellicar
Estate of the late
Gabriel Keleny
Estate of the late
Henryk Kitaszewski
Estate of the late
Nathalie Kulakowski
Estate of the late Denise Lang
Estate of the late
Adell Littlejohn
Estate of the late
Mabs Melville
Estate of the late
Helen Morgan
Estate of the late
Elizabeth Newton
Estate of the late Clare O'Brien
Estate of the late Shirley Power
Estate of the late Ann Roche
Estate of the late
Elizabeth Rudduck
Estate of the late
Reginald Ryan
Estate of the late
Helen Southern
Estate of the late Helen Short
Estate of the late
Reginald Stubbs
Estate of the late Nola Wagner
Estate of the late
Richard Warren
Estate of the late
Adrian Wilden

Peer-reviewed funding



Dr Marie Dziadek, Chief Scientific Officer

From the CSO

To support their own salaries and their research work, it is essential for our researchers to receive fellowship and grant funding from the National Health and Medical Research Council (NHMRC) and other funding bodies.

These grants are peer-reviewed and if successful demonstrate how highly the applications are regarded by our peers in the medical research sector. However, competition for the available money is extremely high. Due to funding constraints, not all the excellent applications are successful.

Garvan researchers had an outstanding year in 2017 with a 29.4% success rate for NHMRC grants and fellowships, compared to the national average of 19.3%. Researchers spend many months putting their applications together and it's always a tough time when the outcomes are announced.

Therefore, the fundraising efforts and contributions of Garvan's donors are absolutely necessary to support all of our researchers' life-changing work. Private funds enable our researchers to continue their important research until they are able to acquire competitive grant funding.

GARVAN-LED GRANTS 2017

Funding Body	Type of grant	Principal Investigator	Co-Investigators	Project Title	Amount Funded	Years of funding
Allergy and Immunology Foundation of Australasia	Research Grant	Marcia Munoz	Mike Rogers Tri Phan	A new approach to overcome a childhood autoinflammatory disease	\$30,000	1
Avner Pancreatic Cancer Foundation Ltd	Innovation Grant	Shane Grey	Marina Pajic	Harnessing a novel 'tunable' immune check point to enhance the immunogenicity of anti-pancreatic ductal adenocarcinoma	\$99,536	1
	Accelerator Grant	Paul Timpson	Thomas Cox, Anthony Gill (Royal North Shore Hospital) Marina Pajic, Jeff Evans (Beatson Institute, Scotland) Benjamin Parker (University of Sydney), Angus Grey (University of Auckland, NZ), Jennifer Morton (Beatson Institute, Scotland) Lorraine Chantrill	Seeing is believing: mapping and targeting the extracellular matrix in pancreatic cancer	\$809,676	3
Cancer Australia	Priority-driven Young Investigator Project Grant	Mark Pinese		Comprehensively surveying the complex genetic determinants of sarcoma risk	\$65,000	2
	Priority-driven Standard Project Grant	Marina Pajic	Paul Timpson, Anthony Gill (Royal North Shore Hospital), Shane Grey, Stephen Clarke (Royal North Shore Hospital), Jas Samra (Royal North Shore Hospital)	Dual-targeting of Src and JAK/STAT3 signalling as a novel personalised treatment strategy for pancreatic cancer.	\$600,000	3
Cancer Council NSW	Project Grant	David Gallego-Ortega	Chris Ormandy, Ido Amit (Weizmann Institute, Israel)	Identifying molecular targets for immunotherapy using highly-parallel single-cell transcriptomics	\$440,000	3
	Project Grant	Ruth Pidsley	Susan Clark, Phillip Stricker (St Vincent's Hospital)	A novel predictive epigenetic test to stratify men for prostate cancer focal therapy	\$299,483	2
Cancer Institute NSW	Translational Research Program Grant	Lisa Horvath	Philip Stricker (St Vincent's Hospital), Anthony Joshua (St Vincent's Hospital), James Kench (Royal Prince Alfred Hospital), Louise Emmett (St Vincent's Hospital), Susan Clark, Vanessa Hayes	Integrating research into clinical practice in prostate cancer	\$3,750,000	5
Commonwealth Department of Health and Ageing	Public Health and Chronic Disease Grant Program	Philip Stricker	Quoc Nguyen, Anthony Joshua (St Vincent's Hospital), James Kench (Royal Prince Alfred Hospital), Louise Emmett (St Vincent's Hospital), Susan Clark, Vanessa Hayes	APCRC NSW TRANSITIONAL FUNDING: Science and clinical innovation in prostate cancer research	\$1,500,000	1.5

GARVAN-LED GRANTS 2017 *continued*

Funding Body	Type of grant	Principal Investigator	Co-Investigators	Project Title	Amount Funded	Years of funding
Diabetes Australia Research Trust	General Grant	Carsten Schmitz-Peiffer	Amanda Brandon (University of Sydney)	Dual deletion of PKCepsilon and CerS6 in adipose tissue to protect insulin sensitivity	\$60,000	1
	General Grant	Trevor Biden	Piero Marchetti, (University of Pisa, Italy)	Novel roles for endoplasmic reticulum stress in beta cell dysfunction	\$60,000	1
Gastroenterological Society of Australia	'Near-Miss' NHMRC project grant	Maija Kohonen-Corish	Jane Dahlstrom (Canberra Hospital), Stephen Clarke (University of Sydney)	Determine the role of MCC silencing in the promotion of colorectal cancer and how it can be targeted with anti-invasive therapy.	\$50,000	1
Juvenile Diabetes Research Foundation	Australian Type 1 Diabetes Clinical Research Network Innovation Award	Shane Grey	Kazu Kikuchi (Victor Chang Cardiac Research Institute), Dan Hesselton, Kylie Webster, Jonathan Sprent, Chris Goodnow, Simon Barry (University of Adelaide)	Utilizing "Islet-Helper" T regulatory cells to regenerate damaged beta cells	\$1,500,000	3
National Breast Cancer Foundation	Investigator Initiated Research Scheme	Clare Stirzaker	Susan Clark, Rodney Scott (University of Newcastle), Alexander Dobrovic (Olivia Newton John Cancer Research Institute), Vinod Ganju (Monash University), Alexander Swarbrick	Novel epigenetic blood biomarker panel to stratify triple negative breast cancer	\$602,414	3
	Investigator Initiated Research Scheme	Alex Swarbrick	Sandra O'Toole, Joseph Powell (University of Queensland), Elgene Lim Mun Hui, Paul Timpson	Discovering new therapeutic strategies for metastatic triple negative breast cancer at cellular resolution	\$716,450	3
	Investigator Initiated Research Scheme	David Herrmann	Paul Timpson, Tatyana Chtanova	"Priming" the immunosuppressive tumour microenvironment of breast cancer to boost immunotherapy and survival outcomes	\$297,000	3
	Investigator Initiated Research Scheme	David Croucher	Thomas Cox	Targeting stiffness induced JNK activity as a novel therapy in triple negative breast cancer	\$214,000	2
National Health and Medical Research Council	Project Grant	David Croucher	Thomas Cox	Location, location, location: Sub-cellular specific targeting of JNK as a novel therapy in breast cancer	\$625,005	3
	Project Grant	Susan Clark	Clare Stirzaker	A CTCF code for the 3D cancer genome architecture	\$893,193	4
	Project Grant	Paul Timpson	Jennifer Morton (Beatson Institute, Scotland), Yingxiao Wang (University of California San Diego, USA), Marina Pajic	PARP and PI3K inhibition in pancreatic cancer: intravital insights and fine-tune priming using AKT and single/double-strand DNA break biosensor mice	\$750,005	3
	Project Grant	David Croucher	Alex Swarbrick, Walter Kolch (University College Dublin, Ireland), Jamie Fletcher (Children's Cancer Institute)	Precision medicine for high-risk neuroblastoma	\$660,005	3
	Project Grant	Susan Clark	Fatima Valdés Mora	H2A.Z acetylation: deregulation of enhancer activity and 3D chromatin in prostate cancer	\$859,350	3
	Project Grant	Thomas Cox	Paul Timpson	Transient tissue priming via FAK inhibition to impair pancreatic cancer progression and improve sensitivity to gemcitabine/Abraxane	\$643,848	3
	Project Grant	Mike Rogers	Anna Simon (Radboud University, The Netherlands), Elissa Deenick	Protein prenylation and inflammation: new insights into the pathophysiology and treatment of mevalonate kinase deficiency	\$715,755	3
	Project Grant	Peter Croucher	Andrew Zannettino (University of Adelaide), Tri Phan, Ido Amit (Weizmann Institute, Israel)	Myeloma plasma cell dormancy - 'eradicating the sleeping giant'	\$834,428	3
	Project Grant	Tim Mercer	Marcel Dinger, Leslie Burnett, Jim Blackburn	Diagnosis of inherited genetic disorders using DNA reference standards	\$690,820	3

GARVAN-LED GRANTS 2017 *continued*

Funding Body	Type of grant	Principal Investigator	Co-Investigators	Project Title	Amount Funded	Years of funding
National Health and Medical Research Council	Project Grant	Liz Caldon		Endocrine therapy tolerance as a cancer cell survival mechanism for late recurring breast cancer	\$450,083	3
	Project Grant	Daniel Christ	Jonathan Sprent, Cecile King	Mechanisms of action of interleukin-2 superkines	\$725,585	3
	Project Grant	Joanne Reed	Katherine Jackson	Rogue B cell clones in patients with autoimmune disease	\$916,670	4
	Project Grant	Tri Phan	Cindy Ma, Melanie Wong (The Children's Hospital at Westmead)	The mechanism for combined immunodeficiency and autoimmunity due to STK4-deficiency and its broader application to human PIDs	\$648,371	3
	Project Grant	Yanchuan Shi	Herbert Herzog, Ross Laybutt	Control of insulin secretion by Y1 receptor signalling	\$675,582	3
	Project Grant	Elissa Deenick	Cindy Ma	Regulation of immune responses by STAT1 and STAT3	\$704,428	3
	Project Grant	Ross Laybutt		New molecular mechanisms of islet protection against diabetes	\$673,259	4
	Project Grants	Cindy Ma	Elissa Deenick	Molecular and cellular control of human Th9 cell differentiation in health and disease	\$550,888	3
	Project Grant	Herbert Herzog		Distinct populations of Arc NPY neurons control different aspects of energy homeostasis	\$843,340	4
	Project Grant	Jonathan Sprent		Immunogenicity of dendritic cell nanovesicles	\$636,978	3
	Development Grant	Tim Mercer	David Thomas, Marcel Dinger	Synthetic DNA standards for clinical genome sequencing	\$870,005	2
Parkinson's NSW	Research Grant	Antony Cooper	Boris Guennevig (University of Sydney), Anbupalam Thalmuthu (UNSW Sydney)	Blood Biomarkers to diagnose PD and track disease progression	\$49,400	1
	Research Grant	Daniel Hesselton	Yuxi Zhang	Blocking PD progression	\$35,000	1
St Vincent's Clinic Foundation	Research Grant	David Herrmann	Paul Timpson, Anthony Joshua	A novel biosensor to predict prostate cancer spread - implications for anti-invasive drug discovery	\$30,000	1
	Research Grant	Anthony Joshua	Megan Crumbaker, Vanessa Hayes, Louise Emmett (St Vincent's Hospital)	DNA repair defects as a predictor of response to novel treatments in advanced castrate-refractory prostate cancer	\$50,000	1
	Research Grant	Neil Watkins	Richard Gallagher (St Vincent's Hospital), Venessa Chin, Peter Earls (St Vincent's Hospital)	The genomic basis of locoregional metastasis in head and neck squamous cell carcinoma	\$30,000	1
	Research Grant	Jerry Greenfield	Dorit Samocha-Bonet, Mark Danta (St Vincent's Hospital), Richard Day (St Vincent's Hospital)	Personalised medicine in prediabetes - towards preventing diabetes in individuals at risk	\$100,000	1
	Research Grant	Bonnie Lai	Kathy Samaras	Dietary intervention to improve the gut microbiome and body composition for better physical health in newly diagnosed type 1 diabetes mellitus.	\$25,000	1
National Breast Cancer Foundation	2018 Endowed Chairs Program	Elgene Lim		The breast cancer therapeutics and biomarker discovery program	\$3,000,000	10

FELLOWSHIPS AND SCHOLARSHIPS 2017

Funding Body	Type of award	Awardee	Project Title	Amount Funded	Years of funding
Australian & NZ Bone & Mineral Society	Gap Fellowship	Dana Bliuc	Predictors of mortality risk following osteoporotic fractures	\$50,000	1
Cancer Institute NSW	Career Development Fellowship	Mandy Ballinger	A clinical genomics program focused on early onset cancers	\$600,000	3
	Career Development Fellowship	Thomas Cox	Transient tissue 'priming' as a therapeutic modality to impair pancreatic cancer progression and improve sensitivity to adjuvant therapies	\$341,667	3
	Early Career Fellowship	Ira Deveson	Representing the cancer genome with synthetic DNA spike-in controls	\$448,200	3
	Early Career Fellowship	David Hermann	Pin-pointing pro-invasive plasticity of breast cancer in vivo by targeting the Src/EMT signalling axis	\$600,000	3
	Early Career Fellowship	Heloisa Helena Milioli	Expanding the repertoire of therapies targeting sex steroid receptors in breast cancer	\$600,000	3
	Early Career Fellowships	Max Nobis	Intravital imaging using AKT and DNA damage biosensor mice for drug target validation to improve PARP and PI3K inhibition in pancreatic cancer	\$600,000	3

FELLOWSHIPS AND SCHOLARSHIPS 2017 *continued*

Funding Body	Type of award	Awardee	Project Title	Amount Funded	Years of funding
Medical Research Future Fund	Next Generation Clinical Researchers Program	Jacqueline Center	Improving outcomes in osteoporosis and bone health	\$343,683	5
National Health and Medical Research Council	Senior Research Fellowship	Paul Timpson	Biosensor imaging in preclinical pancreatic cancer targeting: taking cancer targeting to new dimensions.	\$640,210	5
	Senior Research Fellowship	Shane Grey	Pancreatic islet inflammation and its role in diabetes and islet transplantation	\$707,370	5
	Early Career Fellowship	James Wang	Developing mouse models of diffuse large B cell lymphoma for therapeutic discovery	\$412,952	4
Susan G Komen for the Cure	Career Catalyst Research Grant	Thomas Cox	Co-targeting tissue stiffness to improve the efficacy of breast cancer therapies	\$449,464	3
Sydney Catalyst	PhD and 'Top-up' Research Scholar Award	Morghan Lucas	TOP UP AWARD: Seeing is Believing: Mapping and targeting the extracellular matrix in pancreatic cancer	\$39,400	2

COLLABORATIVE GRANTS LED BY OTHER INSTITUTIONS 2017

Funding Body	Type of grant	Administering Institution	Garvan Investigator/s	Co-Investigators	Project Title
Australian Research Council	Discovery Project Grant	University of Queensland	Clare Stirzaker	Matt Trau (University of Queensland), Darren Korbie (University of Queensland)	DNA exhibits new self-assembled structures due to clustered DNA methylation
	Discovery Project Grant	UNSW Sydney	Eva Maria Novoa Pardo and Martin Smith	Schraga Schwartz (Weizmann Institute, Israel), Christopher Mason (Weill Cornell Medical College, New York, USA)	Charting the human epitranscriptome
Bill & Melinda Gates Foundation	Global Health Accelerator Platform	Stanford University, USA	Katherine Jackson	Scott Boyd (Stanford University)	To assist with analysis of RNAseq data set from sorted plasmablasts
	Nearest Neighbour HIV Vaccine Project	University of Washington	Christopher Goodnow	David Baker (University of Washington)	Development of nearest neighbour immunogens for HIV1 vaccines
National Health and Medical Research Council	Project Grant	University of Adelaide	Peter Croucher	Andrew Zannettino (University of Adelaide), Peter Psaltis (SAHMRI), Jacqueline Noll (University of Adelaide)	Bone marrow macrophages: 'Resident Evil' in the establishment and progression of multiple myeloma
	Project Grant	University of Adelaide	Elgene Lim and Anthony Joshua	Wayne Tilley (University of Adelaide), Theresa Hickey (University of Adelaide), Luke Selth (University of Adelaide), Jason Carroll (Cancer Research UK Cambridge Institute), Wilbert Zwart (Netherlands Cancer Institute, Amsterdam), Christopher Sweeney (Dana-Farber Institute USA)	Pushing AR towards better outcomes in breast and prostate cancers
	Project Grant	University of Adelaide	Tuan Nguyen	Stan Gronthos (University of Adelaide), Melissa Davis (WEHI)	Deregulation of DNA hydroxymethylases Tet1/ Tet2 compromises skeletal integrity during ageing and bone disease
	Project Grant	University of Sydney	Shane Grey	Phil O'Connell (University of Sydney), David Harris (University of Sydney), Guoping Zheng (University of Sydney), Shounan Yi (Westmead Institute)	Identifying donor and recipient gene pathways in renal transplant fibrosis
	Project Grant	University of South Australia	Alexander Swarbrick	Michael Samuel (University of South Australia)	How does ROCK 'education' of fibroblasts drive neoplastic progression in the breast?
	Development Grant	University of South Australia	Elgene Lim	Shudong Wang (University of South Australia), Robert Milne (University of South Australia), Wayne Tilley (University of Adelaide)	Development of a novel and highly selective CDK4/6 inhibitor for treating cancer
Movember–National Breast Cancer Foundation	Collaborative Grant	University of Adelaide	Elgene Lim and Susan Clark	Wayne Tilley (University of Adelaide), Gail Risbridger (Monash University,) Jason Carroll (Cancer Research UK Cambridge Institute), Theresa Hickey (University of Adelaide), Luke Selth (University of Adelaide)	Transforming endocrine therapy for breast and prostate cancer

Financial highlights

Statement of financial position as at 31 December 2017.

Profit and loss statement

Revenue	2017 \$'000	2016 \$'000	Expenditure on research activities	2017 \$'000	2016 \$'000
Research grants			Staff costs	52,597	49,505
NHMRC research grants	14,795	15,737	Sequencing consumables	9,728	7,724
Other peer-reviewed research grants	6,839	10,734	Research	14,199	12,875
Other grants	4,726	2,583	Depreciation and amortisation	11,502	11,356
Commercial partnerships	533	603	Administration	11,116	7,139
	26,893	29,657	Fundraising*	3,260	2,669
NHMRC and UNSW Infrastructure grants			Building and scientific	6,826	7,045
NHMRC IRIISS grant	2,924	2,953	Finance costs	1,452	988
UNSW contribution	499	668		110,680	99,301
	3,423	3,621	Total comprehensive income for the year	(9,481)	10,065
NSW government support	16,256	18,295			
Donation and bequests	27,024	33,985			
Other income					
Sequencing and facility charges	20,961	19,276			
Investment/interest income	6,306	4,234			
Software licensing revenue	672	0			
Net gain on disposal of property, plant and equipment	(209)	38			
Net gain on interest swap derivative not qualifying as hedges	0	202			
Share of gain of associates accounted for using the equity method	(127)	57			
	27,603	23,807			
Total revenue	101,199	109,365			

*Fundraising costs exclude employment expenses.

Balance sheet

Assets	2017 \$'000	2016 \$'000
Current assets		
Cash and cash equivalents	36,132	57,817
Trade and other receivables	13,787	4,841
Financial assets at fair value through profit and loss	39,962	36,813
Sequencing Consumables	3,765	3,724
Biological assets	518	443
	94,164	103,638
Non-current assets		
Investments accounted for using the equity method	272	397
Property, plant and equipment	86,692	92,904
Intangibles & others	968	427
	87,932	93,728
Total assets	182,096	197,366

Liabilities	2017 \$'000	2016 \$'000
Current liabilities		
Trade and other payables	8,986	11,539
Borrowings	2,224	15,357
Derivative financial instruments	0	245
Provisions	5,685	5,742
Other	70	69
	16,965	32,952
Non-current liabilities		
Borrowings	12,478	2,254
Provisions	1,132	944
Other	1,043	1,257
	14,653	4,455
Total liabilities	31,618	37,407
Net assets	150,478	159,958
Funds		
Reserves	111,020	104,046
Retained surpluses	39,458	55,912
Total funds	150,478	159,958

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 Corporations Act 2001, 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.

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