THE UNIVERSITY of ADELAIDE

Annual report 2021

Healthy children from the start

Robinson Research Institute

ROBINSON RESEARCH INSTITUTE

make history.

Healthy children from the start

Who we are

The foundations for lifelong health are established before birth. A child's growth, development and susceptibility to disease is programmed by a myriad of cues, including genetic, social and environmental factors, the health of parents at conception, the circumstances of conception, environmental exposures and health during pregnancy, the events of labour, and early life experiences.

The Robinson Research Institute (RRI) at The University of Adelaide is comprehensively addressing how to give all children a healthy start in life. Our 45+ research teams are uncovering how events and circumstances before birth and during early life impact an individual's healthy development, their susceptibility to disease and their resistance to adversity. With these discoveries, we are developing effective interventions to protect children and improve their health prospects throughout life.

Our **Vision** is life-time health for all children and families, through research excellence.

Our **Mission** is to deliver world-class advances in human reproduction, pregnancy and child health, informing clinical care, policy and practice to improve health across generations and global communities.

2021 Snapshot

$20,026,487 Competitive funding

5 awarded NHMRC grants

2 awarded MRFF grants

48 Research Leaders

413 Members

6 Fellowships awarded

22 Honours students

110 PhD students

14 Masters students

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Reflections on 2021

L to R: Professor Ray Rodgers, Professor Anton Middelberg, Professor Brandon Wainwright

Our world-class researchers, together with our key stakeholders and research partners, continued to progress our research agenda focusing on healthy children from the start.

The Institute's members achieved excellent funding successes, receiving $20M in funding during 2021. These researchers and their projects had all been supported at early stages by RRI's funding programs

We particularly highlight the success of Associate Professor David Parsons and Dr Martin Donnelley, as part of the Australian Lung Health Initiative, which was awarded $28M from the prestigious MRFF Frontiers in Health and Medical Research Program for *Development of 4D Functional Diagnosis: A new frontier in lung health for children.* The RRI was pleased to support the project at several points towards obtaining this funding.

Many of these innovative and successful supportive programs were initiated by Professor Sarah Robertson, who stepped down as Director of the Institute at the beginning of 2021 after eight years in the role. Sarah is an outstanding leader and built on the legacy and vision of Emeritus Professor Jeffrey Robinson and Professor Rob Norman when she took the reins.

Under her leadership, the Robinson responded to the rapidly changing research landscape and became a leader in collaboration; not only with academics, but also non-traditional stakeholders and health consumers across a vast variety of industries. Sarah was instrumental in the development of online platforms in fertility and endometriosis, large co-creation workshops in the areas of stillbirth, and immunisation in reproduction and pregnancy, the running of niche workshops in cutting-edge research, and opening up the Institute to our stakeholders and the community at early stages to help set our research agenda at a large world café event.

Sarah experienced many research achievements during this time, including being elected as a Fellow of the Australian Academy of Science and the Australian Academy of Health and Medical Sciences, publishing 100 papers, being awarded NHMRC and ARC grants, presenting at conferences around the world and sitting on many influential boards. We thank her for her incredible leadership during her time as Director, and are pleased she remains an Institute member and can dedicate her time to her world-leading research.

We are proud of our members who continue to receive accolades for their brilliant work across the Institute's research scope. Of particular mention are Professor Jodie Dodd and Professor Helen Marshall AM who were elected as Fellows of the Australian Academy of Health and Medical Sciences. Fellows are elected by their peers for their outstanding contributions. Additionally, Helen was recognised as South Australia's Australian of the Year for 2022 for her work in vaccinology, public health and infectious diseases.

Professor Jeremy Thompson, who has been a leader in commercialisation and in mentoring the next generation of researchers, recently stepped down from his research commitments and is now focusing on his new spin-out company Fertilis. Fertilis will take forward a range of cell culture technologies which have promising application in the IVF industry. This includes development towards automation of IVF which was the first project funded under the RRI Major Research Initiatives Program.

Our researchers produced 487 publications, with many outstanding advances. Some notable outcomes were: uncovering that Type 1 diabetes in pregnancy is associated with distinct changes in the gut microbiome; discovering that the health profile differs between women diagnosed with PCOS and women with undiagnosed PCOS; understanding that macrophages exert anti-inflammatory effects in late gestation to protect against fetal inflammatory injury that compromises postnatal survival; discovery of potential biomarkers for early detection of ovarian cancer to increase survival rates; and demonstration that vaccinating adolescents with 4CMenB was associated with a reduction in group B meningococcal disease.

While COVID continued to impact aspects of the research environment, the RRI remained dynamic in the rollout of funding programs and research support. The Career Development Program that launched in 2020 continued, and RRI delivered workshops and mentoring opportunities for our early and mid-career researchers. The RRI hosted Writer-in-Residence, Heather Warne throughout 2021, providing Institute researchers with the opportunity to spend time focusing on their reflective writing skills. Heather delivered multiple workshops to enhance research endeavours through introducing participants to the creative use of reflective writing, exploring the use of narrative and metaphor, and other creative devices to unpack and illuminate specific situations.

Following another strong year, we want to thank the Institute's Advisory Board, Executive Committee, Early and Mid-Career Researcher Council, professional services team, and the amazing members for their continual perseverance and innovative thinking. As a group, we are improving the lives of families around the world.

Professor Ray Rodgers, Interim Director
Professor Anton Middelberg, Deputy Vice-Chancellor (Research)
Professor Brandon Wainwright, Chair of the Advisory Board

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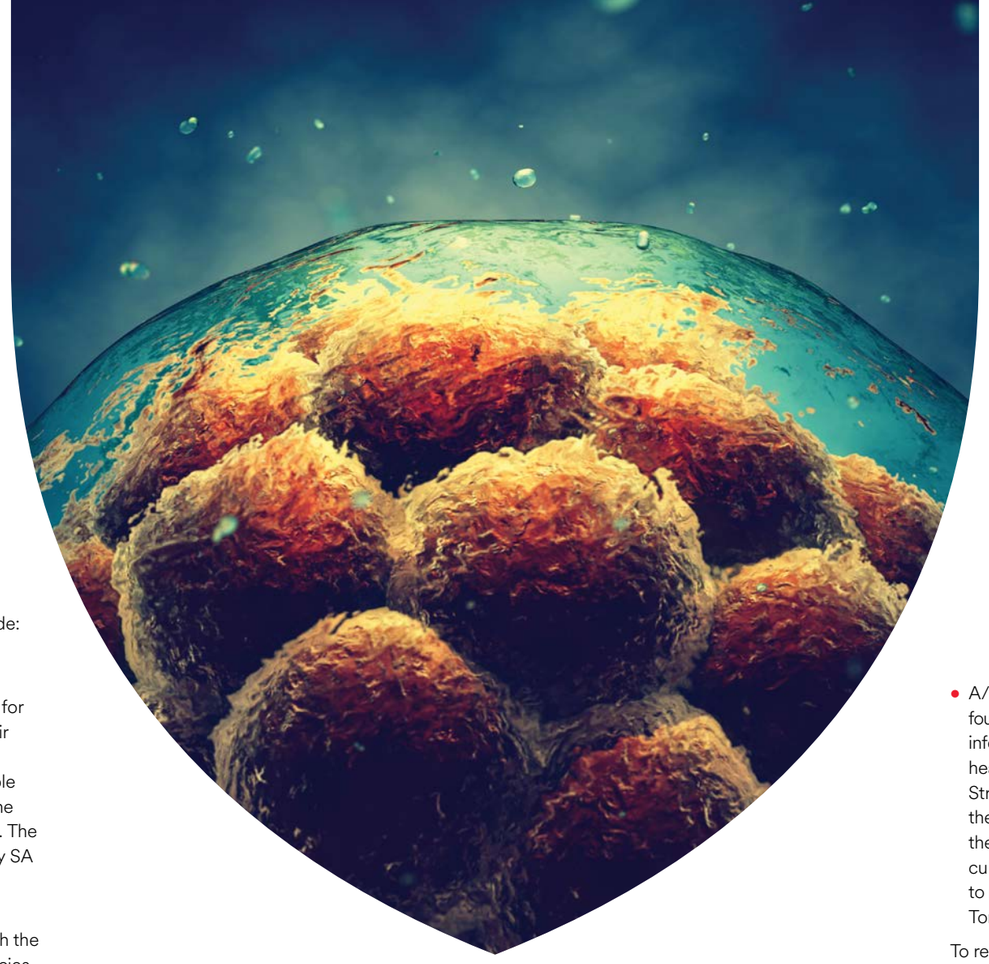
Research themes

Fertility and conception

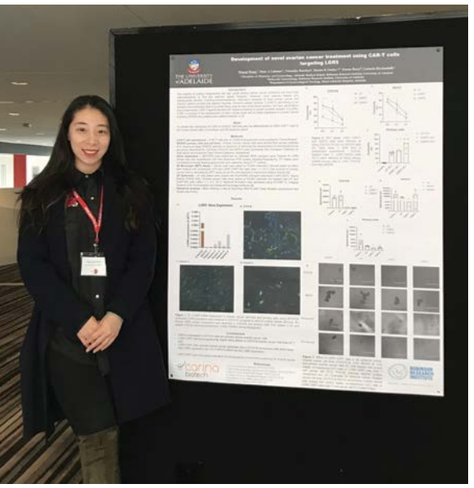


To improve the ongoing health of future generations, our research in this theme spans:

- Pre-conception health and environment
- Causes of infertility and successful interventions
- Molecular and cellular biology of the reproductive cycle
- Developmental programming in gametes and embryos
- Reproductive immunity
- Diseases that affect reproductive capability
- Novel non-hormonal contraceptives

We have found that the greatest potential for lifetime health, free from chronic disease in adulthood, is attainable through preventative approaches, starting in the earliest stages of life.

While conception is the foundation event for each new life, the preconception period is critical for a healthy pregnancy and establishing the health trajectory of the developing fetus. Our research considers the health, environment and social circumstances of prospective parents prior to and at conception.



Jady Wanqi Wang next to her ASMR winning poster.

Research advances

Examples of how RRI members progressed research in this field include:

- Dr Tiffany Tan, Dr Kylie Dunning and team developed an innovative approach that overcomes the need for a cell biopsy in embryo testing. Their approach uses light to take a non-invasive 'molecular photo', and is able to detect whether an embryo has the expected number of chromosomes. The work is in collaboration with Fertility SA and colleagues at The University of New South Wales.
- Prof Paul Thomas has partnered with the CSIRO and Centre for Invasive Species Solutions to test two breakthrough genetic biocontrol technologies to prevent future mice plagues. The 'X-shredder' approach, eliminates sperm carrying the X chromosome, producing more male than female offspring. The 'female infertility' approach initially spreads a genetic modification through the population, and once saturated, all the females generated will be infertile.
- A/Prof Wendy Ingman and team demonstrated that gene expression profiles in mammary cancers are affected by ovarian cycle stage, suggesting breast cancer tests that use gene expression profiling in women could be affected by the menstrual cycle. This has implications for breast cancer treatment decision-making in young women with breast cancer.
- Comparison of three commercial human embryo culture mediums used in assisted reproduction technology found differences in the type and concentration of fatty acids in the human serum albumin component. Dr Nicole McPherson and collaborators found this influenced blastocyst development and successful implantation rates in a pre-clinical model.
- Dr Carmella Ricciardelli and team demonstrated that CAR-T cells targeting nfP2X7 receptor are effective at killing ovarian cancer cells both in vitro and in vivo. This study demonstrates that nfP2X7-CAR-T cells have potential to be developed as a novel immunotherapy for ovarian cancer.
- Paternal experiences and exposures before conception can influence fetal development and offspring phenotype. The composition of seminal plasma contributes to paternal programming effects. Drs John Schjenken, Nicole McPherson and Prof Sarah Robertson demonstrated in mice that an obesogenic high fat diet alters the composition of seminal vesicle fluid and impairs seminal plasma capacity to elicit a favorable immune response in females at conception.
- Pouch of Douglas obliteration is a severe consequence of inflammation in the pelvis, often seen in patients with endometriosis. Dr Gabriel Maicas, Professors Gustavo Carneiro, Louise Hull and team developed an accurate deep learning model for the prediction of the dynamic transvaginal ultrasound-based sliding sign classification.
- Prof Ray Rodgers, Rafiatu Azumah, Menghe Liu and collaborators are the first to show that candidate genes for polycystic ovary syndrome (PCOS) can be regulated by TGFbeta in the fetal ovary. They found that TGFß signalling molecules are dynamically expressed during fetal ovary development and that TGFbeta 1 inhibits 7 of the 25 PCOS candidate genes in fetal ovarian fibroblasts in vitro. This suggests that TGFß signalling could be part of the aetiology of PCOS or at least the aetiology of polycystic ovaries.
- A/Prof Alice Rumbold and colleagues found that health care providers perceive infertility to be a major and unrecognised health issue for Aboriginal and Torres Strait Islander people. This highlights the need for better evidence to quantify the impact of infertility and develop culturally-responsive care approaches to manage infertility in Aboriginal and Torres Strait Islander communities.

To read more research advances from 2021 visit: adelaide.edu.au/robinson-research-institute/about-us/annual-reports

Academic connection

Society for the Study of Reproduction

Prof Darryl Russell is on the Board of Directors for the Society for the Study of Reproduction, and chaired the organising committee for the 2021 conference: *New Contraceptive Discovery*, attracting almost 300 attendees.

Sponsorship of ASMR

Sponsorship of the ASMR Annual Scientific Meeting provides the opportunity to support the Institute's early career researchers and students in career development. The Institute sponsored the *Robinson Research Institute prize for the best presentation in the field of reproduction, pregnancy or child health*, awarded to RRI member Jady Wanqi Wang for *Development of novel ovarian cancer treatment using CAR-T cells targeting LGR5*.

Partnership with SRB

Continuing our 15+ year partnership, the RRI sponsored the Society for Reproductive Biology at its annual conference. The Institute sponsored the *Robinson Research Institute Award for Excellence in Reproductive Biology*, awarded to A/Prof Natalie Hannan at The University of Melbourne.

Immunology downunder

The RRI hosted a special satellite session for the American Society for Reproductive Immunology, arguably the world's top meeting in the field. The session was chaired by Prof Sarah Robertson with presentations from:

- Prof Eva Dimitriadis (University of Melbourne), *Inflammatory mediators damage the placenta and affect pregnancy outcomes*
- Dr Ella Green (Robinson Research Institute), *Progesterone as a critical determinant of Treg cells at embryo implantation*
- Ms Urooza Sarma (Monash University), *Is ovarian infection the missing piece in the puzzle of chlamydia-associated infertility?*
- Dr Emily Bryan (Queensland University of Technology), *Prophylactic and therapeutic vaccination protects sperm health from Chlamydia muridarum-induced defects*

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Research themes

Pregnancy and birth

Most prospective parents anticipate healthy, problem-free pregnancies.

In reality, complications are common, with a quarter of Australian pregnancies affected by one or more of the following conditions: preeclampsia, preterm birth, fetal growth restriction, and gestational diabetes.

Pregnancy complications can have serious life-long health implications for both the mother and her baby.

Research advances

Examples of how RRI members progressed research in this field include:

- Prof Jodie Dodd and colleagues led an international individual participant data meta-analysis of child follow-up at 3-5 years from antenatal dietary intervention studies for pregnant women with overweight or obesity. They found that antenatal diet and lifestyle interventions do not reduce the risk of child obesity.
- There is no standard dietary approach that effectively mitigates risk for gestational diabetes. Drs Jessica Grieger and Nahal Habibi are using mathematical modelling to identify links between nutritional and metabolic markers that will characterise personalised diets in a clinical trial. Study outcomes will lead to a scalable approach in real-world clinical practice, to improve maternal and offspring health, and the development of nutritional recommendations for women at high risk of gestational diabetes.
- Using data obtained from mothers in the ENDIA study, Drs Madeline Hall and Rebecca Thomson, Prof Jenny Couper and colleagues showed that maternal mental health in pregnancy is not different for women living with type 1 diabetes versus women without the condition. This study, the largest of its kind, was published in the most influential journal in the field, Diabetes Care.
- In 2021 Prof Bill Hague, Corey Markus, Dr Suzette Coat and collaborators completed the Australian arm of the Bile Acid Harmonisation Study (BACH). This study aims to harmonise the clinical serum bile acid assay results across chemical pathology labs providing the clinical testing for sites collaborating in the TURRIFIC study.
- Dr Hassen Mohammed, Prof Helen Marshall AM and collaborators demonstrated the safety of maternal pertussis vaccination with no increased risk of adverse pregnancy and birth outcomes. These findings support recommendations for pertussis vaccination during pregnancy to prevent morbidity and mortality associated with early-infant pertussis disease.
- Dr Clare van Eyk, E/Prof Alastair MacLennan, Prof Jozef Gecz, and colleagues have discovered that B-lymphocytes of 182 children with cerebral palsy they studied show a distinct ‘molecular signature’. The signature consists of altered expression of a number of genes related to trophic signalling. Future validation and application of this signature to whole blood may open opportunities for early identification of children at risk of developing cerebral palsy.
- Macrophages are commonly thought to contribute to the pathophysiology of preterm labour by amplifying inflammation, but a protective role has not previously been considered. Prof Sarah Robertson and A/Prof Nardhy Gomez-Lopez showed that anti-inflammatory M2 macrophages exert a critical regulatory role in sustaining late gestation, and are implicated as a determinant of susceptibility to spontaneous preterm birth and fetal inflammatory injury.

To read more research advances from 2021 visit: adelaide.edu.au/robinson-research-institute/about-us/annual-reports

To postively impact curent and future pregnancies, research in this theme spans:

- Pregnancy and fetal growth biological pathways
- Factors leading to complications
- Challenges facing disadvantaged communities
- Maternal immune responses to implantation and placental formation
- Immune and inflammatory mechanisms controlling the timing of labour
- Interventions to identify at-risk women
- Education for pregnant women

Clinician connection

WCH Co-hosted Grand Rounds

Continuing our collaboration with the Women’s and Children’s Hospital, the RRI co-hosted two Grand Rounds seminars in 2021:

- Prof Stephen Tong, Clinician-Scientist at the Mercy Hospital for Women and The University of Melbourne: *Improving outcomes for those destined to develop preeclampsia and eclampsia*.
- Distinguished Laureate Prof Roger Smith AM, The University of Newcastle and The Hunter Medical Research Institute: *Time, aging and the aetiology of stillbirth*.

These seminars highlight tangible benefits of research on clinical practice, and facilitate engagement with researchers and clinicians at the Women’s and Children’s Hospital.

A/Prof Wendy Ingman’s interview ahead of her presentation at the Gold Lactation Online Conference.

Gold Lactation Online Conference

Every year, leading lactation clinicians and researchers around the world present at the Gold Lactation Online conference, which upskills breastfeeding support providers. A/Prof Wendy Ingman was invited to speak on *The Biology of the Mammary Gland in Lactation*.

In addition, Wendy was interviewed by Fiona Lang-Sharpe where she spoke about her research, her personal experience as a breast feeding mother and the changes that breasts undergo at different stages in life. Watch the interview at this link https://www.youtube.com/watch?v=pHQtFla0XxU

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Research themes

Early origins of health

Early life environment determines the trajectory of chronic disease later in life including metabolic and cardiovascular health, immune and reproductive health, and neurological function.

To increase the chances of life-long health, our research in this theme spans:

- Factors that affect early development
- Early interventions that can be administered during pregnancy
- Early life environments that program asthma and allergy development
- The impact of economic and social disadvantage on life-long health
- Pregnancy and infant care guidelines and public health policy

Parental health and well-being prior to conception, during pregnancy and in early postnatal life determines the quality of this crucial early environment: a concept known as developmental programming.

Research advances

Examples of how RRI members progressed research in this field include:

- Professors Vivienne Moore, Michael Davies and colleagues investigated the number of births in South Australia that occurred after dispensing of clomiphene citrate, a medication for infertility. In South Australia, 1.6% of pregnancies of at least 20 weeks' gestation were conceived proximal to clomiphene dispensing. Of these, 5.7% were multiple pregnancies. This takes the proportion of women who achieved an ongoing pregnancy with medical assistance from 4.4%, based on reports from assisted reproductive technology clinics, to 6% in total.

- Despite the dogma that Complement Receptor Immunoglobulin (CRIg) is only expressed by tissue fixed macrophages, Prof Antonio Ferrante, Dr Annabelle Small and team have shown that a form of this receptor is expressed by neutrophils in the blood stream only when the cells are activated, arming the neutrophil in an inflammation scenario and promoting the cells phagocytosis and killing of bacteria. Unlike other complement receptors CRIg is naturally active and the neutrophil only expresses and deploys the receptor at time of infection. While the findings place new perspectives in infection and immunity, such measurements of CRIg expression may have a potential of a biomarker for inflammation.

- Prof Leonie Heilbronn and Lijun Zhao showed for the first time that restricted eating improved glucose metabolism and 24 hour rhythms in hormones and metabolites, and restored rhythm in 450 genes in adipose tissue in men with obesity.

- Dr Clare Van Eyk, Prof Jozef Gecz and E/Prof Alastair MacLennan applied multi-tiered omics investigations including RNA sequencing, epiphenotyping and whole genome sequencing to DNA samples of the majority of cerebral palsy biobank of 526 families. They discovered that one at least one quarter of children with cerebral palsy have a genetic aetiology, with around half of these children potentially benefiting from a change in management based on their genetic diagnosis.

- A/Prof Cheryl Shoubridge and team demonstrated that treatment in early postnatal life with neurosteriods for those with genetic causes of intellectual disability and intractable seizures leads to a reduced frequency and severity of seizures, but without improvement in behavioural deficits. By identifying the molecular pathways that contribute to overlapping phenotypes of intellectual disability, seizures and neuropsychiatric disorders, they are now seeking to uncover drug targets for future treatment interventions.

- Low guanine content sequences associate with false positive CHH methylation calls in the mitochodrial genome. This finding by Dr Takeshi Okada and Prof Jus St. John has major implications for assessing DNA methyation calls in mammalian mitochondrial genomes.

- Building on their 2018 Nature paper, Dr Fatwa Adikusuma, Prof Paul Thomas and team developed a novel CRISPR gene editing tool called a Nuclease Prime Editor (NPE). They demonstrated that NPE can be used to generate specific genetic changes in cultured cells and mice with very high efficiency. This new technology will facilitate rapid generation and analysis of preclinical cell and animal disease models to investigate disease mechanisms and perform drug-screening trials. NPE also has potential to be developed as therapeutic to repair a wide array of disease-causing mutations.

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Research themes

Child and adolescent health

The future health of society depends on the health and wellbeing of our children. There is a pressing need to develop safe and effective interventions that can be accessed in early life to prevent life-long conditions.

Our members comprise world-leading clinicians and researchers who are working to detect, prevent and treat serious childhood diseases.

To improve the health of infants, children and adolescents, our research in this theme spans:

- Immunisation programs to prevent serious infections in children
- Treatments for paediatric conditions including diabetes, sleep, neurological disorders and cystic fibrosis
- Biomarkers for early diagnosis and treatment of autoimmune diseases, allergies and asthma
- Genetics of intellectual disability, cerebral palsy, and epilepsy
- Preventing and reversing childhood diabetes and obesity
- Mental health of mothers, young children and adolescents
- Generational disadvantage
- Large clinical trials and cohort studies

Research advances

Examples of how RRI members progressed research in this field include:

- Ms Sophie Kezior, A/Prof Alice Rumbold and colleagues found that high school secondary students highly value the inclusion of topics about consent in relationships and sexual health education in secondary school, drawing on results of an annual survey involving 29,533 secondary school students aged 12–16 years.
- Prof Jozef Gecz and Drs Raman Sharma and Mark Corbett identified a deep intronic variant in TIMMDC1 gene that codes for an essential subunit of mitochondrial complex I in two children with severe peripheral neuropathy. Complete loss of TIMMDC1 mRNA, protein and mitochondrial function in patient fibroblasts was restored by splice-switching antisense oligonucleotide treatment, opening opportunity for treating such patients.
- Dr Hassen Mohammed, Prof Helen Marshall AM and team conducted a rapid review to identify effective strategies for improving the uptake of the influenza vaccination programs in Australia. They found uptake could be improved by interventions that increase community demand and access to influenza vaccine and overcome practice-related barriers; and reinforce the critical role healthcare providers play in driving influenza vaccination uptake.
- Dr Lachlan Jolly created the first patient-derived stem cell model of Sanfilippo Syndrome Type A, and revealed that alterations in brain development may proceed the overt neurodegenerative characteristics of the syndrome.
- Little is known about patterns of contact with child protection services among culturally and linguistically diverse (CALD) populations in Australia. Razlyn Abdul Rahim and Prof John Lynch found that up to age 7, CALD children had lower risk of contact across all levels of contact with the child protection system in South Australia, from notification to out of home care placement. CALD and non-CALD groups did not markedly differ by the type of maltreatment, source of notification, or on background socioeconomic factors.
- Evaluation of the South Australian meningococcal B vaccine program showed high vaccine effectiveness against meningoccoal B disease for infants and adolescents and a significant reduction in meningococcal disease in both age groups. The evaluation led by Prof Helen Marshall AM also showed evidence of a significant and moderate vaccine effectiveness against gonorrhoea in 15-17 year olds in South Australia.
- A/Prof David Parsons and Drs Martin Donnelley and Alexandra McCarron further developed novel gene delivery methods that demonstrated substantial enhancement of lentiviral vector mediated airway gene transfer in rats. These new techniques resulted in the filing of a patent application in October 2021, and new funding from the Cystic Fibrosis Foundation.
- Dr Zohra Lassi, A/Prof Alice Rumbold and collaborators led a series of reviews that quantified the impact of the COVID-19 pandemic on child and adolescent mental health, and identified the maternal characteristics that predict adverse perinatal outcomes following COVID-19 infection in pregnancy, informing clinical guidelines around management of COVID-19 in pregnancy.

Participants from the virtual ENDIA Sympsoium.

To read more research advances from 2021 visit: adelaide.edu.au/robinson-research-institute/about-us/annual-reports

Academic and health care connection

SA Vaccinology Update

Together with SA Health, the Women's and Children's Hospital and SAHMRI, the RRI hosted the eighth SA Vaccinology Update. This full day event for immunisation providers, doctors and researchers educates attendees about the latest developments in immunisation research, policy and programs and is now a highly regarded immunisation conference.

This year's program focused on COVID-19, what's new in immunisations, and tackling vaccine myths and concerns.

2021 ENDIA Symposium

The 2021 ENDIA Symposium was attended by 90 participants from across Australia, USA, UK, Finland, Germany and Belgium. Highlights from the day included: Prof Richard Oram, an expert in type 1 diabetes genetics from Exeter University in the UK; Prof Chantal Mathieu, Director of the European INNODIA initiative for intervention trials in type 1 diabetes; Prof Mikael Knip, University of Turku and Head of the long-standing DIPP cohort in Finland; and Dr Peter Achenbach from the European GPPAD platform that is screening infants at birth for increased risk of type 1 diabetes.

Additionally, four ENDIA families from across Australia shared their experience in participating in ENDIA, including what the study means to them and what they would like to see happen with their samples and data.

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Improving lives through collaboration

Endometriosis digital health platform

The Robinson Research Institute and Australia's endometriosis community, with the support of the Australian Government and Jean Hailes for Women's Health, are co-creating a digital platform to empower and support people affected by endometriosis, to make informed and timely decisions regarding their health.

People affected by endometriosis identified the following priorities to be addressed by the platform: improving doctors' education and communication about endometriosis, addressing normalisation of period pain, and providing strategies for better managing symptoms of endometriosis. The platform is being co-created with the endometriosis community including the Australian Coalition for Endometriosis (ACE), people with, and those who support people with endometriosis, clinicians, researchers, health informatics specialists and IT developers. The platform was in development in 2021 and is due for release early 2022.

Reproductive Health Australia

Chaired by RRI Interim Director, Prof Ray Rodgers, Reproductive Health Australia is a unified voice for Australian reproduction research, advocating directly to the community, opinion leaders and the Government on behalf of the entire sector.

This alliance seeks to make reproductive health a national priority for the economic and social benefit of the nation, leading to improved environmental, agricultural and human health outcomes. The RRI is a founding partner and continues to support this alliance for the benefit of the community.

BEBOLD Platform: Goodstart Early Learning

The Better Start group's *Better Evidence, Better Outcomes, Linked Data platform (BEBOLD)* Study is a whole-of-population linkage study, which uses de-identified linked data from pre-existing government databases for SA children born 1991 onwards, as well as their caring environment (e.g. parents, caregivers, households). It is an on-going sustainable platform that receives data updates on a regular basis and seeks to improve service delivery across health, education and human services to support better outcomes for all children and young people, parents and caregivers, and for disadvantaged populations in particular.

The addition of Goodstart Early Learning data facilitates the building of longitudinal evidence that will enable research on the:

- Impact of attendance rates on improving educational outcomes for children
- Degree to which centre quality impacts on outputs and outcomes
- Educational and wellbeing outputs and outcomes for vulnerable cohorts of children: for example, children at risk of abuse and neglect and children from jobless and low SES families

Breast density fact sheet

Despite the increased risk of breast cancer and breast cancer masking associated with mammographic density (MD), there is poor overall awareness in the community. It is estimated that women with extremely dense breasts have a four-to-six fold increased risk of developing breast cancer compared to women with very low density.

A/Prof Wendy Ingman was part of a Clinical Oncology Society of Australia working group who developed a factsheet to assist clinicians in understanding breast density. This factsheet can be found at this link https://cosa.org.au/publications/reports-and-papers/mammographic-breast-density-facts-and-issues/

Mitochondrial donation review

The Senate of the Federal Government undertook a review of changes to existing legislation, to allow mitochondrial donation techniques to be used for research, training and human reproductive purposes. The overall aim was for women who are at risk of passing on mitochondrial disease to have reproductive options for biological children without the increased risk of their child having mitochondrial disease.

Led by Professors Rebecca Robker and Jus St John, the RRI made a submission to the Community Affairs Legislation Committee addressing the Mitochondrial Donation Law Reform (Maeve's Law) Bill 2021. This document highlighted key areas where further research is needed before the technology is offered for clinical use. Prof Rebecca Robker presented the RRI opinion at the Australian Senate Public Hearing on August 6, 2021.

B Part of It NT

Prof Helen Marshall AM's *B Part of It NT* study follows the successful 2017/2018 *B Part of It* study in South Australia, which saw almost 35,000 senior school students vaccinated against meningococcal B and gained valuable findings that went on to inform meningococcal vaccination programs globally.

7,000 young Territorians will be vaccinated against meningococcal B for free to determine whether the number of cases reduces in the Territory after participants receive the vaccine, including how many people carry the meningococcus bacteria in their throat. Additionally, researchers are interested in whether the vaccination offers protection against gonorrhoea.

CSIRO Nutrition in Pregnancy Guide

For women who are thinking about fertility and pregnancy, there is increasing evidence that eating well improves pregnancy health, and the health of the mother and baby in both the short and long term. The CSIRO saw a gap and invited the RRI to collaborate on a Women's Health and Nutrition Guide.

Dr Jessica Grieger contributed her knowledge and expertise on content for pregnancy planning, infertility, and breastfeeding. Jessica also assisted in delivering a clear step-by-step guide to help women form healthy habits that are backed by research, including practical tips and recipes to help women turn plans into actions. In addition, Prof Sarah Robertson provided editorial oversight and fact-checking assistance.

Gene-Disease relationships for cerebral palsy

Dr Clare Van Eyk is an expert reviewer for the cerebral palsy (CP) gene panel through PanelApp Australia and contributed to the design of the PanelApp CP gene panel v1. PanelApp is a publicly available knowledge base that enables development of virtual gene panels related to human disorders. It includes a crowdsourcing tool that allows genes to be added or reviewed by experts, for the standardisation of gene panels, and a consensus on which genes have sufficient evidence for disease association.

Additionally, Clare is an expert reviewer for the newly formed CP gene curation expert panel (GCEP) for ClinGen (USA). ClinGen GCEPs are also designed to aid in evaluating the strength of a gene-disease relationships based on publicly available evidence, but in this case all evidence is reviewed by a panel of expert reviewers. Both platforms collect information about the gene-disease relationship, including genetic, experimental, and contradictory evidence curated from the literature, in order to assign a clinical validity classification for diagnostic use.

Machine learning for endometriosis diagnosis: The *Imagendo* Project

A/Prof Louise Hull and Prof Gustavo Carneiro have brought together their two areas of expertise (endometriosis and machine learning) to facilitate less invasive and quicker diagnosis for endometriosis. This project has attracted $2M in MRFF funding from the Commonwealth Government in 2021, and is recruiting nationally and internationally.

Using a diagnostic dataset as a training sample, a computer program has been built that reads specialist ultrasounds and MRIs to recognise the imaging markers of endometriosis. The project is recruiting for participants for the next phase of the study during 2021 and into 2022.

Maternal Looking Guide

The Maternal Looking Guide (MLG) has been developed by Dr Patricia O'Rourke and colleagues to support the mother-infant relationship soon after birth. Perinatal professionals can use the MLG to assess the way mothers look at their infants so they can recognise those mothers who would benefit from extra support. The guide and an accompanying training video has been evaluated in three international sites.

An initial rollout of the training and guide is now underway with the Child and Family Health Service (CaFHS). Around 120 maternal health nurses across SA will be trained in the second half of 2022. An accompanying study will aim to identify how the intervention can best be implemented with a focus on adherence, fidelity and upskilling.

Diagnostic evidence for intellectual disabilities

Prof Jozef Gecz and collaborators studied > 4,000 South Australian children with intellectual and other neurodevelopmental disabilities, including autisms, epilepsies and movement disorders. i.e. cerebral palsies. In addition to the discovery of >45 novel disease genes, they identified numerous likely pathogenic variants in known disease genes.

In a fruitful collaboration with the South Australian Clinical Genetics Service at the Women's and Children's Hospital, this extensive body of research is being translated into diagnostic research reports for the benefit of the participating families.

ARC Advisory Committee

Prof Mark Hutchinson was appointed to the Australian Research Council's Advisory Committee. The Committee and Chair are appointed by the Minister for Education and Youth and guide the strategic direction of the ARC to ensure its programs achieve value and impact for Australia.

Genome sequencing for cerebral palsy

The Australian Cerebral Palsy research group's multiomics investigations, have led to the new clinical recommendation that all children with cerebral palsy should undertake whole genome sequencing as early as possible in life. Some genomic pathways to cerebral palsy have clinically actionable interventions which have greater chance of success while infants are young as there is still neural plasticity.

Additionally, knowledge of a genomic cause facilitates parental understanding of causation, future family planning and reduces litigation and ineffective therapies.

Your Fertility

The RRI is a proud partner of Your Fertility; a national public education program that seeks to improve community understanding about modifiable factors that affect fertility, conception and a healthy birth. The program has funding from the Commonwealth, until 2023.

Prof Louise Hull and Dr Jodie Avery on 'The Discovery Pod'.

The Discovery Pod

The *Discovery Pod* podcast series is an initiative of the University of Adelaide, where leading experts are interviewed about solutions to society's most pressing challenges.

Institute members contributed to two podcasts in 2021, to educate the community on:

- **Vax unpacked**: how do they protect us? What are the different ways of making them? Why have COVID vaccines been made so much quicker. Presented by Prof Helen Marshall AM and Prof James Paton
- **Fertile ground**: what are the tell-tale signs and new ways to identify endometriosis and polycystic ovary syndrome? Presented by Prof Louise Hull and Dr Jodie Avery

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Community connection

Lloyd Cox Memorial Lecture

Prof Ingrid Scheffer AO, Paediatric Neurologist, Clinician-Scientist and Co-Director of the Epilepsy Research Centre at Austin Health, presented the 7th annual Lloyd Cox Memorial Lecture on the topic: *Solving the hidden genetics of the epilepsies*.

Professor Scheffer has defined many novel epilepsy syndromes and refined the phenotypic spectrum of many others, and her major interests are in the genetics of the epilepsies, epilepsy syndromology and classification, and translational research.

Healthy Development Adelaide forums

Healthy Development Adelaide (HDA) plays a key role linking research, service delivery and policy development in South Australia. They aim to promote, facilitate and enable multidisciplinary research to advance understanding of healthy development, ensuring the physical, psychological and social health of infants, children and adolescents.

The Institute was a founding partner in 2004 and has continued to support HDA annually. In 2021 the RRI co-hosted two events with healthy development Adelaide:

- *Empowering personal change for pregnancy and child health*: Q&A Session
- *COVID vaccination in children and young people*: public forum

Women's Health Week

As part of *Women's Health Week* in September, the Institute partnered with Your Fertility to host a Facebook live event to discuss how chronic reproductive conditions, specifically endometriosis and polycystic ovary syndrome, can affect your fertility. Dr Jodie Avery was interviewed by Dr Pallave Dasari who explained how these conditions can interfere with your attempts to become pregnant.

AAMRI Membership

The Association of Australian Medical Research Institutes (AAMRI) is the peak body for medical research institutes (MRIs) across Australia; representing through advocacy, information provision, relationship building and member services. The Institute joined AAMRI in 2016.

Sponsorship of BLiSS

BLiSS Science and Innovation is an Australian not-for-profit organisation that encourages transdisciplinary collaborations to solve real world problems. Their initiatives are created by and dedicated to dynamic, forward thinking EMCRs who want to build the research of the future.

In 2021, the RRI sponsored the *BLiSS Networking for Collaboration* day, aimed at forging multi-disciplinary collaborations between industry, government and academia.

AIPS take over

As the 2020 Tall Poppy Awardee from SA, Dr Kylie Dunning took over the Australian Institute of Policy and Science social media channels for a week to share research achievements about her Reproductive Success research team.

Posts introduced her cross-disciplinary team of talented PhD students and post-docs, including biologists and physicists, and highlighted their projects.

Instagram stories included interactive quizzes such as:

- How many couples in Australia and New Zealand struggle with infertility?
- What determines the biological sex of the baby? Sperm or Egg?

Kylie also announced the new winners of the Tall Poppy Awards later in the year. She shared a little about the amazing science by these young researchers from South Australia.

Dr Kylie Dunning's Instagram post introducing her team.

RRI Research Symposium

The RRI's annual flagship event is an opportunity for members of the RRI community to come together to celebrate achievements from the year, learn about research occurring across the Institute, and provides the platform for forming new research collaborations and partnerships.

The 2021 event focused on "Collaboration, successes, and the future", and included sessions on partnerships with industry, research development, and valorising science.

Congratulations to the following award winners:

- **Director's Award:** Dr Zohra Lassi
- **Best EMCR Rapid-fire Talk:** Dr Rebecca Thomson
- **Best PhD Rapid-fire Talk**: Holly Withers
- **Most Creative Rapid-fire Talk:** Holly Withers

Dr Zohra Lassi receiving the Director's Award from Prof Ray Rodgers.

Robinson Research Institute Annual Report 2021

Competitive funding highlights

Medical Research Future Fund

Frontiers in Health and Medical Research Program

$28.9M to A/Prof David Parsons and Dr Martin Donnelley as part of the Australian Lung Health Initiative Pty Ltd team: *Development of 4D functional diagnosis - a new frontier in lung health for children.*

Primary Healthcare Research Data Infrastructure Grant Scheme

$1.9M to Prof Louise Hull and Prof Gustavo Carneiro
Investigate the use of machine learning for non-invasive diagnosis of endometriosis.

NHMRC

Investigator Grants commencing in 2021

$3,560,520 to Prof Sarah Robertson
Leadership: *Critical determinants of reproductive and pregnancy health*

$1,705,260 to Prof Jodie Dodd
Leadership: *Healthy diet and weight management in pregnancy: evidence to ease a hefty clinical burden.*

Investigator Grants awarded in 2021

$650,740 to Dr Emily Shepherd
Emerging Leadership 1: *Preterm birth and neurodevelopment: Improving long-term outcomes.*

$1,560,435 to Dr Zohra Lassi
Emerging Leadership 2: *Addressing evidence gaps to improve adolescent sexual and reproductive health.*

Ideas Grants commencing in 2021

$1,629,373 to Prof Jus St John
Understanding the benefits and limitations of metaphase II spindle transfer.

$1,266,777 to Dr Kylie Dunning
Novel optical approaches in diagnosing cellular and embryo health.

$1,122,760 to Prof Jozef Gecz
A no-nonsense approach to genetic disease.

$936,623 to Dr Alison Care
Immune cell dysregulation impairs vascular function in early-onset preeclampsia.

$854,007 to Dr Jessica Grieger
Revolutionising personalised nutrition for gestational diabetes.

$685,453 to Prof Laura Parry
A sweet therapeutic for vascular disease in pregnancy.

Ideas Grants awarded in 2021

$1,449,103 to Prof Rebecca Robker
Remodelling the ovary to extend female fertility and health.

$1,189,927 to Prof Leonie Heilbronn
Only a matter of time? A comparison of caloric restriction verses time restriction of food intake.

$946,417 to A/Prof Wendy Ingman
A paradigm shift in lactational mastitis.

The Leona M. and Harry B. Helmsley Charitable Trust

$3,496,270 to Prof Jennifer Couper
Continuation of the ENDIA Type 1 diabetes project.

Australian Government Department of Defence

$3M to Prof Mark Hutchinson
Human Integrated Sensor Systems for The KNOW Project.

NSW and SA Government

$2.8M to Prof Paul Thomas
Genetic biocontrol technology for pest mammal control ($1.8M NSW Government) *and SA genetic biocontrol technology hub for invasive mammalian pests* ($1M SA Government).

Meat and Livestock Australia

$1.6M to Prof Mark Hutchinson
Sheep pain mitigation program.

ARC

Commenced in 2021

$821,700 to Prof Frank Grutzner
Discovery Project: *Evolution and function of mammalian sex chromosomes.*

Awarded in 2021

$629,916 to Prof Sarah Robertson
Discovery Project: *Immune control of reproductive compatibility and maternal investment in mammals.*

$463,399 to Dr Nicole McPherson
Discovery Early Career Researcher Award: *How mammalian males indirectly control transmission of paternal traits.*

Fellowships

Awarded or commenced in 2021

- The University of Adelaide Future Fellows: Dr Kylie Dunning and Dr Zohra Lassi
- Lloyd Cox Fellowship: Dr Carmela Ricciardelli
- Marie Curie Fellowship: Dr Adrian Galdran
- First 1,000 Days Mid-Career Fellowship: Dr Lachlan Jolly
- Australian Institute for Machine Learning Research Fellowship: Dr Lauren Oakden-Rayner

Top awards

Australian Academy of Science

Two of our leaders were elected as Fellows of the Australian Academy of Science in 2021 for their outstanding research achievements.

Prof Jodie Dodd is recognised as being at the forefront of a paradigm shift in the management and prevention of obesity in pregnancy. The outcomes of her research, a series of unique and harmonised RCTs and associated systematic reviews and individual participant data studies, have changed clinical guidance internationally.

Prof Helen Marshall AM is an international leader in vaccinology and infectious disease epidemiology, with significant and sustained achievement in vaccine research and translation to practice and policy. Her work underpins changes in vaccination practise for children, adolescents, and pregnant women in Australia and internationally.

RANZCOG Distinguished Service Medal: E/Prof Alastair MacLennan

NHMRC Elizabeth Blackburn Investigator Award: Prof Sarah Robertson

Australian Pain Society, Plenary Lecturer: Prof Mark Hutchinson

Sigma Global Experience Episteme Laureate for 2021: Dr Zohra Lassi

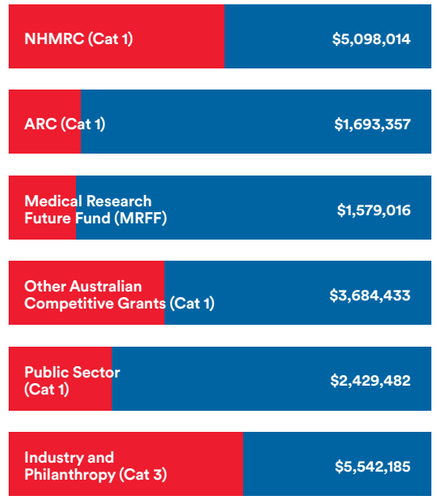
Most highly cited article globally on PCOS published between 2009 and 2019: Prof Michael Davies

SA Science Awards Excellence in Citizen Science Winner and Finalist for Eureka Innovation in Citizen Science: Prof Frank Grutzner, Dr Tahlis Perry, Dr Peggy Rismiller and Isabba Wilson

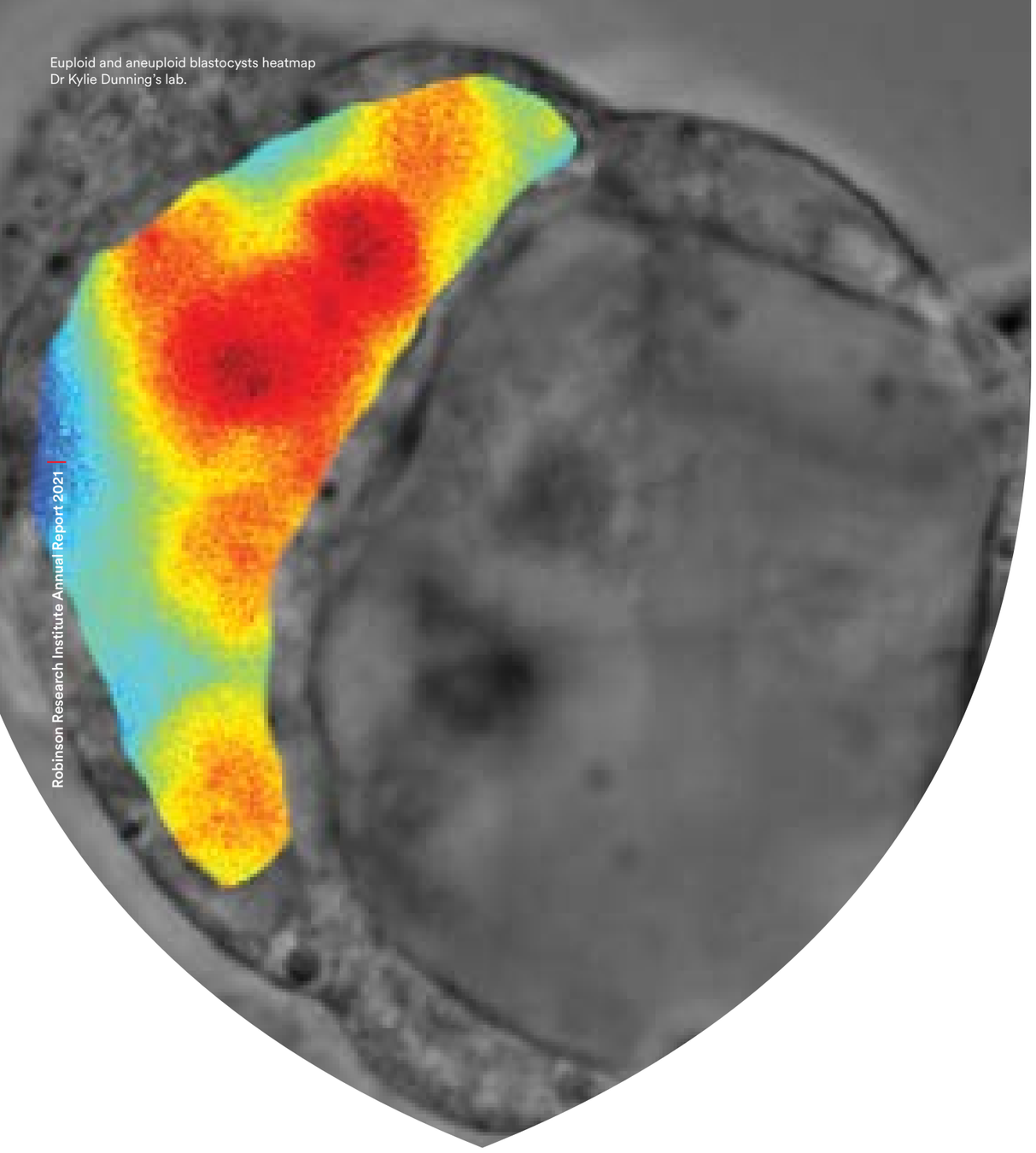
Tall Poppy Award: Dr Catia Malvaso

Ross Wishart: Dr Amita Ghadge

2021 Financial summary $20,026,487



Robinson Research Institute Annual Report 2021



Euploid and aneuploid blastocysts heatmap
Dr Kylie Dunning's lab.

Research groups

Our senior researchers lead a diverse range of Research Groups across the Institute's four themes.

Fertility and conception

Prof Gustavo Carneiro
Medical Machine Learning

Development of new machine learning methods to solve medical image analysis problems

Group members

PhD Candidates: James Condon, Renato Hermoza, Fengbei Liu, Po Liu, Michael Mogford, Luke Oakden-Rayner, Khan Pham and Yu Tian **Masters Students:** Wengping Du and Yuan Zhang

Dr Kylie Dunning
Reproductive Success

Understanding the impact of genetic and metabolic disruption to gametes, embryos and the reproductive tract

Group members

Postdoctoral Researchers: Megan Lim and Erik Schartner **Manager and Quality Coordinator: IVF Vet Solutions:** Marie Ellul **PhD Candidates:** Carl Campugan, Darren Chow, Cheow Yuen Tan, Annie Whitty and Suliman Yagoub

Dr Jessica Grieger
Nutrition, Metabolic and Reproductive Health

Investigating how maternal diet and lifestyle affects time to pregnancy, pregnancy complications and offspring health

Group members

Research Fellow: Dr Carolyn Puglisi **Postdoctoral Researcher:** Nahal Habibi **PhD Candidate:** Tin Oi Cheung **Honours Student:** Amber Hanks

Prof Frank Grutzner
Comparative Genome Biology

Comparing genetic and epigentic mechanisms in mammalian species to improve our understanding of how human diseases originate

Group members

Postdoctoral Researchers: Tahlia Perry and Linda Sherwin **Affiliated Research Leader:** Peggy Rismiller **PhD Candidates:** Filip Pajpach, David Stevens and Isabella Wilson **Masters Students:** Jackson Dann and Madison Helms

Prof Leonie Heilbronn
Obesity and Metabolism

To identify and understand the benefits of timed restricted eating to support circadian health in humans

Group members

Postdoctoral Fellows: Amy Hutchison and Bo Liu **Study Coordinators:** Helen Checklin and Lijun Zhao **PhD Candidates:** Rasha Charrouf, Rajesh Chaudhary Kai Liu and Xiao Ting Teong

Prof Louise Hull Endometriosis

Developing diagnostic and therapeutic tools to treat pelvic pain and infertility caused by endometriosis

Group members

Research Leader: Gustavo Carneiro **Gynaecologist, Laparoscopic Surgeon:** Susan Evans **Visiting Professor:** Neil Johnson **Adjunct Lecturer:** Mathew Leonardi **Clinical Lead and O&G Registrar:** Sarah Linthwaite **Senior Research Fellow:** Jodie Avery **Postdoctoral Researchers:** Rebecca O'Hara and John Schjenken **PhD Candidates:** Faizz Fattah, Kavita Panir and Diksha Sirohi **Research Assistant:** Nicola Mathews **Personal Assistant:** Gigi Koehne

Prof Mark Hutchinson
Neuroimmunopharmacology Laboratory

Exploring the real time contributions of the brain immune-like cell signalling at the neuroimmune synapse that contribute to behaviour

Group members

NHMRC Fellow: Alexandra Whittaker **Senior ARC Research Fellow:** Sanam Mustafa **Senior Research Fellow:** Daniel Barratt **Research Fellows:** Juliana Bajic, Josh Holmes and Stefan Musulino **ARC Research Associate and Industry Engagement Officer:** Jacob Thomas **Research Associate:** Sam Evans **Lab Manager:** Josh Woenig **PhD Candidates**: Benjamin Barry, Charlotte Johnston and Jane Morphet **Masters Candidate:** Kariel Siemens

A/Prof Wendy Ingman
Breast Biology and Cancer

Improving breast health throughout the lifecourse

Group members

Postdoctoral Researchers: Pallave Dasari and Ali Farajpour Ouderji **PhD Candidates:** Sarah Bernhardt, Avisak Bhattacharjee, Amita Ghadge and Joe Wrin **Honours Students:** Keirrthana Jothy and Zuhal Naderi **Research Officer:** Leigh Hodson

A/Prof Mark Nottle
Reproductive Biotechnology

Innovative approaches to regenerative medicine and human IVF

Group members

Research Fellow: Ivan Vassilev **PhD candidate:** Anmol Saini and Annie Whitty **Research Assistant:** Stephen McIlfatrick

Dr Carmela Ricciardelli and Prof Martin Oehler
Reproductive Cancers

Identification of novel biomarkers and therapeutic targets for ovarian cancer

Group members

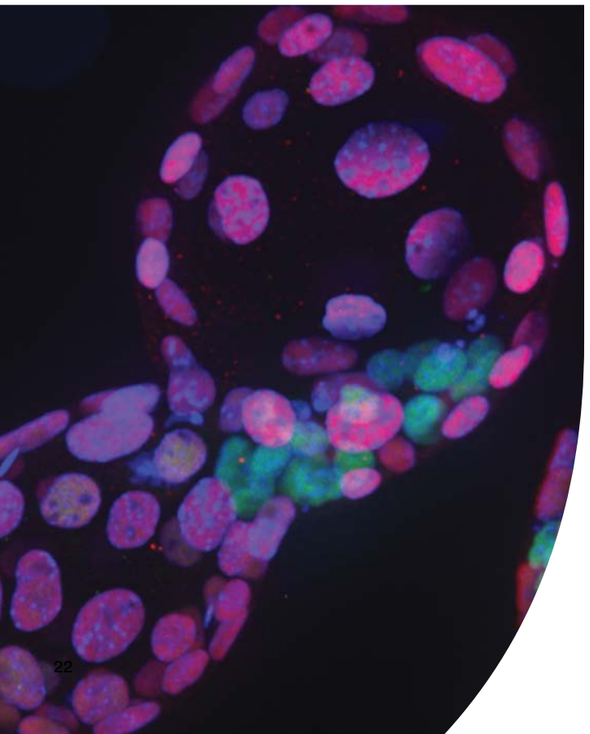
Postdoctoral Researcher: Noor Lokman **PhD Candidates:** Tannith Marie Noye, Zoe Price and Wanqi Wang **Research Assistant:** Liz Marie Goonetilleke **Honours Student:** Annaliese Thompson

Prof Sarah Robertson
Reproductive Immunology

Understanding how the immune system enables healthy conception and pregnancy and is a key factor in infertility and inflammatory disorders of pregnancy

Group members

Senior Research Associates: Lachlan Moldenhauer and David Sharkey **Postdoctoral Researchers:** Hon Yeung Chan, Peck Chin, Ella Green and Kerrie Foyle **PhD Candidates:** Evangeline Lovell, Hannah Lyons and Jessie Walker **Research Assistants:** Camilla Dorian, Stephanie O'Hara, Ricky Matias and Jasmine Wilson



Mouse blastocyst with cells labelled for Oct4 (green) that will become the foetus, and CDX2 (pink) that will form the placenta. Prof Rebecca Robker and Dr Yasmyn Winstanley.

Prof Rebecca Robker
Ovarian Cell Biology and Embryology

Discovering the biological mechanisms that drive ovulation and early embryo development

Group members

Clinical Research Fellow: Atushi Morimoto **Clinical Titleholder:** Ryan Rose **Postdoctoral Researchers:** Eryk Andreas and Macarena Bermudez Gonzalez **PhD Candidates:** Yasmyn Winstanley and Kirsten Smith

Prof Ray Rodgers
Ovarian Developmental Biology

Understanding how the ovary produces oocytes and hormones, what can go wrong and why

Group members

Postdoctoral Researcher: Katja Hummitzsch **PhD Candidates:** Rafiatu Azumah, Menghe Liu and Feng Tang

Prof Darryl Russell
Ovarian and Reproductive Cancer

Defining the molecular mechanisms of hormone control of ovarian folluculogenesis

Group members

Research Associates: Alaknanda Alaknanda, David Bersten, Tasman Daish, Doan Thao Dinh, Natalie Foot, Danielle Mazurkiewicz and Tim McPhee

Prof Jus St John
Mitochondria Genetics

Understanding how the mitochondrial genome is transmitted through the oocyte into the embryo and to the offspring

Group members

Postdoctoral Researchers: Eryk Andreas, Takashi Okada and Alex Penn **Casual Research Assistant:** Vartan Vartparonian

Prof Paul Thomas
Neural Development

Generation and analysis of mouse models for epilepsy and intellectual disability

Group members

Postdoctoral Research Fellows: Fatwa Adikusuma, Mark Bunting, Gelshan Godahewa and Stefka Tasheva **PhD Candidates:** Jayshen Arudkumar, Luke Gierus and Caleb Lushington **Masters Students:** Ashleigh Geiger and Ya-Han Kang **Research Assistants:** Sandra Piltz, Michaela Scherer and Melissa White

Pregnancy and birth

Dr Tina Bianco-Miotto
BM Epigenetics Lab

Understanding how organisms develop to maximise chances of a healthy life

Group members

PhD Candidates: Jacqueline Barsby and Amy Doan **Honours Student:** Zane Marks

Dr Alison Care
Vascular Immunology of Pregnancy

Immune and vascular adaptations to pregnancy: building understanding to develop new treatment targets

Group members

PhD Candidates: Shanna Hosking and Evangeline Lovell **Research Assistant:** Stephanie O'Hara

Prof Gus Dekker
Academic Head, Women's and Children's Division of the Northern Adelaide Health Service

Implementing screening tests for women in early pregnancy to alleviate major complications of pregnancy

Group members

Collaborators: Prabha Andraweera, Jessica Grieger and Claire Roberts

Prof Jodie Dodd
Lifelong Health Research

Start early, stay healthy, stop obesity

Group members

Clinical Trials Managers: Andrea Deussen and Megan Mitchell **Research Dietitian:** Melissa Visentin **Research Midwife:** Kerry Curtin **Senior Statistician:** Jennie Louise **PhD Candidates:** Casey Nottage and Amanda Popreczny **Data Manager:** Mark Armstrong **Research Officers:** Hannah-Marie Berry, Ashlee Jacobssen, Angela Newman, Caroline Sheppard and Olivia Stephens **Research Assistant:** Jordan Peters

Prof Bill Hague
Obstetric Medicine

Improving outcomes for pregnant women with medical complications

Group members

Clinical Collaborators: Jessica Gehlert, Ana McCarthy, Angela Teh and Melissa Whalan **Laboratory Collaborator:** Sarah Giles **Statistician:** Jennie Louise **Trial Collaborators:** Jodie Dodd, Robert Edwards, Maria Fuller, Yee KhongCorey Markus and Michael Stark **Research Coordinator:** Suzette Coat **Research Assistants:** Jacqui Aikens and Jessica Marathe

Prof Stefan Hiendleder
Epigenetics and Genetics

Understanding epigenetic and genetic mechanisms and programming in prenatal development

Group members

PhD Candidates: Laura Latimer Marsh, Hanh Nguyen and Entesar Shuaib

E/Prof Alastair MacLennan AO and Prof Jozef Gecz
Cerebral Palsy

Understanding the genetic causes and epigenetic interaction with genetic susceptibility for cerebral palsy

Group members

Postdoctoral Fellow: Mark Corbett **Hospital Research Foundation Fellow:** Clare Van Eyk **Australian CP Biobank Data Manager:** Jesia Berry **Bioinformatician:** Jimmy Breen **PhD Candidates:** Sayaka Kayumi, Urwah Nawaz and Nandini Sandran **Research Officers:** Kelly Harper and Dani Webber **Honours Students:** Huy Pham

A/Prof Philippa Middleton
Health of Women and Babies

Improving the care of women & babies through evidence-based clinical practice and policy

Group members

Affiliate Senior Lecturer: Emily Bain **Clinical Trials Manager:** Pat Ashwood

Dr Jo Zhou
Food, Nutrition and Health

To optimise health through a sustainable diet and lifestyle

Group members

PhD Candidates: Olaide Akintayo, Shaeny Chandra, Bereket Menota and Jia Zhou **Honours Student:** Angela Li

Early origins of health

Prof Michael Davies and Prof Vivienne Moore
Life Course and Intergenerational Health

Uncovering how inequalities in the health of women and their children arise through social and biological pathways, and identifying opportunities for change

Group members

Research Fellow: Judith Gomersall **Postdoctoral Researcher:** Renae Fernandez **Statistician:** Kathy Haskard **Teaching & Research Academic:** Lynne Giles **Project & Data Manager:** Anthea Hutchinson **PhD Candidates:** Tassia Oswald and Rachelle Warner

Dr Kathy Gatford
Early Origins of Health and Disease

Understanding how early life exposures increase risk of adult disease and developing interventions to improve long-term health

Group members

PhD Candidates: Georgia Clarke, Sebastian Overduin, Joshua Robinson and Andrea Roff

Prof Lyle Palmer
Machine Learning in Medicine

Discovery of novel biomarkers associated with the diagnosis and prognosis of pathology. Applying deep learning to medical images in order to generate translatable insights into clinical and public health problems

Group members

Co-Director: Mark Jenkinson **Senior Lecturer:** Lauren Oakden-Rainer **Psychiatry Registrar:** Tristan Bampton **PhD Candidates:** Alix Bird, Antonia Kolovos, Alice Krige, Khan Pham, Luke Smith, Lana Tikhomirov and Minyan Zeng **Masters Candidate:** James Condon

A/Prof Alice Rumbold
Equity and Healthy Futures

Improving the lifelong health of women and children by reducing inequality in disadvantaged families

Group members

Postdoctoral Research Fellow: Zohra Lassi **PhD Candidates:** Anna Ali, Jessica Dawson, Anna Fragkoudi and Sophie Kedzior

A/Prof Michael Stark
Neonatal Medicine

Ensuring life-long health for newborns born preterm

Group members

Clinical Researchers: Chad Andersen, Sam Axford and Amy Keir **Clinical Trials Coordinator:** Tara Crawford **PhD Students:** Megan Bater, Kathryn Martinello, Amelia Noon and Joshua Robinson

Prof Megan Warin
Biosocial Approaches to Health

Examining the biological and social processes that are entangled in the gendered reproduction of bodies, families and environments

Group members

Senior Postdoctoral Fellow: Tanya Zivkovic **PhD Candidates:** Henrietta Byrne, Tarmia Klass and Pallavi Laxmikanth

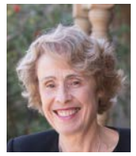
Child and adolescent health

Prof Simon Barry
Molecular Immunology

Understanding the molecular basis for immune tolerance

Group members

Postdoctoral Research Fellows: Cheryl Brown and Timothy Sadlon **Postdoctoral Researcher:** Veronika Bandara and Chris Hope **PhD Candidates:** Katherine Brown, Ying Ying Wong, Soon Wei Wong **Masters Students:** Jacqueline Stephens and Holly Withers **Honours Student:** Jerry Zhang **Research Assistants:** Batjargal Gundsambuu and Silvana Napoli



Prof Jennifer Couper
Diabetes

Preventing type 1 diabetes and its complications

Group members

Clinical Partner: Alexia Pena-Vargas **Clinical Research Fellow:** Madelaine Hall **Clinical Researcher:** Pyria Augustine **Project Managers:** Mandy Anderson, Megan Penno and Rebecca Thomson **Biospecimen Manager:** Dao Huynh **Biostatisticians:** James Brown, Emma Knight and Helena Oakey **Data Manager:** Pat Ashwood **Research Dieticians:** Rachel Battersby and Andrea McCall **Research Nurses:** Sarah Beresford, Alison Gwiazianski, Kirsty Herewane, Meredith Kreig, Roger Gent, Trung Nguyen and Ben Ramoso **Engagement Officer:** Kelly McGorm **PhD Candidate:** Jessica Haribson **Masters Student:** Myff Geyer **Senior Administrator:** Leanne Cavenett

Prof Antonio Ferrante
Developmental and Genetic Immunology

Cellular signalling pathways in childhood allergy and inflammatory disorders

Group members

Principal Scientist: Charles Hii **Senior Scientists:** Nick Gorgani and Alex Quach **Scientist:** Trishni Putty **Immunopathologist:** Tatijana Banovic **Paediatric Immunologist:** Jovanka King **PhD Candidates:** Yunyu Lao, Khalida Parveen David Shields and Annabelle Small **Trainees:** Athena Lee and Sarah Wall

Prof Jozef Gecz
Neurogenetics

Genetics and biology of human neurodevelopmental disabilities

Group members

Postdoctoral Fellows: Mark Corbett, Lachlan Jolly and Clare Van Eyk **PhD Candidates:** Rudra Bhattacharjee, Rebekah De Nys, Sayaka Kayumi, Thomas Lister, Urwah Nawaz and Nandini Sandran **Research Officer:** Raman Sharma **Research Assistants:** Renee Carroll, Alison Gardner, Thessa Kores and Dani Webber

The Cerebral Palsy research group.

Prof Jon Jureidini
Critical and Ethical Mental Health

Promoting safe, effective and ethical research and practice in mental health

Group members

Postdoctoral Fellow: Melissa Raven **Affiliate Senior Lecturer:** Catalin Tufunaru and John Walsh **Postdoctoral fellow:** Natalie Aboustate **Affiliate Senior Lecturer:** Tom Benjamin **PhD Candidates:** Julie Klau and Sheelah Mills

Prof Declan Kennedy
Sleep Disorders

Understanding the morbidity of sleep disorders and their effect on child development

Group members

Medical Scientists: Jessica Carlson-Jones and Anna Kontos **Head, School of Psychology & Social Policy:** Kurt Lushington **Respiratory Physician:** James Martin **PhD Candidate:** Yunyu Lao **Research Student:** Priscilla Vokolos and Nathaneal Yap **Clinical Trial Administrative Assistant:** Anthea Hall

Prof John Lynch
Better Start

Providing children with the best start in life

Group members

Associate Professor Paediatric Public Health: Lisa Smithers **Senior Lecturer:** Catherine Chittleborough **Research Fellow:** Clare Hume **Statistician:** Murthy Mittinty Postdoctoral Researchers: Naomi Baum, Angela Gialamas, Dandara Haag, Sandia Hossain, Kostas Kapellas, Catia Malvaso, Rhiannon Pilkington and Pedro Santiago **Research Associates:** Janet Grant, Alicia Montgomerie and Alexandra Procter **Senior Research Coordinator:** Jacqueline Aldis **Research Officer:** Jessica Dobrovic **PhD Candidates:** Razlyn Abdul Rahim, Mi Du and Cherise Fletcher **Masters Students:** Judy Chu and Michaela Magann **Honours Students:** Joshua Goddard, Jessica Judd and Ben Karnon **Research Assistants:** Anna Kalamkarian and Kimberly Klassman

Prof Helen Marshall AM
Vaccines and Infectious Diseases

Optimising protection for babies, children, adolescents and pregnant women against serious infectious diseases through improved immunisation strategies

Group members

Research Fellows: Bhavya Balasubramany and Suja Matthew **Postdoctoral Researchers:** Josh McDonough, Hassen Mohammed and Jane Tuckerman **Area Leads:** Prabha Andraweera, Michelle Clarke, Sue Evans, Simon Gunn, Christine Heath, Andrew Lawrence, Mark McMillan, Kathryn Riley and Bing Wang **Research Nurses:** Louise Goodchild, Meredith Krieg, Donna Martin, Anna Seppelt and Mary Walker **Study Coordinator:** Lynda Saunders **Laboratory Technicians:** Dao Huynh and Trung Nguyen **Administrative Assistant:** Manasa Arani Krishna

A/Prof David Parsons and Dr Martin Donnelley
Cystic Fibrosis

Development of genetic therapies for treating and preventing cystic fibrosis lung disease, effective lung airway delivery and the non-invasive measurements of their effects

Group members

Postdoctoral Researchers: Patricia Cmielewski, Nigel Farrow, Ali McCarron and Nathan Rout-Pitt **PhD Candidates:** Thomas Goddard and Nikki Reyne **Administrative Assistant:** Bernadette Boog

A/Prof Cheryl Shoubridge
Intellectual Disability Research

Defining molecular and cellular pathways for intellectual disability and seizures, and developing effective interventions

Group members

Research Assistants: Karagh Loring, Rebecca O'Rielly and Monica Thai **Honours Student:** Hayley Kennedy

Investing in our members

Core facilities

Our Core Facilities are led by world-leading experts who provide essential services for RRI members, and in many cases, consultancy for external clients:

- Adelaide Research Assay Facility (ARAF) - Led by Professor David Kennaway and Mark Salkeld
- Gene Silencing and Expression Facility (GSEx) – Led by Jason Gummow
- SA Genome Editing Facility (SAGE) - Led by Professor Paul Thomas

2021 fellowships and scholarships

Jeffrey Robinson Honours Scholarship

Each year the Institute awards the *Jeffrey Robinson Honours Scholarship* to a top performing student, who commences honours under the supervision of a RRI Member. This scholarship references Emeritus Professor Jeffrey Robinson CBE, for whom the Institute is named after.

In 2021, the recipient of this scholarship was Victoria Drysdale who undertook the honours project, *Demonstrating the effectiveness of gene therapy for altering CF-related lung and airway health in CF rat lungs*, under the supervision of Dr Alexandra McCarron, Nicole Reyne and Dr Martin Donnelly.

Repromed Reproductive Health Scholarship

Since 2016, the RRI and Repromed have partnered to offer the *Repromed Reproductive Health Scholarship*. This scholarship is awarded to a top student completing their honours year under the supervision of a RRI Member.

Repromed are a South Australian fertility treatment company offering a complete range of fertility treatments and options. The 2021 recipient of this scholarship was Jessica Williamson who progressed her project: *Identification of progesterone receptor regulated genes that are the essential mediators of ovulation* under the supervision of Prof Rebecca Robker and Prof Darryl Russell.

Summer Research Scholarships

During the 2021/2022 break, the Institute funded two Summer Scholarships. These positions provide an insight into a research career and seek to encourage undergraduate students to consider postgraduate study. The recipients were:

- Madeleine Camac, *Mechanistic insight on the negative impact of yellow light on the embryo*. Supervised by Dr Kylie Dunning
- Shi Ying Caryl Lei, *Effect of GM-CSF on sperm quality and function*. Supervised by A/Prof Mark Nottle

Writer in Residence
Heather Warne.

Funding programs

Every year we run carefully designed programs to best meet the needs of our members in the ever-evolving research landscape.

Writer in Residence

The RRI welcomed Heather Warne as its inaugural Writer in Residence for 2021. Heather was based at the RRI Head Office and provided a creative resource for members, using story-telling as a way to highlight the fundamental importance of infancy and connecting with broad audiences.

Heather presented at multiple RRI events, ran two creative writing workshops for EMCRs and Senior Researchers, explored collaborations with stakeholders and contributed to RRI led projects.

- **Career Development**: supports the career development of Early and Mid-Career Researchers particularly towards them achieving independent research fellowship funding.
- **Engaging Opportunities**: supports the development of new relationships with key stakeholders to jointly address research priorities.
- **Designed for Success**: improves the scientific quality and competitiveness of external funding applications through facilitated development over an extended period and set stages, and significant external review.
- **Innovation Seed Funding**: supports the RRI's early and mid-career researchers to collaborate across research groups and themes, and to explore novel research questions.
- **Investigator Grant Near-Miss Funding Program**: supports all levels of NHMRC Investigator Grant applications that were a near-miss, to be developed into more highly competitive applications for resubmission.
- **Mentoring Program**: strengthens networks, builds relationships, develops career pathways and enhances resumes, providing mutual benefit for both the mentee and mentor.
- **Reflective Writing Workshop**: supports researchers to explore career-related issues through developing narratives and reflective writing techniques.
- **Strategic Research Initiatives**: supports strategic initiatives designed to advance the Institute's strategic research agenda.
- **Travel Grants**: enables researchers to present and share their research findings at national and international conferences and meetings.
- **Exchange Program**: enables RRI members or collaborators to spend extended periods of time at other institutions (or the RRI). In 2021 we hosted Prof Mary Wlodek who presented to Career Development Program participants, participated in a Meet the Professor session and other key collaborative events.

Invest for success

This program increases competitiveness for external funding by developing highly competitive (but as yet unfunded) project grant applications, into more competitive applications for subsequent submissions. The two examples below highlight the benefit this program has provided to our members.

Prof Leonie Heilbronn was awarded $1.18M from the NHMRC Ideas scheme for her research *Time restriction or caloric restriction of food intake to improve cardiometabolic health in humans (OMIT trial).*

The project aims to compare diets that restrict the amount of food eaten, with diets that restrict the time that food is eaten, or both, on risk factors for type 2 diabetes and cardiovascular disease. Based on emerging evidence, we will test whether the time restriction of food intake is necessary to activate circadian and nutrient signaling pathways and maximises the known health benefits of caloric restriction.

"Participating in Invest for Success allowed me to discuss ideas with a like-minded group who were not specifically knowledgeable in my field. In this way, the program encouraged the development of a clear vision to showcase the importance and relevance of ideas."

Dr Alison Care was awarded $936,623 from the NHMRC Ideas scheme for her research *A novel interaction between the immune and vascular systems in early onset preeclampsia; an opportunity for new treatments?*

This project aims to interrogate how the immune and vascular systems interact in healthy pregnancy, and how this interaction fails in early-onset preeclampsia. It focuses on regulatory T (Treg) cells, a specialised immune cell that modulates inflammation and is deficient in many women with preeclampsia.

"Participating in this program helped me to develop and refine my project over a series of workshops. I received project-specific advice from members of the RRI Executive Committee, as well as peer-review from other program participants and external review. This program provided funding that enabled me to employ a research assistant and purchase reagents necessary to acquire essential preliminary data to provide the first evidence to demonstrate that Treg cells are critical for vascular function and placental development."

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Representative Publications

The following publications (of a total of approximately 500 peer-reviewed primary papers, reviews and book chapters) illustrate the scope and impact of the RRI's research outputs in 2021.

The full list of publications is at adelaide.edu.au/robinson-research-institute/research/publications.

1. Abbas, S., Keir, A. K., Makrides, M., Klein, L. D., Grzeskowiak, L. E., McPhee, A. J., & Rumbold, A. R. (2021). Tailoring Human Milk Oligosaccharides to Prevent Necrotising Enterocolitis Among Preterm Infants. *Frontiers in Nutrition, 8*, 702881-702888.

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Kaurna acknowledgement

We acknowledge and pay our respects to the Kaurna people, the original custodians of the Adelaide Plains and the land on which the University of Adelaide's campuses at North Terrace, Waite, and Roseworthy are built. We acknowledge the deep feelings of attachment and relationship of the Kaurna people to country and we respect and value their past, present and ongoing connection to the land and cultural beliefs. The University continues to develop respectful and reciprocal relationships with all Indigenous peoples in Australia, and with other Indigenous peoples throughout the world.