Contents

Who We Are 1
RRI at a Glance 2
Our Discoveries Impact 3
Message from the Acting Deputy Vice-Chancellor (Research) 4
& Message from the Chair 4
Message from the Director 5
Research Priorities 6
Funding Highlights 28
Fellowships and Awards 30
Collaboration 32
Financials 37
Institute Engagement 38
Media Impact 40
Research Groups 41
Investing in our Members 66
Advisory Board 70
Early and Mid-Career Researcher Council 70
Executive Committee 71
Member List 72
Publications 74
Support us 93
Our vision is to achieve life-time health for all children and families, through research excellence.

Our mission is to deliver world-class advances in knowledge of human reproduction, pregnancy and child health, and to inform clinical care, policy and practice that will improve health across generations and global communities.

Who we are

The Robinson Research Institute is a collective of internationally renowned researchers in human reproduction, pregnancy and child health at the University of Adelaide.

We focus on the early stages of life to improve the health and well-being of children and families over the life course and across generations, in Australia and around the world. We seek to enable a healthy start through fertility choices and mindful conception, nurturing the baby during pregnancy and birth, strengthening the brain and body in early life, and advancing child and adolescent health to treat and prevent disease.
RRI at a glance

$24.5m+
competitive funding

48
Research Leaders

$11,615+
donations

380+
Members

4
Research Themes

10
Research Priorities

30
Honours Students

85
PhD Students

6
New Patents Filed

5
Embedded in 5 SA Hospitals

5
Top ERA Ranking of 5 for all 3 rounds

120+
Conference Presentations (56 international)

20+
Media Releases

38,400+
citations by Research Leaders in 2016 (Google Scholar)

560+publications

IF 15+
15

IF 10+
45

IF 6+
65
Our discoveries impact on:

Fertility & Conception
- Breast health
- Contraception
- Congenital abnormalities
- Embryo development
- Endocrine disorders
- Environmental reproductive toxins
- Endometriosis
- Female and male reproductive health
- Female fertility
- Gamete development & quality
- Genome editing
- Immune disorders
- Implantation failure
- Infertility
- IVF
- Male fertility
- Metabolic disease
- Miscarriage
- Mitochondrial disease
- Ovarian cancer
- Pelvic pain
- Polycystic ovary syndrome
- Preconception care and planning
- Puberty
- Reproductive cancers
- Sexually transmitted infection

Pregnancy & Birth
- Gestational diabetes
- Intrauterine growth restriction
- Labour induction
- Maternal overweight and obesity
- Multiple pregnancies
- Neonatal medicine
- Obstetric medicine
- Placental development and dysfunction
- Postnatal depression
- Preeclampsia
- Pregnancy health & care
- Preterm birth
- Stillbirth
- Vaccination in pregnancy
- Zika virus

Child & Adolescent Health
- Cerebral palsy
- Circadian rhythms
- Cystic fibrosis
- Diabetes (Type 1 and Type 2)
- Educational achievement
- Epilepsy
- Influenza
- Intellectual disability
- Juvenile arthritis
- Meningococcal disease
- Mental health
- Organ transplantation
- Pertussis (whooping cough)
- Sleep disorders
- Stem cells
- Vaccine safety

Early Origins of Health
- Asthma & Allergy
- Autism
- Autoimmune disorders
- Cancer
- Cardiovascular disease
- Health equity
- Epigenetics
- Neurodevelopment
- Obesity
- Transmission of health across generations
- Type 1 and Type 2 diabetes
In both my current and previous roles at the University, I have been fortunate to be actively involved with the Robinson Research Institute, and to see first-hand how the Institute’s research advances are benefiting society and improving lives. With members producing an outstanding 500+ publications in 2016, many important research discoveries are emerging.

Notable advances in 2016 include a new understanding of how shiftwork affects fertility; evidence that risk of stillbirth is twice as high for disadvantaged women; identifying that an extra 1,000 steps a day benefits children with type 1 diabetes for life-long health; and a new technique for IVF embryo selection which improves conception rates and healthy pregnancy outcomes.

The Institute continues to seek ways to improve life-long health for children and families by focusing on the earliest stages of life. Members are increasingly building the evidence for links between early-life events and chronic disease, and now understand that investment in a healthy start is vital for producing healthy, resilient communities.

I am impressed not only by the Institute’s research discoveries, but also the willingness of members to share their findings with our community through media and public seminars. This communication is necessary to raise awareness, influence policy and practice, and educate people on choices and changes they can make to improve their own health, and the health of their families.

I am confident in the ability of the RRI to make significant improvements for the health of generations to come.

Professor Julie Owens

Message from the Chair

Competition for scarce research funds in Australia is at an all-time high. As such, strategic directional change is required to ensure organisations and members continue to thrive, and I am optimistic about the future of the Robinson Research Institute as I see necessary changes being put in place.

In 2016, the Institute joined the Association of Australian Medical Research Institutes whose mission is to advocate for medical research, and is in frequent communication with the government and opposition ministers to keep research at the forefront of politicians’ minds. Being a member of this important body connects us into a group of like-minded organisations who are working together to make real change and ensure sustainability for the future of medical research in Australia.

In addition, members are increasingly forming new collaborations with non-traditional partners to tackle big research questions together. It is a big shift from how research has previously been undertaken, but I can see innovative approaches and partnerships being created and I look forward to seeing what the future holds for these partnerships.

In particular, members are looking towards health consumers for input into tackling research questions, which is hugely important for not only relevance to the community, but for translating research findings into improved health for South Australians – and people around the globe.

I congratulate the Director, Prof Sarah Robertson on her election as a Fellow of the Australian Academy of Science recognising her reproductive immunology research. This is an outstanding achievement, and one that really demonstrates the immense contribution to science that Sarah has made.

As always, I want to sincerely thank the RRI Advisory Board Members for their commitment, contribution and insight provided to the Institute during 2016. We are fortunate to have such a competent Advisory Board with the breadth of expertise to provide exceptional support to the RRI leadership team during challenging times.

I look forward to continuing to Chair the Advisory Board into 2017 and beyond, and congratulate RRI members on another outstanding year.

Professor Jock Findlay AO
The Robinson Research Institute has had another strong year. I am proud of the progress of our members towards understanding the early life origins of health, and putting research to work for the benefit of current and future generations.

Our research delivers new fundamental insight and advances solutions for major health conditions ranging from infertility, preterm birth and preeclampsia, through to debilitating childhood conditions including cystic fibrosis, diabetes, asthma and infectious disease.

It is clear that the impediments to health, equality and quality of life for children and families everywhere require collaborative, multidisciplinary research effort if solutions are to be found. As such, in 2016 we have intentionally turned our attention to focus on building research collaborations and partnerships.

We initiated new connections and built on existing partnerships with a variety of stakeholders. The Engaging Opportunities Program was established to support members in developing new research partnerships. One notable example is with the Birthing Kit Foundation of Australia - together we are reviewing the effectiveness of birthing kits on maternal and newborn outcomes with the aim of reducing maternal and newborn mortality and morbidity in developing nations. Other new relationships are with Ferring Pharmaceuticals to develop treatments for gestational disorders, and with SHine SA to understand determinants of reproductive health in young South Australians.

A particular highlight of 2016 has been partnering with Glaxo Smith Kline on the B Part of It study, led by Prof Helen Marshall. This world-first study will offer vaccinations to almost 60,000 South Australian high school students to protect against the potentially deadly Meningococcal B bacteria. Results from this study will establish whether, when a significant proportion of a population is immunised against Meningococcal B, herd immunity is provided for those who are not immune. This $11m study is a collaboration partnership with SA Health, local state councils and schools. As the largest Meningococcal B vaccine heard immunity study ever conducted, the results will inform vaccine policy around the world.

We are pleased to have joined two organisations in 2016; The Association of the Australian Medical Research Institutes - the peak body for medical research, who actively engage with government, the opposition and sector leaders to advocate for the medical research sector; and the Medical Research Commercialisation Fund - an innovative venture capital collaboration that invests in early stage development and commercialisation opportunities.

We continue to be committed to supporting our early and mid-career researchers, understanding that developing early and mid-career researchers is critically important to sustain and build on the work of the Institute. To facilitate this we established the Early and Mid-Career Researcher Council, which seeks to link the Institute’s EMCRs with the Executive Committee and provides a platform to advise and influence the RRI’s operations. As always, I am grateful for the University’s continued encouragement and confidence in the value of the Institute’s research and its significance for the University’s impact.

We are well-supported by the Institute’s professional staff, to whom I am grateful for their dedication and professionalism. I also thank the Advisory Board, Executive and EMCR Council for their time and commitment to oversight and leadership of the Institute. Particularly, I thank our Advisory Board Chair, Professor Jock Findlay, for his invaluable support and guidance, as well as the Institute’s Deputy Directors, Professors Helen Marshall, Claire Roberts and Ray Rodgers.

I’m looking forward to an exciting year ahead, with many of our members moving into the new Adelaide Health and Medical Sciences building in the West End precinct in mid-2017. This fantastic new environment adjacent to SAHMRI and the new Adelaide Hospital, with its world-class research infrastructure, will further facilitate opportunities for partnership, collaboration and making research advances that matter.

Professor Sarah Robertson
We seek to prevent and alleviate infertility
Infertility is common; 1 in 6 couples are diagnosed as clinically infertile, and demand on IVF services is growing, costing Australians more than $360 million per year.

To address infertility the Robinson Research Institute is:

- Advancing knowledge of the physiological processes of gamete production, conception and early embryo development
- Uncovering how diet, infection and lifestyle choices alter fertility and the health of the baby
- Understanding how metabolic conditions such as obesity, diabetes and PCOS cause infertility and alter fetal growth, and developing interventions
- Improving the process of IVF to make it safer, less invasive and more cost effective
- Developing new infertility treatments to expand options and to improve success
- Building tools to educate the community on the importance of early planning for conception and parenthood

Translational Impact

Your Fertility

Your Fertility is a national public education program that works to increase community understanding of modifiable factors that affect fertility as well as chances of conceiving a healthy baby. The program is targeted towards women and men of reproductive age in Australia. By sharing the latest scientific and medical information, Your Fertility empowers people to make informed and timely decisions regarding their reproductive health.

The RRI is a proud partner of the Fertility Coalition led by the Victorian Assisted Reproductive Treatment Authority that includes the Jean Hailes Research Unit and Andrology Australia.

In 2016 the coalition launched the Your Fertility Potential webtool, which provides tailored guidance to users based on input of personal factors including age, BMI, smoking and alcohol consumption, with the intent of improving conception success. We will continue to develop the webtool over 2017 and beyond.

Endometriosis drug development

A/Prof Louise Hull is the principal investigator for a clinical trial assessing a new pharmaceutical drug for endometriosis in South Australia. This newly formulated GnRH antagonist (Elogolix) is for oral use, meaning it is easy to administer daily over long periods of time, compared to the currently available injectable GnRH antagonists.

Adelaide is one of the sites in this multinational, randomised controlled clinical trial and the Robinson Research Institute has partnered with the Pain and Anaesthesia Research Clinic to conduct this trial in association with AbbVie

IVF Vet Solutions funds new research into IVM

Established by A/Prof Jeremy Thompson and A/Prof Robert Gilchrist (UNSW), IVF Vet Solutions provides mouse embryo assays for screening toxicity that may be present in media and disposables used in human IVF. The facility provides consultancy and training for complete bovine IVP and vitrification, to boost productivity in the cattle industry. Income is fed back into world-leading mouse embryo assays.

BlastGen

A/Prof Louise Hull led the Australian BlastGen clinical trial for IVF patients with previous miscarriage or poor IVF success. BlastGen is the next phase of the successful EmbryoGen product developed in Adelaide in partnership with Origio A/S (Denmark), and is formulated to support blastocyst stage embryo transfer. Both BlastGen and EmbryoGen contain the signalling molecule GM-CSF, which protects the embryo from stress, making it stronger and more robust following conception. In this new IVF treatment, the embryo is cultured in medium that more closely mimics the natural uterine environment, leading to a higher pregnancy success rate. Data on efficacy will be available in 2017.

Tackling PCOS

In collaboration with Prof Helena Teede and colleagues at Monash University, RRI members are working towards improving health and fertility outcomes for women with PCOS. Ultimately we seek to understand the underlying causal mechanisms of this pervasive condition. Our work builds on success in developing clinical guidelines for the evaluation, management and health care needs of polycystic ovary syndrome, through the NHMRC Centre for Research Excellence.

The guidelines have been distributed to every general practitioner and specialist in Australia. These guidelines are being implemented internationally, to significantly impact the health and treatment of millions of women around the world living with PCOS.

Bed, Birth and Beyond Conference

The RRI teamed up with Fertility SA to co-host the inaugural Bed, Birth and Beyond workshop, for South Australian General Practitioners. This full day event updated attendees on the latest knowledge about fertility and conception health, with presenters from both the RRI and Fertility SA providing information with the intention of building reproductive health capacity amongst GPs and other primary care providers.

The Embryo Selfie

Collaborations between the Robinson Research Institute and the ARC-funded Centre for Nanoscale Biophotonics are opening a world of possibilities in sensing and imaging. Bringing together physicists, chemists, biologists, engineers and an array of other expertise is allowing technologies never before seen in the biology space to be applied to the periconception period. One such technology is a statistical modelling and image analysis technique, coined The Embryo Selfie.

One of the greatest challenges within current IVF clinics is the non-invasive selection of the best embryo. There is a pressing need for cheap, rapid, non-invasive diagnostics, to improve success rates. This technology is allowing us to distinguish between embryos, where we’ve not been able to in the past, and the collaboration has recently entered into a research partnership...
with Repromed, allowing us to assess the capabilities of The Embryo Selfie in humans. This collaboration involves Dr Hannah Brown, A/Prof Jeremy Thompson, Dr Mel Sutton-McDowall, Dr Deirdre Zander-Fox, Tiffany Tan and Tahlee Stevenson.

**OnPrime**

Two RRI teams were successful in being accepted into the OnPrime program, seeking to assist research teams in validating their research and developing real world applications for discoveries.

**At home fertility screening kit**

A/Prof Jeremy Thompson, Prof Ray Rodgers, Dr Nicole McPherson and Marcus Goddard seek to develop an at home fertility screening kit, that analyses sperm count and motility utilising a smart phone.

**Making better babies using light**

Dr Melanie McDowall and colleagues at the CNBP are exploring completely new ways to predict embryo health using computational physics, exploiting the properties of light. Akin to the “whispering gallery” of St. Pauls Cathedral, the team is investigating how light “bounces” within a spherical object, like an egg and embryo. It’s an approach that adds to the “Embryo Selfie” project.

**Advances in 2016**

- We discovered that when one twin dies in early gestation, the surviving twin has an increased risk of major congenital malformations. Prof Michael Davies’ discovery provides additional evidence for increasing the adoption of single embryo transfer as best practice worldwide.

- We showed that routine hysteroscopy does not improve livebirth rates in infertile women with a normal transvaginal ultrasound of the uterine cavity scheduled for a first IVF treatment. Prof Ben Mol’s findings demonstrate that women with a normal transvaginal ultrasound should not be offered routine hysteroscopy.

- Components for a smart-phone sperm motility analyser are being developed in conjunction with RMIT researchers. Professors Jeremy Thompson, Sarah Robertson and colleagues hope this ‘At Home’ reproductive assessment test will motivate couples struggling to conceive to investigate their fertility potential using this readily accessible, non-threatening tool.

- We are examining expression of genes in adult ovaries and fetal ovaries to identify gene pathways underlying PCOS development. In particular, Prof Ray Rodgers and colleagues found four PCOS-related genes to be highly expressed early in the developing ovary, indicating that PCOS may be entrained before birth.

- We showed that administering human growth hormone for poor responders of IVF delivered no benefit. Prof Rob Norman hopes his findings will put an end to clinics treating with this expensive and unnecessary drug.

- We completed pre-clinical experiments optimising drugs and nutraceuticals for improving oocyte quality in obese females. A/Prof Rebecca Robker and colleagues demonstrated that treating the oocyte protects the integrity of mitochondrial inheritance in the embryo, and they are planning clinical in vitro testing in human oocytes.

- We described fluctuations over time in immune-regulatory TGFB factors within the seminal fluid of men. Prof Sarah Robertson and Dr David Sharkey believe that as TGFB regulates immune tolerance for pregnancy in the female partner, this may contribute to unexplained variations in the fertility status of men, that are independent of sperm parameters.

- We found that species with a relatively large testes mass produce far more uniform and streamlined spermatozoa, than those with small relative testes. Prof Bill Breed’s findings show some similarities to those of the human species providing new insight and suggesting new options for therapeutic targets.

- We localised selenium in the ovary using the Australian Synchrotron. Prof Ray Rodgers and colleagues are now testing the hypothesis that follicle micronutrient availability and utility changes with aging, leading to a deterioration of eggs.

- We demonstrated that a 6-month structured intervention program to facilitate weight loss preceding infertility treatment, did not improve rates of vaginal birth of healthy singletons at term 24 months after follow-up. Prof Ben Mol’s findings were the result of a randomised controlled trial.
We seek to prevent and alleviate infertility.

Early pregnancy human placental villous with the trophoblast cells stained in red and fetal endothelial cells stained in yellow. Rebecca Wilson & Prof Claire Roberts
Optimising growth of the fetus in the womb
An average Australian baby weighs 3.4kg with over 6% of babies less than 2.5kg and 12% more than 4kg. Both small and large babies are at greater risk of health complications leading to childhood disability, adult onset diseases and early death.

To understand how and why some babies are born too small or too large, and to optimise birth weight, the Robinson Research Institute is:

> Investigating how birth weight is influenced by the interaction between genetic and epigenetic factors and the environment
> Developing effective interventions to ensure babies are born at a healthy weight
> Educating the community about the risk factors associated with unhealthy birth weight: diet, alcohol, drug usage, smoking, mental health problems, diabetes, BMI and socioeconomic status and disadvantage
> Understanding why Indigenous women are at increased risk of delivering an unhealthy birth weight infant, and working with these women to improve outcomes for both mothers and babies

Our work positively impacts the community through the translation of research findings into clinical practice; for example, findings from the LIMIT randomised trial and the impact of positive changes to women’s diet and physical activity during pregnancy have been incorporated into local state-wide clinical practice guidelines, and are informing recommendations in the United Kingdom and Europe.

Translational Impact

Prediction to prevent pregnancy complications

Approximately 25% of women in their first on-going pregnancy in Australia are affected by one or more of the four major complications: preeclampsia, preterm birth, intrauterine growth restriction and gestational diabetes. Health issues for the resulting babies range from childhood obesity, mild learning and behavioural problems, to severe disabilities such as cerebral palsy, intellectual handicap, blindness or even death.

Prof Claire Roberts is seeking to prevent the onset of these complications and has developed the world’s first pregnancy screening test that can predict a women’s risk. Women at high risk can then be offered early interventions. Testing and validation of the algorithms in a new pregnancy cohort is underway. Claire has garnered the support of a commercial partner and hopes this screening test will be implemented in antenatal clinics in the next few years.

Cochrane Pregnancy and Childbirth Group

Cochrane Pregnancy and Childbirth prepares and maintains systematic reviews of interventions that relate to pregnancy, childbirth, and up to 30 days following childbirth, as well as lactation. They maintain a comprehensive database of all relevant randomised trials. Prof Caroline Crowther and A/Prof Philippa Middleton co-ordinate the Australian and New Zealand Satellite for Cochrane Pregnancy and Childbirth, and during 2016 with Emily Shepherd as the Cochrane Research Fellow, supported review author teams to prepare 11 new protocols, 13 new reviews and 16 updated reviews.

Advances in 2016

> We completed the Australian recruitment for the international Folic Acid Clinical Trial study, assessing the benefits and harms of taking folic acid into the third trimester for the prevention of preeclampsia. Prof Bill Hague and colleagues are planning a long-term follow up study to assess the potential impact of folic on fetal genome methylation, and therefore on growth and development of offspring.
> We found that women whose babies are conceived in winter are more likely to develop gestational diabetes, increasing a range of risk factors for both child and mother. Dr Petra Verbong’s findings were part of a study investigating more than 60,000 births in South Australia over a five year period.
> We demonstrated sex-specific polar over-dominance in imprinted gene expression of hybrids. Prof Stefan Hiendleder and Drs Consuelo Estralla, Mani Samami and Ali Javadmanesh hope their findings will be used in selection for heterosis retention in hybrid animals as it explains specific growth related heterosis effects in mammals.
> We commenced a large animal trial to investigate the impact of simulated shift work exposure during pregnancy on maternal, fetal and progeny health. Initial results from Prof David Kennaway and Drs Tamara Varcoe and Kathy Gafford’s findings demonstrate maternal shift work exposure disrupts patterns of behaviour, melatonin secretion and peripheral clock gene expression, leading to altered metabolic control. Studies are underway to investigate the impact of this exposure in utero on the progeny through to adulthood.
> We demonstrated in a randomised controlled trial that in the diagnosis of gestational diabetes in a Chinese population, a single fasting plasma glucose measurement, can predict whether women are at increased risk of delivering a large for gestational age baby. Prof Ben Mol and colleagues’ findings will help refine interventions to limit growth size.
Preventing early labour and improving outcomes for babies born prematurely
1 in 10 babies are born preterm at less than 37 weeks gestation. This carries immediate and life-long risks to the infant’s health and survival as the brain and organs are not fully developed.

To improve outcomes for babies born preterm and to ultimately predict and prevent premature birth, the Robinson Research Institute is:

- Uncovering how factors such as infection, stress and immune responses interact in some women to trigger early labour and birth
- Developing predictive tests to identify early in pregnancy which women are at increased risk for preterm birth
- Identifying and evaluating preventative drugs and treatments for mothers assessed to be at risk
- Developing treatments to improve short and long-term health outcomes for babies born preterm

Translational Impact

Neonatal and Paediatric Guidelines

Associate Prof Michael Stark and Dr Amy Keir were contributing authors of the Patient Blood Management Guidelines: Module 6 Neonatal and Paediatrics.

The final in a series of six evidence-based guidelines, this module assists and guides health-care professionals in making clinical decisions about blood management in neonatal and paediatric patients, and includes guidance on dosing, assessment and the optimisation of various products and situations in the neonatal and paediatric population. The module’s recommendations have been approved by the National Health and Medical Research Council.

Advances in 2016

- We showed that a small molecule inhibitor of Toll-like receptor-4 called (+)-naloxone is effective in preventing infection-induced preterm birth in mice. Prof Sarah Robertson and her team now seek to evaluate (+)-naloxone in human tissues and progress the work to clinical studies.
- We found that late preterm birth from mothers who were treated with betamethasone, did not impair glucose metabolism or insulin sensitivity in adult progeny. Dr Kathy Gatford’s findings add to variable results of other pre-clinical studies to suggest that effects of prenatal corticosteroids and preterm birth vary between drugs and may depend on when the baby is delivered, highlighting the need for direct comparisons of the corticosteroids in common clinical use.
- We recruited neonates who require blood transfusions to take part in a randomised controlled trial to compare the efficacy of a new washed blood product. Dr Nicolette Hodyl’s study incorporates basic science and clinical data to increase scientific understanding and facilitate a more rapid clinical translation of findings.
- Ben Mol working with the 4P trial group demonstrated that daily administration of vaginal natural progesterone did not reduce risk of preterm birth or neonatal adverse outcome in women with preterm labour.
- We contributed to a study investigating how microbial-derived immune modulating agents can protect mice from preterm birth and fetal growth restriction. Prof Sarah Robertson, A/Prof Deborah Strickland and colleagues’ findings may offer a novel approach to boosting the immune response and ensuring protection from inflammatory challenges that lead to preterm birth.
- We showed a direct link between continued marijuana use during pregnancy and preterm delivery. Prof Claire Robert’s and collaborators were the first to show this as part of their international SCOPE study.
- We showed that allosteric peptide antagonists of interleukin-1 signalling protect mice from preterm birth.

We contributed to a study investigating how microbial-derived immune modulating agents can protect mice from preterm birth and fetal growth restriction. Prof Sarah Robertson, A/Prof Deborah Strickland and colleagues’ findings may offer a novel approach to boosting the immune response and ensuring protection from inflammatory challenges that lead to preterm birth.

We contributed to a study investigating how microbial-derived immune modulating agents can protect mice from preterm birth and fetal growth restriction. Prof Sarah Robertson, A/Prof Deborah Strickland and colleagues’ findings may offer a novel approach to boosting the immune response and ensuring protection from inflammatory challenges that lead to preterm birth.
Maximising brain developmental potential

The development of the brain and nervous system is fundamental to how we function throughout life. Children born preterm often experience problems in neurodevelopment, which impacts their ability to contribute to society and impacts their career, earning potential, where and how they live, and physical and psychological health. Others have genetic conditions that impair normal intellectual function.

To further our limited understanding of genetic and environmental drivers of neurodevelopment, the Robinson Research Institute is:

> Investigating the physiology that is responsible for changes in neurodevelopment for preterm babies, and determining whether changes are due to being born early, or growth restriction during pregnancy
> Understanding how adverse environments during pregnancy and events in early life affect brain development
> Developing interventions to counter neurodevelopmental changes through improving the strength of neuron connections in the brain and improving environmental learning settings for children
> Gaining a better understanding of how socioeconomic disadvantage effects cognitive and motor abilities
> Identifying genetic causes of neurodevelopmental disease

Translational Impact

Chair for the Prevention of Childhood Disability

Prof Jozef Gecz was appointed as the inaugural Chair for the Prevention of Childhood Disability in 2016. Jozef will lead a comprehensive, multi-disciplinary research program in Adelaide focused on defining the origins and early diagnosis of childhood disability and building Adelaide’s research capacity in this area. Jozef holds a joint appointment as an RRI-SAHMRI Research Leader, and this new position was granted in partnership with the Channel 7 Children’s Research Foundation, SAHMRI and the University of Adelaide.

Preterm birth research impact

The research findings from Dr Julia Pitcher’s research team demonstrates subtle but significant neurophysiological changes in brain function in adolescents born mildly preterm or early term. These results have contributed notably to the increasing international recognition by clinicians and educational experts that this very large group of children are vulnerable to increased health, educational and behavioural difficulties into adulthood. For example, her group’s findings are informing the current debate regarding the relative risks of elective inductions and caesarian sections prior to 37 weeks gestation for non-medical reasons.

Advances in 2016

> We’ve shown through preliminary evidence that exposure to gestational diabetes in utero blunts neuroplasticity during adolescence. Drs Julia Pitcher and Luke Schneider, Jago Van Dam and Prof Bill Hague’s findings lead them to believe maternal metformin treatment may provide neuroprotection against the effects of gestational diabetes.
> We provided preliminary evidence demonstrating there is a short-lasting period of enhanced brain plasticity following stroke. If confirmed, A/Prof Mike Ridding’s finding has major implications for stroke rehabilitation.
> We discovered that a non-coding variant in the 5’ UTR of DLG3 attenuates protein translation to cause non-syndromic intellectual disability. A family of >130 individuals from Australia, which Prof Jozef Gecz and colleagues have studied for >25 years, has provided one of a few examples of a non-coding mutation, which explains heritable cause of intellectual disability.
Preventing and reversing childhood obesity

Approximately 56% of women, 70% of men and 23% of children are overweight or obese. Children born to overweight or obese parents are at increased risk of obesity throughout life.

To reduce the incidence of obesity and tackle its intergenerational transmission, the Robinson Research Institute is:

- Developing interventions for pregnant women who are overweight or obese to improve pregnancy health and the health of the baby - through large randomised controlled trials
- Identifying key dietary, metabolic and other factors in obese mothers that are related to poor health in their children
- Uncovering why maternal and paternal obesity can each lead to an increased risk of poor metabolic health and obesity in their children
- Developing tools to match women to the most appropriate and cost-effective form of intervention to limit gestational weight gain, especially in disadvantaged and Indigenous women
- Developing guidelines and tools for improving clinical care of pregnant women who are overweight or obese

Translational Impact

Obesity in pregnancy
Prof Jodie Dodd led the LIMIT randomised controlled trial seeking to improve outcomes for pregnant women who were overweight or obese at the start of pregnancy. Women who received achievable dietary and lifestyle advice made significant improvements to their diet and physical activity, and their babies were less likely to be born with a birth weight over 4kg.

Jodie demonstrated that the additional cost of providing this one-on-one lifestyle advice was offset by improved outcomes at birth, through reduced healthcare costs for both mothers and their babies, providing an impetus to change current clinical care. Longer term follow up of the 3 to 5 year old children whose mother’s participated in the LIMIT Trial has been completed and the findings (to be published in 2017) will continue to inform healthcare, particularly the impact of maternal diet on early childhood health and development.

Advances in 2016

- We led the first face to face meeting of the early child follow up individual participant data meta analysis collaboration in London for the LIMIT trial. In this meeting hosted by Prof Jodie Dodd, 17 international collaborators gathered to formalise the project which will continue through 2017.
- We completed an intervention trial in 90 women examining the metabolic benefits of alternate day fasting diets. A/Prof Leonie Hellbronn demonstrated that fasting diets are as effective as calorie restriction in improving metabolic health in the short term.
- We completed follow up assessments of the 3 to 5-year-old children of the women who participated in the LIMIT randomised trial, assessing diet and lifestyle interventions in pregnant women who were overweight or obese. Prof Jodie Dodd obtained data on 75% of children with data currently being analysed.

- We showed the importance of not just the mothers’ metabolic status, but also the father’s, for preventing intergenerational transmission of metabolic dysfunction that underpins childhood weight gain. Prof Michelle Lane and Drs Tod Fullston and Nicole McPherson progressed their work showing how paternal obesity changes the microRNA content in both mice and men, contributing to obesity programming in offspring.
Discovering causes and cures for reproductive cancers

Breast and prostate cancers are the most prevalent forms of cancer with 1 in 9 Australians diagnosed each year; and this is increasing.

To understand and cure reproductive cancers the Robinson Research Institute is:

- Identifying the common features of reproductive organs which are likely to contribute to cancer susceptibility in these tissues
- Understanding the role of sex hormone responsive tissues and how their frequent changes compromise the immune system, leading to cancer development
- Uncovering how diet, lifestyle and environmental factors encourage (or discourage) reproductive cancer development
- Developing new treatment options to prevent cancer-related disability and death

Translational Impact

INFORMD Alliance
Almost 8% of women aged between 40–74 years have extremely high breast density which can make it difficult for doctors to detect breast cancer on a screening mammogram. Breast density is a highly contentious issue and until recently there was no information about breast density on any Australian government website, and no policies or position statements around reporting it.

Together with leading breast cancer researchers from 5 different institutions across Australia, A/Prof Wendy Ingrman founded the INFORMD alliance (INformation FORum on Mammographic Density), with the goal of raising awareness around breast density and calling for the development of guidelines so that density can be routinely reported to women having mammograms.

Ovarian cancer diagnosis
Despite improvements in surgery and new developments in chemotherapy, ovarian cancer mortality rates have not improved substantially over the last two decades. The poor prognosis results from late diagnosis and limited treatment options after recurrence. Important approaches to improve survival rates include early diagnosis that requires the identification of specific biomarkers, and the identification of more effective molecularly targeted therapies for advanced stage disease.

Prof Martin Oehler and Dr Carmela Ricciardelli’s work investigating interactions between ovarian cancer and the mesothelium (a layer of cells surrounding abdominal organs) have identified a protein annexin A2 that plays a major role in ovarian cancer invasion. Annexin A2 is highly expressed in 90% of serous ovarian cancers and actively involved in the process of ovarian cancer metastasis. Additionally, they have demonstrated that local up-regulation of annexin A2 within the tumour is reflected in a systemic ~2.0-fold increase of annexin A2 in the plasma of patients with early stage serous ovarian cancer. Plasma annexin A2 levels in combination with CA125 significantly improves the sensitivity and specificity of detecting early stage serous ovarian cancer. These findings hold considerable promise for using annexin A2 as both a therapeutic target and diagnostic marker and improving ovarian cancer survival.

Advances in 2016

- We identified a new blood cell based biomarker. Prof Tony Ferrante’s group have shown that a protein expressed on human blood cells may be a biomarker of prognostic value in cancer and inflammatory conditions.
- We discovered that chronic low-level inflammation caused by a protein called CCL2 could increase breast density and increase risk of breast cancer in an animal model. A/Prof Wendy Ingman and Dr Sally Sun’s findings are the first to show that inflammation is a key driver of breast density and the associated increased risk of cancer.
- We demonstrated that the HA inhibitor 4-MU can improve the response to carboplatin. Prof Martin Oehler and Dr Carmela Ricciardelli believe that reducing HA production is a promising strategy to improve ovarian cancer survival in serous ovarian cancer patients with chemo-resistant disease.
- We showed that a range of environment and lifestyle stressors influence ovarian somatic cell function and in turn impact on oocyte and embryo health. A/Prof Darryl Russell found that these stress response mechanisms are important in the initiation and progression of cancers of reproductive organs.
Investigating early life origins of allergies and developing interventions
Allergies affect hundreds of millions of children worldwide and there is no cure. Asthma, rhinitis, eczema, dermatitis, food allergies and anaphylaxis are on the increase – now 20% of Australians suffer from at least one allergy.

To progress allergy and immunity research the Robinson Research Institute is:

- Identifying environmental factors and events that occur during pregnancy that increase susceptibility to allergy in childhood
- Identifying the genetic and epigenetic changes that occur in the placenta that program immune function in early childhood and increase susceptibility to allergy
- Identifying biomarkers that predict the risk of allergy in childhood
- Developing effective interventions for allergy prevention either during pregnancy or after birth
- Uncovering the causes of food allergies and developing interventions to prevent and treat these allergies
- Educating the community about how to safely manage allergies and asthma during pregnancy

**Translational Impact**

**Infant feeding guidelines**

Findings of the STEP (Starting Time for Egg Protein) study have been translated into the Australasian Society of Clinical Immunology and Allergy (ASCIA) infant feeding guidelines. The STEP study is a randomised controlled trial looking at early versus late introduction of egg into an infant’s diet. Findings from Prof Michael Gold, Dr Merryn Netting, A/Prof Debbie Palmer and Prof Maria Makrides’s study showed that early introduction of egg does not prevent egg allergy. This is one of the large international trials that has provided an evidence base for feeding guidelines for infants around the introduction of egg to possibly prevent egg allergy.

**Advances in 2016**

- Dr Kathy Gatford and colleagues from Monash University investigated in sheep models, how the prenatal environment affects allergy risk, and in particular, how limiting growth before birth reduces allergy susceptibility in progeny. Evidence to date is consistent with a role for fetal availability of 1-carbon donors such as folic acid during late gestation in determining allergic susceptibility after birth, and we are continuing to explore these mechanisms.
Tackling life-threatening infectious diseases
Protecting children and adolescents from serious infectious diseases is a national priority to secure the future health of the nation.

To eliminate life-threatening conditions in children the Robinson Research Institute is:

- Improving the effectiveness of vaccine programs for pregnant women to increase protection for both women and their babies against serious infections such as influenza and whooping cough
- Combatting life-threatening infections such as meningococcal and pneumococcal disease by optimising infectious disease prevention
- Testing new and current vaccines for babies, children, adolescents and pregnant women to ensure they are safe and effective
- Uncovering how and why some health conditions, such as pregnancy, obesity and immune compromise, impact on vaccine effectiveness
- Educating the community on the importance of vaccinations and incorporating community views and values into immunisation policy

Translational Impact

B Part of It Study
In South Australia the highest number of meningococcal disease notifications occur in adolescents, with the majority of these infections due to the B strain. Commencing at the end of 2016, the B Part of it study led by Prof Helen Marshall, will provide up to 60,000 adolescents in South Australia with a free licensed Meningococcal B vaccine. Students will also supply a throat swab which will measure the effectiveness of the Meningococcal B vaccine in reducing carriage of Neisseria meningitides in adolescents. If a herd immunity benefit is shown there is the potential to introduce Meningococcal B to Pharmaceutical Benefit Scheme, providing free coverage for Australian infants.

SA Vaccinology Update
In partnership with SA Health, the Women’s and Children’s Hospital and SAHMRI, the RRI runs the annual SA Vaccinology Update with the VIRTU group leading the event. In its 4th year, this event provides health care professionals with the latest research discoveries, policy changes, clinical trials and all vaccinology and immunology information, to ensure the best service, advice and care is provided to patients, with nurses able to claim CPD Points.

Advances in 2016
- We discovered a novel regulatory element far upstream from a key immune function gene in T cells. Prof Simon Barry and colleagues are the first to show linkage of genetic risk to a specific target gene in human T cells by conformation capture. Their research may explain how genetics contributes to the pathobiology of autoimmune diseases including irritable bowel disease, multiple sclerosis and colitis.
RESEARCH PRIORITY

Population interventions to secure a BetterStart for all children
For children to fulfill their health and development potential, early intervention is vital to ensure their optimal capabilities can be achieved; this includes their physical, mental, social and emotional health, cognitive ability and academic achievement.

Enhanced Service Delivery Framework
The BetterStart Child Health and Development Research Group using the SA Early Childhood Data Project, characterised the levels of vulnerability and disadvantage experienced by the South Australian community to inform the design of the Enhanced Service Delivery Framework for the South Australian Child and Family Health Service. This work is directly contributing to the design of government-led services and interventions that aim to optimise the health and development of South Australia’s children.

SA Early Childhood Data Project
Using data from the SA Early Childhood Data Project, Dr Rhiannon Pilkington and Prof John Lynch presented analyses on the trajectories of children through the SA child protection system to several SA government executive committees. Following this, a two-page translational research brief was developed by the BetterStart group for media release following the delivery of the Nyland Royal Commission report into South Australia’s Child Protection System. The key finding from this research brief is that 1 in 4 children in SA will have contact with the child protection system by age 10. This research is the first time in South Australia that the prevalence of child protection system contact has been widely disseminated, and this is the key result used by government Ministers including Premier Jay Weatherill and Minister Susan Close to communicate the gravity of this issue to the media and the wider community.

AEDC State and Territory Coordinator Training Workshop
Drs Angela Gialamas and Rhiannon Pilkington presented to state and territory coordinators on research and policy translation using the Australian Early Development Census (AEDC). This presentation provided examples of how the AEDC is being used in South Australia to inform government and early childhood policy conversations. They described how a profile of children who are both emotionally vulnerable on the AEDC and socioeconomically disadvantaged was used in policy; and are investigating whether the AEDC can predict future child protection system contacts.

Translational Impact

Online parenting support
As part of the CRE for EMPOWER: Health Systems, Adversity and Child Wellbeing, we developed an innovative nurse-moderated internet-based group intervention, to support mothers experiencing sub-threshold depressive symptoms and parenting problems when caring for infants. These mothers are a high priority because of the common co-occurrence of these problems, their high prevalence, and their adverse impact on mother-infant relationships and later child development. During 2017 and 2018 we will evaluate the effectiveness of this new program.

Biosocial panel
A/Prof Megan Warin convened the Biosocial futures: from interaction to entanglement in the postgenomic age panel at the European Association for the Study of Science and Technology and the Society for Social Studies of Science conference in Barcelona, with colleagues from the University of York (Canada) and Sheffield University (UK). Speakers explored what epigenetics contributes to concepts of gender, race and class, where the understanding that intergenerational legacies can be transmitted epigenetically is highly relevant but novel territory. This work is important as it reinforces and explains the need for policies and programs to address inequity, as individuals cannot be responsible for overcoming historically entrenched disadvantage and accompanying poor health.
Pioneering interventions to improve the health of children
Many serious physical and mental disorders affecting adults have their origins in childhood. To prevent the development of disease and/or disability, interventions need to be administered in early life, be safe and as targeted as possible.

To tackle childhood genetic, neurodevelopmental, metabolic and immunological conditions, the Robinson Research Institute is:

- Uncovering the causes of these childhood conditions through discovery research, large-scale clinical trials and cohort studies
- Developing effective treatments and interventions to prevent disorders progressing from early life to adulthood
- Running unique e-health delivery trials to provide healthcare services and parenting support

Translational Impact

Pancreatectomy and islet autotransplant

Australia’s first total pancreatectomy and islet autotransplant in a child with hereditary pancreatitis was performed by Professors Toby Coates and Jenny Couper, along with interstate and international collaborators.

The 7-year-old boy had a severely fibrosed pancreas but has achieved a remarkable improvement in quality of life with only partial insulin now required.

Carina Biotech Launch

Carina Biotech is a newly established start-up company developing cellular immunotherapies, particularly for the treatment of childhood cancers.

This company was spun out of the $63 million CRC for Cell Therapy Manufacturing, which was jointly established with the University of South Australia, with A/Prof Simon Barry leading the T cell therapy program.

Initial work will focus on developing technologies involving Chimeric Antigen Receptor T-cells (‘CAR T-cells’), which have shown unprecedented results in clinical trials against leukaemia.

Watch the salt intake in children’s diets

There has been little attention given to salt intake in children, including those at risk of heart disease. Dr Alexia Pena and Prof Jenny Couper have shown that dietary intake of salt is generally very high in children, associated with consumption of processed snack foods. High daily intake of salt is contributing to poorer blood vessel function in children with diabetes. These findings support educating families about their children’s salt intake, in addition to other risk factors contributing to heart disease.

ICMStemcell PTY ltd

Human embryonic stem cells offer considerable promise for treating a range of diseases and injuries for which no effective treatment exists, and which currently constitutes a significant health burden estimated to cost billions of dollars globally.

A/Prof Mark Nottle and colleagues have isolated a new embryonic stem cell type which differs from other stem cells, in that these are isolated earlier in development. These cells may have advantages for developing cell-based therapies compared with existing human embryonic stem cells.

Given this potential Mark and colleagues have filed a patent to protect their method, which has been granted in Australia and the United States. With support from TachInSA they have established the startup company - ICMStemcell Pty Ltd to raise funding to provide researchers with improved stem cells for developing cell-based therapies.

Advances in 2016

- We discovered that monotremes evolved a glucagon-like peptide 1 (GLP-1) gene that is resistant to degradation in human serum. Prof Frank Grutzner believes that this could be used to develop novel GLP-1 based treatment options for type 2 diabetes in children.
- We isolated a new pluripotent cell type (Inner Cell Mass Stem Cells), isolated earlier in embryo development from the undifferentiated inner cell mass. A/Prof Mark Nottle believes these cells may have advantages for developing cell-based therapies including the potential to treat Type 1 diabetes.
- We investigated the genetic basis of blood pressure regulation across infancy and childhood in three large birth cohorts. Prof Lyle Palmer discovered two novel loci and found that some, but not all, known adult blood pressure genes associated with childhood blood pressure.
- We utilized CRISPR/Cas9 gene editing in a collaboration with the Australian Phonemics Network to generate the first Australian cystic fibrosis rat model. A/Prof David Parsons and his colleagues believe this model will allow the group to demonstrate, for the first time, that airway gene therapy can prevent cystic fibrosis lung disease from initiating.
- We demonstrated that keeping count of daily steps and boosting physical activity can improve cardiovascular health in children with type 1 diabetes. Dr Alexia Pena’s findings provide an easy intervention to protect life-long heart health in affected children.
During 2016 the Robinson Research Institute successfully attracted funding from major bodies to continue to support our research. A selection of highlights is listed below.

**NHMRC**

Centres for Research Excellence commencing in 2016

**$2.5 million to Prof John Lynch**

Prof John Lynch, Prof Michael Sawyer, Prof Ben Mol, Prof Claire Roberts, Prof Gus Dekker and A/Prof Naomi Dwyer awarded a CRE for **EMPOWER: Health systems, adversity and child well being**

Project Grants commencing in 2016

**$1.3 million to E/Prof Alastair MacLennan**

*Genetic pathways to cerebral palsy*

**$920,972 to Prof Sarah Robertson**

Priming the maternal immune response to resist inflammatory disorders of pregnancy

**$814,272 to A/Prof David Parsons**

Identifying the role of airway stem cells in maintaining lentiviral mediated gene expression for cystic fibrosis lung disease

**$796,979 to Prof David Kennaway**

Impact of disrupted sleep and rhythms during pregnancy on the mother and her offspring

**$683,622 to A/Prof Cheryl Shoubridge**

Improving the phenotypic severity of intellectual disability and seizures caused by expanded polyalanine tract mutations in the ARX homeobox transcription factor

**Targeted Call commencing in 2016**

Prof Jozef Gecz – member of a team (led by Prof Kathryn North and Prof Andrew Sinclair) awarded **$25 million**

Prof Jozef Gecz, together with 47 partner organisations led by Murdoch Children’s Research Institute, awarded a Targeted Call for Research into Preparing Australia for the Genomics Revolution in Health Care
Centres for Research Excellence
awarded in 2016
Prof Jozef Gecz and team (led by Dr Tony Roscioli) awarded $2.5 million
Dr Tony Roscioli (Garvan Institute) together with Prof Jozef Gecz (CIB) and colleagues awarded a CRE for Transforming the diagnosis and management of severe neurocognitive disorders through genomics

Partnership Projects awarded in 2016
$1.05 million to Prof Helen Marshall
Reducing vaccine preventable diseases in children: Using national active hospital based surveillance to evaluate and improve immunisation program performance

Project Grants awarded in 2016
$1.5 million to A/Prof Rebecca Robker
Re-energising the pre-implantation embryo to extend lifetime health

$1 million to Prof Simon Barry
Identification of the conformation dependent targets of autoimmune disease linked variation in human regulatory T cells

$791,369 to A/Prof Chris Wilkinson
STan intrapartum fetal monitoring (cardiotocographic plus electrocardiographic) compared with cardiotocographic (CTG) monitoring alone: an Australian randomised controlled trial

$523,988 to Prof Paul Thomas
Identifying the pathological mechanism of PCDH19-Girls Clustering Epilepsy

NHMRC–ARC Linkage
Grant awarded in 2016
$480,000 to Prof Sarah Robertson
Adelaide Flow Cytometry Facility

ARC
Prof Sarah Robertson awarded $433,000 for her project: Male to female sperm signalling – a new role for sperm in reproduction? (commenced 2016);
Prof Frank Grutzner awarded $380,000 for his project: Non-coding RNAs in mammalian reproduction;
Prof Jozef Gecz awarded $234,000 for his project: TREX-mediated nuclear mRNA export in neuronal differentiation and function.

Channel 7 Children’s Research Foundation
RRI members were awarded 11 project grants commencing in 2016/2017 totalling more than $750,000. This includes $75,000 to A/Prof Philippa Middleton for increasing breastfeeding and Aboriginal children’s health through culturally appropriate and responsive support.

Diabetes Australia
Prof Michael Davies awarded $75,000 for his project: Why do children born after infertility treatment have more congenital heart defects?

GlaxoSmithKline
Prof Helen Marshall awarded $11 million to run the SA Meningococcal B Vaccine Herd Immunity Study;

Juvenile Diabetes Research Foundation
Prof Toby Coates awarded US$750,000 for his project: The Biodegradable Temporizing Matrix as an Alternative Site for Human Islet Transplantation.
A/Prof Peter Cowan (St Vincents Hospital) together with A/Prof Mark Nottle (CIB) and colleagues awarded US$1.04 million for their project: Genetic modification to protect pig islets from T cell-mediated xenogeneic rejection.

Lowitja Institute
Prof Vivienne Moore, Dr Alice Rumbold and colleagues awarded $247,845 for their project: Reclaiming strong Aboriginal and Torres Strait Islander identities through a gender equality lens.

National Blood Sector
Prof Gus Dekker, A/Prof Michael Stark and Dr Nicolette Hodyl awarded $139,123 in a R&D Pilot Grant for RCT on iron need in pregnancy and after birth, single centre at LMH.

US National Institutes of Health
Prof Claire Roberts awarded US$953,209 through a RFA Human Placenta Project scheme for her research: Maternal molecular profiles reflect placental function and development across gestation.

Ovarian Cancer Research Foundation
Prof Martin Oehler awarded $581,218 for two projects: Blood proteomic signatures of ovarian cancer; and Autoantibody biomarkers for ovarian cancer detection.

Research Foundation of Cerebral Palsy Alliance
Prof Jozef Gecz awarded $261,442 for his project: Multi-omics investigations of cerebral palsy causation in discordant monozygotic twins and singletons.

Royal Adelaide Hospital
Prof Toby Coates, Prof Lyle Palmer and colleagues awarded $400,000 for their project: Pancreatic Islet Autotransplantation for Chronic Pancreatitis.

SA Department of Premier and Cabinet
Prof John Lynch awarded $980,000 for SA Early Childhood Data Project.

Stillbirth Foundation
Prof Ben Mol awarded $50,000 for his project: COSTIL Study: Core Outcomes in STILbirth trials.

The Hospital Research Foundation
A/Prof Wendy Ingman awarded $100,000 for her project: Exploring the impact of menstrual cycling on personalised medicine for premenopausal breast cancer patients.

Viertel Charitable Foundation
Dr Brenton Hordacre awarded $85,000 for his project: Characterising motor network connectivity to improve application of non-invasive brain stimulation in stroke.

Women’s and Children’s Hospital Foundation
RRI members were awarded 10 project grants commencing in 2016/2017 totalling more than $450,000. This included $74,875 to Dr Nicholas Smith for his project: Diagnostic mass spectrometry profiling in acquired and genetic disorders of central nervous system myelination in childhood.

University of Adelaide
Prof Jozef Gecz awarded a $180,000 Equipment Grant for a Multi-Electrode arrays and DNA/RNA Extractor.

Annual Report 2016 29
Fellowships and Awards

**ARC**

- **Commencing in 2016**
  - Discovery Early Career Research Award
    Dr Lachlan Jolly
  - Future Fellowship
    Prof Frank Grutzner

- **Awarded 2016**
  - Future Fellowship
    Prof Frank Grutzner
  - NHMRC Research Fellowship
    A/Prof Darryl Russell and Prof Ray Rodgers
  - NHMRC-ARC Dementia Research Development Fellowship
    Dr Sam Buckberry and Dr Mitchell Goldsworthy

**NHMRC**

- **Commencing in 2016**
  - NHMRC Research Fellowship
    A/Prof Darryl Russell and Prof Ray Rodgers
  - NHMRC-ARC Dementia Research Development Fellowship
    Dr Sam Buckberry and Dr Mitchell Goldsworthy

- **Awarded in 2016**
  - NHMRC Research Fellowship
    A/Prof Rebecca Robker
  - NHMRC Early Career Fellowship
    Dr Carolyn Berryman and Dr Brenton Hordacre

**Other Fellowships (awarded 2016)**

- CRE for PCOS – Early Career Fellowship
  Dr Jodie Avery
- Lloyd Cox Fellowship
  Prof Michael Davies, A/Prof Michael Ridding and Dr Nicolette Hodyl
- MS McLeod Fellowship
  Postdoctoral Fellowship – Dr Christopher Hope
  PhD Scholarships – Alexandra McCarron and Mark McMillan
- National Heart Foundation
  A/Prof Lisa Moran
- Research Foundation of Cerebral Palsy Alliance
  Dr Mark Corbett
- The Hospital Research Foundation
  A/Prof Wendy Ingman
- The University of Adelaide Fellowships
  Dr Hannah Brown and Dr Zohra Lassi
- Women’s and Children’s Health Network Clinical Fellowship
  Dr Priya Augustine

**Awards and Prizes**

- Asia Pacific Initiative on Reproduction
  Dr Jodie Avery awarded Best Presentation
- Australian Sleep Association
  Anna Kontos awarded Best Poster Prize
- Australian Society for Medical Research (ASMR)
  Daniel Pederick received prize for the Best Presentation in the Field of Reproduction, Pregnancy or Child Health
- Chinese Ambassador
  Sally Sun received the Outstanding Self-Financed Chinese Students Studying Abroad Award
- Endocrine-Related Cancers
  Dr Carmela Ricciardelli was celebrated in the Endocrine-Related Cancers special issue, highlighting exceptional women in this area of research
- EPiCSA
  Ben Mayne and Dr John Schjenken received the joint award for the Best Epigenetic Research, and John also received the People’s Choice Award
- Fay Fuller Foundation
  Alexandra Procter awarded an Honours Scholarship
- Ferring Pharmaceuticals
  Dr Vicki Nisenblat received the CREI Award
- Fertility Society of Australia
  Dr Rui Wang awarded Best Clinical Paper
- Inflammation in Reproduction, Pregnancy and Development
  Dr Loretta Chin, Dr John Schjenken, Dexter Chan and Bihong Zhang received Travel Awards
  Natalie Aboustate and Tara Crawford received Travel Awards
- International Federation of Placenta Associations
  Natalie Aboustate and Rebecca Wilson received YW Loke New Investigator Awards
- International Society for the Immunology of Reproduction
  Ella Green received the International New Investigator Award

**Healthy Development Adelaide (HDA)**

Dr Alice Rumbold awarded the inaugural Women’s Excellence in Research Award
Prof Sarah Robertson

Elected as a Fellow of the Australian Academy of Science for research in reproductive immunology, which has formed the basis for a new understanding of the origins of health at conception.

Visit science.org.au/fellowship/fellow to watch Prof Robertson’s election video.
Our members are forming collaborations with for-purpose organisations to improve the evidence-base and effectiveness of their work.

Collaboration

**Hospitals**
Members are embedded within the 5 SA public hospitals.

**Peak Bodies**
We advocate for the significance of our research through memberships and partnerships with peak bodies including Association of Australian Medical Research Institutes and PSANZ.

**Not-for-Profits**
We partner with Not-for-Profit organisations including The Birthing Kit Foundation Australia and SHineSA to support evidence-based impact.
Many clinicians are RRI members, and we collaborate with fertility clinics, hospitals and other primary health organisations.

Research translation and implementation is facilitated through industry clients and pharmaceutical collaborations and our MRCF membership.

Collaborating with researchers around the globe. Members were invited to present at more than 120 meetings and conferences, of which 56 were at international events.

Collaborating with health consumers ensures our research is relevant and provides access to unique perspectives and solutions.

Our members collaborate with local, state and federal Government on projects to improve the health of the community.
Collaboration highlights

VARTA
The Victorian Assisted Reproductive Treatment Authority (VARTA) provides independent information and support for individuals, couples, and health professionals on fertility, infertility, assisted reproductive treatment, and the best interests of children born. VARTA and the Robinson Research Institute together with Andrology Australia and the Jean Hailes Foundation make up the Your Fertility Coalition funded through the Commonwealth Department of Health. Through this Coalition, the Your Fertility webtool has been developed. The webtool supports members of the public to gauge their fertility based on a range of variable factors, including age, weight, smoking and alcohol consumption. RRI will work with VARTA, Flinders University and SAHMRI, to enhance the webtool so that we can understand and apply effective approaches to improving fertility through interactive web-based tools.

Women’s and Children’s Health Research Alliance (WCHRA)
Through the WCHRA Alliance, the Institute collaborates with the Women’s and Children’s Hospital, Women’s and Children’s Hospital Foundation, Women’s and Children’s Health Research Institute, Women’s and Children’s Health Network, SA Pathology, SAHMRI, and other research groups at the Women’s and Children’s Hospital site. Many of our Research Leaders and their teams reside in the Women’s and Children’s Hospital. This alliance seeks to foster research excellence in the area of women’s and children’s health in South Australia, translate research findings into policy and practice, establish a highly visible focus for funding, ensure sufficient research infrastructure needs are met, and communicate the benefits of health investment to the wider community.

South Australian Health & Medical Research Institute (SAHMRI)
The RRI and SAHMRI are partnering to develop collaborative research programs, joint research appointments, and shared core facilities. By working together we will progress health advances for mothers, babies and children, and tackle adult conditions through investigating early origins of health and disease.

Our partnership seeks to advance a

Clinical Partners

Dr Alexia Peña
Dr Alexia Peña is a Paediatric Endocrinologist at the Women’s and Children’s Hospital and a Senior Lecturer at the University of Adelaide. In her clinical role, Alexia regularly consults for children with type 1 diabetes, obesity or other hormonal conditions, driving her to progress research into this space to improve the life-long health of children living with these diseases.

Around 11,000 children in Australia have type-1 diabetes (T1D), significantly affecting not only their lives, but also their families. Insulin injections, blood glucose monitoring, stringent meal planning, and being prepared for high and low blood glucose levels are all part of the daily routine for these families. For people with type 1 diabetes, cardiovascular disease is the most common cause of morbidity and mortality, and can reduce the lifespan by 15 years. Alexia discovered early changes in the thickness of blood vessels in children with T1D; and this, together with a build-up of plaque as these children age, leads to the high risk of cardiovascular disease (3x the chance of those without T1D even with good glucose control).

Alexia’s research is focused on developing early interventions to mediate this risk. She discovered that by taking an extra 1,000 steps a day, there was a measurable decrease in the arterial thickness, blood pressure, lipids and weight. She is also investigating the impact of a high sodium diet on blood vessels, and the use of drug interventions such as metformin, which improves also the way insulin works and weight. Alexia’s other research interests include improving the management of adolescents with severe obesity and improving diagnostics for adolescents with Polycystic Ovary Syndrome.

Alexia is an Investigator of the NHMRC’s Centre of Research Excellence for PCOS with RRI members: Professors Rob Norman, Ray Rodgers, Michael Davies, Ben Mol and Dr Alice Rumbold. Additionally, Alexia collaborates with Prof Jenny Couper and Dr Roger Gent around vascular health in T1D.
progressive research agenda in South Australia where we can provide an optimal environment for world-class research and to attract, support and train the very best researchers in our areas. Collaboration examples include:

- Co-appointment of Professors Jozef Gecz and Ben Mol
- Establishing a shared Flow Cytometry Facility
- Jointly resourcing the SA Genome Editing Facility
- Research collaboration through the Aboriginal Families Health Research Partnership
- Co-hosting research and community forums

Healthy Development Adelaide (HDA)

HDA promotes, facilitates and enables multi-disciplinary research that advances the understanding of healthy development, and ensures the physical, psychological and social health of infants, children and adolescents. HDA plays a key role in South Australia, linking research, service delivery and policy development, and is led by Institute members Professors Claire Roberts and Ben Mol. The Institute’s Research findings and new treatment options are translated into practice, ensuring greater choices for couples seeking fertility assistance. In 2016 RRI co-hosted a GP workshop and visiting speaker program with Fertility SA, and offered an additional honours scholarship with the support of Repromed - the Repromed Reproductive Health Scholarship.

SA Fertility Clinics

Robinson Research Institute members have a key presence in clinical practice and research development at two leading fertility clinics in Adelaide: Fertility SA and Repromed. The Institute’s Research findings and new treatment options are translated into practice, ensuring greater choices for couples seeking fertility assistance. In 2016 RRI co-hosted a GP workshop and visiting speaker program with Fertility SA, and offered an additional honours scholarship with the support of Repromed - the Repromed Reproductive Health Scholarship.

Cure4 Cystic Fibrosis

Cure4 Cystic Fibrosis is taking action to create a future free of the devastating effects of cystic fibrosis for people living with the disease, and their families. They exist solely to find a cure for cystic fibrosis. The Foundation joins forces with a formidable community to raise funds that can be invested in the work of the world leading Cystic Fibrosis Airway Research Group, led by pioneering scientist and RRI Research Leader, A/Prof David Parsons. They strive to accelerate a potential cure for cystic fibrosis.

The only way to accurately test for endometriosis is through surgery, which is invasive, costly and explains the delay experienced by many women in receiving an accurate diagnosis. Accurate low-invasive tests are expected to be more acceptable to women, make diagnosis faster. Currently it is not understood what causes endometriosis and why the symptoms vary between women. There is no cure for endometriosis, with researchers continuing to look for new treatments to alter the course of the disease and to improve quality of life in the affected women.

Dr Victoria Nisenblat

Dr Victoria Nisenblat is a Specialist in Obstetrics and Gynaecology and is undertaking a subspecialty training in reproductive endocrinology and infertility (CREI). She works as CREI Fellow in multiple locations throughout SA both in metropolitan and rural areas. Vicki also practices as Obstetrician and Gynaecologist and holds an affiliate appointment as a Clinical Academic and Senior Researcher at the University of Adelaide. Her experience spans menstrual and hormonal disorders, conditions that impede infertility in men and women, and strategies to optimise natural fertility. Vicki has a particular clinical and research interest in endometriosis.

Approximately 10-15% of women live with endometriosis, often taking many years to be correctly diagnosed. It is a chronic hormonal condition in young women where the lining of the womb grows outside the womb, mainly into the abdominal cavity, but can extend into other organs. The symptoms vary largely between women and often are similar to those experienced from other health issues. Symptoms may range from occasional cramps and period pains to severe debilitating pain that gets progressively worse over time. Low mood, chronic fatigue, headaches, bowel issues and bladder complaints are common. Some women also experience infertility. The only way to accurately test for endometriosis is through surgery, which is invasive, costly and explains the delay experienced by many women in receiving an accurate diagnosis. Accurate low-invasive tests are expected to be more acceptable to women, make diagnosis faster. Currently it is not understood what causes endometriosis and why the symptoms vary between women. There is no cure for endometriosis, with researchers continuing to look for new treatments to alter the course of the disease and to improve quality of life in the affected women.

Vicki is undertaking laboratory work and systematic reviews directed towards establishment and evaluation of less invasive accurate diagnostic testing for endometriosis and presents her work at national and international conferences. She will spend 6 months in Beijing in 2017 aiming to work with international collaborators to progress research on diagnostics and improving treatment strategies for women with endometriosis. Vicki recently completed her PhD with A/Prof Louise Hull and collaborates with RRI members Professors Rob Norman, Ben Mol and Neil Johnson.

Birthing Kit Foundation Australia

The Birthing Kit Foundation Australia’s (BKFA) vision is a world in which preventable maternal and newborn mortality and morbidity has been eliminated. BKFA works to provide a clean and safer birthing environment for women in developing countries by facilitating the assembly and supply of clean birthing kits. The BKFA birthing kit was developed to address the potentially fatal impact of infection acquired during childbirth, which is a leading cause of an estimated 3.3 million newborn deaths and 300,000 maternal deaths globally each year. The kit contains disposable gloves, a small piece of soap, a sterile scalpel blade, gauze, a plastic birthing sheet and pieces of string for tying the cord. Over the last decade, BKFA have distributed more than 1.5 million kits throughout Africa, Asia and the Pacific regions. Since April 2016, BKFA and RRI have been working on a collaborative project to assemble evidence regarding the impact and effectiveness of birthing kits on maternal and newborn outcomes, as well as factors that hinder or facilitate the use of birthing kits for delivery.

The annual report for the Robinson Research Institute includes the following features:

- Progress report on research and community engagement activities
- Highlights of research projects and collaborations
- Information on the Institute’s membership and funding sources
- Details of the Institute’s impact and achievements
- Contact information for further inquiries
Universities

RRI members collaborate with universities and research institutes around the globe to maximise efforts in answering major research questions. Examples of our important collaborations are listed below:

**Australia**
- CSIRO
- Flinders University
- Garvan Institute of Medical Research
- Hudson Institute of Medical Research
- Mater Medical Research Institute
- Menzies School of Health Research
- Monash University
- Northern Territory Government
- Royal Children’s Hospital
- SAHMRI
- Telethon Kid’s Institute
- The Florey Institute
- The University of New South Wales
- The University of South Australia
- The University of Western Australia
- Victoria University
- Walter and Eliza Hall Institute

**Argentina**
- Juan A. Fernandez Hospital
- University of Buenos Aires

**Belgium**
- Limburg Catholic University
- Vrije Universiteit Brussel

**Brazil**
- Sao Paulo State University

**Canada**
- McGill University
- The Hospital for Sick Children
- University of Alberta
- University of Montreal

**China**
- Peking University
- Shanghai Jiao Tong University
- Zhejiang University

**Denmark**
- National Institute of Public Health
- University of Copenhagen

**France**
- Inserm - French National Institute of Health and Medical Research
- University of Nantes

**Germany**
- Goethe University
- Limes-Institut-Bonn
- Max Planck Institutes
- School of Life Sciences
- University of Marburg

**Ireland**
- University College Cork

**Italy**
- Universita Cattolica
- University of Sassari

**Japan**
- Japan Synchrotron Radiation Research Institute
- Osaka University

**The Netherlands**
- Radboud University
- Rotterdam University
- University of Groningen
- Utrecht University

36 Robinson Research Institute
## Financials 2016

$24,570,966

### ARC

<table>
<thead>
<tr>
<th>Country</th>
<th>Institution</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand</td>
<td>The University of Auckland</td>
<td>$1,324,948</td>
</tr>
<tr>
<td></td>
<td>University of Otago</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>University of Madrid</td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>University of Witwatersrand</td>
<td></td>
</tr>
<tr>
<td>South Korea</td>
<td>Chungbuk National University</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>ETH Zurich</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University of Lausanne</td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Bristol University</td>
<td></td>
</tr>
<tr>
<td></td>
<td>King’s College London</td>
<td></td>
</tr>
<tr>
<td></td>
<td>National Institute for Medical Research</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public Health England</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The University of Edinburgh</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University College London</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University of Cambridge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University of Oxford</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University of Westminster</td>
<td></td>
</tr>
<tr>
<td>United States of America</td>
<td>Baylor College of Medicine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Benaroya Research Institute</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Centers for Disease Control and Prevention</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Emory University</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Harvard Pilgrim Health Care</td>
<td></td>
</tr>
<tr>
<td></td>
<td>National Institutes of Health</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University of California</td>
<td></td>
</tr>
<tr>
<td></td>
<td>University of Washington</td>
<td></td>
</tr>
<tr>
<td>Vietnam</td>
<td>Vietnam National University</td>
<td></td>
</tr>
<tr>
<td>West Indies</td>
<td>St. George’s University</td>
<td></td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Medicines Control Authority of Zimbabwe</td>
<td></td>
</tr>
<tr>
<td>International</td>
<td>World Health Organization</td>
<td></td>
</tr>
</tbody>
</table>

### Donations & Foundations

<table>
<thead>
<tr>
<th>Country</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Africa</td>
<td>$75,747</td>
</tr>
<tr>
<td>South Korea</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td></td>
</tr>
<tr>
<td>United States of America</td>
<td></td>
</tr>
<tr>
<td>Vietnam</td>
<td></td>
</tr>
<tr>
<td>West Indies</td>
<td></td>
</tr>
<tr>
<td>Zimbabwe</td>
<td></td>
</tr>
<tr>
<td>International</td>
<td></td>
</tr>
</tbody>
</table>

### Government & Public Sector

<table>
<thead>
<tr>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,993,461</td>
</tr>
</tbody>
</table>

### Industry

<table>
<thead>
<tr>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9,687,975</td>
</tr>
</tbody>
</table>

### NHMRC

<table>
<thead>
<tr>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2,236,595</td>
</tr>
</tbody>
</table>

### Non Commonwealth Competitive

<table>
<thead>
<tr>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>$4,866,802</td>
</tr>
</tbody>
</table>

### International Competitive
Community Events
The RRI hosts public events throughout the year to educate the local community about ways to improve their health, and the health of their families.

Science Meets Parliament March
Drs Melanie McDowall and Hannah Brown attended Science meets Parliament (SmP) in Canberra. SmP links researchers with politics, policymaking and the media, while educating parliamentarians (Including Malcolm Turnbull and Bill Shorten) about the ground-breaking work being undertaken by attendees.

Research Tuesdays May & July
Hosted by the University of Adelaide, Institute members presented at two Research Tuesdays events in 2016; Prof Claire Roberts – Pregnancy screening tools to predict which women will develop complications foreshadowing heart disease; and Prof Helen Marshall – Pregnancy protection.

Men’s Health Matters May
Co-hosted by the RRI and Healthy Development Adelaide, attendees heard from Dr Nicole McPherson, Dr Deidre Zander-Fox, A/Prof Darryl Russell and Prof Gary Wittert, who presented on the topic: Making healthy babies – men’s health matters.

Lloyd Cox Memorial Lecture September
The Institute’s flagship annual public lecture was presented by Prof Fiona Stanley AC, FAA, FASSA on the topic Before the bough breaks – data and research to guard our children’s future. Professors Fiona Stanley and Sarah Robertson pictured below.

Making Babies in the 21st Century November
The RRI teamed up with the Australasian Sexual Health Conference to host the public forum Making Babies in the 21st Century. This event featured presentations from Prof Sarah Robertson, A/Prof Darryl Russell, Prof Vivienne Moore, Prof Gary Wittert, Dr Christopher Fox and Dr Helen Calabretto.

Research Events
Involvement in research events provides members the opportunity to network with peers, share research discoveries, learn about recent advances and build existing and new collaborations to address important health issues.

ENDIA state-wide meeting February
The national ENDIA study held its first study-wide face-to-face meeting, with 45 scientists, clinicians and research nurses from VIC, NSW, QLD, WA and SA attending, to discuss the current progress and future directions of the internationally unique investigation that aims to identify the genetic and environmental factors contributing to type 1 diabetes development.

WCH Co-hosted Grand Rounds April, August & October
A new initiative in 2016, the RRI co-hosted three of the Women’s and Children’s Hospital’s Grand Rounds seminars; Prof Euan Wallace, Hudson Institute of Medical Research – Does the bed need the bench? Perinatal translational research; Prof Rob Norman, Fertility SA – From little things, big things grow – the importance of health around conception; and Prof Jonathan Morris, Kolling Institute – The short and long term implications of late preterm and early term birth.

New Frontiers for a Healthy Start to Life May
The RRI hosted the third New Frontiers thinktank conference, to bring together researchers spanning the healthy start topic, both internal and external to the RRI. This unique conference stimulates new interactions and encourages BIG thinking, prospectively and proactively.

Writing a systematic review following Cochrane methods September
The RRI together with the SAHMRI Theme Healthy Mothers, Babies and Children, hosted the annual workshop by Cochrane Australia to support current and prospective authors of Cochrane reviews. This three-day workshop provided 25 participants with a comprehensive overview of the methods required to write their protocols and get started on their systematic reviews of health care interventions.

Fertility SA co-hosted seminars August & September
For the first time, the RRI and Fertility SA co-hosted two seminars on fertility science. The two presenters were: Dr Tracey Edgell, Hudson Institute for Medical Research – Biomarkers of endometrial receptivity; and A/Prof Caroline Gargett, Ritchie Centre – Role of endometrial stem/progenitor cells in endometriosis and infertility.

INSPIRE Series September
The INSPIRE Series luncheon, provides the opportunity for the Institute’s early career researchers to network with and learn from the Institute’s Emeritus Faculty. Prof Bob Seamark was the guest presenter, reflecting on his career for this third RRI-hosted event.

RRI Symposium November
The Institute’s largest internal event brings members together for a day of collaboration and networking. Members have the opportunity to present their work and learn about the research of their colleagues. The program focused on reproductive cancers, healthy lifestyle in the 21st century and global health. Award recipients included: Holly Groome – Best Student Poster, Dr John Schjenken – Best ECR Poster and Prof Helen Marshall – Director’s Award.

SA Vaccinology Update November
The RRI teamed up with SA Health, the Women’s and Children’s Hospital and SAHMRI to host the third SA Vaccinology Update. This full day event for immunisation providers, doctors and researchers featured presentations that showcased the latest developments in immunisation research, policy and programs.
To support members in their career growth and to increase reputation, the RRI strategically sponsored the following events in 2016:

**SRB**
For the 11th year in a row the RRI sponsored the Society for Reproductive Biology at its annual joint meeting with the Endocrine Society of Australia and the New Zealand Bone and Mineral Society. The Institute sponsored the Robinson Research Institute Award for Excellence in Reproductive Biology, which was awarded to A/Prof Wendy Ingman.

**IRPD**
For the first time, the RRI sponsored the Inflammation in Reproduction, Pregnancy & Development Conference which was a satellite meeting of the 16th International Congress of Immunology. RRI members presented at the conference and IRPD Travel Awards were received by Dr Loretta Chin, Dr John Schjenken, Dexter Chan, and Bihong Zhang.

**SIRT**
RRI sponsored A/Prof Mark Baker (The University of Newcastle), to present at the 2016 Scientists in Reproductive Technologies conference held in Adelaide. A/Prof Baker met with RRI members and presented a Friday seminar as part of our invited speaker program.

**EpiCSA**
RRI sponsored the inaugural Epigentics Consortium of South Australia annual meeting, to support this newly established group of South Australian epigenetic researchers. Dr John Schjenken was awarded the Best EMCR Presentation and joint winner of the RRI Award for Best Epigentic Research in Reproduction, jointly received by RRI member Ben Mayne.

**ASMR**
Sponsorship of the ASMR Annual Scientific Meeting provides the opportunity to support early career researchers and students in their career development. The Institute sponsored the Robinson Research Institute prize for the best presentation in the field of reproduction, pregnancy or child health, which was awarded to RRI member Daniel Pederick (pictured below).
The Robinson Research Institute’s research discoveries are actively publicised in the media and on social media to better inform the community about reproduction and fertility, pregnancy and child health issues.

In 2016, the Institute disseminated 20 media releases, with top performing stories including:

**Baby boys at greater risk of pregnancy complications**
Prof Claire Roberts has shown that boy babies are much more likely to experience potentially life-threatening outcomes at birth than girls. Her research investigated data looking at more than 574,000 SA births over a 30-year period. Published in PLOS ONE.

**Breast density matters in detection of breast cancer**
Almost 8% of women have extremely high breast density which can make it harder to detect breast cancer on a screening mammogram. A/Prof Wendy Ingman is co-leading a new Australian alliance of breast cancer researchers who are working together to raise awareness of this issue to improve cancer diagnosis.

For more information on breast density visit [informd.org.au](http://informd.org.au).

**Kids’ eating habits highlight need for healthier lunchboxes**
Dr Melissa Whitrow found that children aged 9-10 years old are receiving almost half of their daily energy requirements from discretionary or junk foods. The study evaluated the core food intake of more than 430 South Australian children aged 9-10. Published in the Journal of Human Nutrition and Dietetics.

**Drug shows promise for preventing preterm birth**
A drug known for its abilities to switch off pro-inflammatory pathways was successfully tested, entirely preventing preterm birth in pregnant mice. Prof Sarah Robertson’s lab also significantly reduced infant fatalities, and reversed low birth weight normally associated with preterm birth. Published in the Nature journal, Scientific Reports.

**Could assisted reproduction reduce birth defects for older women?**
Babies born to women aged 40 and over from assisted reproduction have fewer birth defects compared with those who conceive naturally. Prof Michael Davies’ findings are contrary to widespread belief that the greater risk of birth defects after assisted conception is due to the frequent use of these services by older women. Published in BJOG.

**Winter conception increases mum’s diabetes risk**
Women whose babies are conceived in winter are more likely to develop gestational diabetes during pregnancy, increasing a range of risk factors for both child and mother. Dr Petra Verburg and colleagues’ study investigated more than 60,000 births in SA over a five-year period. Published in BMJ Diabetes Research & Care.
Australia’s unique mammalian fauna has a southern Gondwanan origin, the marsupials, and a northern Asian origin, the native rodents. Our work focuses on the evolution and morphology of the sperm and eggs, and their interaction at fertilisation, in selected species from both of these groups of mammals. As comparative cellular morphologists with an interest in evolution, our recent work has looked at the quantity and quality of male gametes produced in Australian mammals. Very large differences in relative testes mass occur across the species which is likely to result from interspecific differences in intensity of inter-male sperm competition and breeding system. We are currently probing the effects of these differences on gamete morphology.

In 2016 our research focused on the effects of variation in post-copulatory sexual selection on sperm form and the resultant morphological differences that occur. We found that species with a relatively large testes mass produce far more uniform and streamlined spermatozoa than those with small relative testes mass where the sperm populations produced are highly polymorphic and include various pathological forms even in sexually mature adults. These highly polymorphic sperm populations in the few species in which they occur show similarities to those in humans. Next we will test our predictions that the differences in sperm morphology relate to differences in sperm behaviour within the confines of the female reproductive tract to determine their effects on fertilisation success.

### Group Members

**Research Leader:** Bill Breed  
**Senior Lecturer:** Eleanor Peirce  
**Research Assistants:** Hannah McLennan and Tessa Pahl  
**Affiliate:** Natasha Speight  
**External Collaborators:** Chris Dickman (University of Sydney), Stefan Lupold (University of Zurich), Richard Oko (Queen’s University) and Kevin Rowe (Museum Victoria)

---

Comparative Genome Biology

**Professor Frank Grützner**

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

The comparison of genes, genomes and epigenetic mechanisms in different species has provided many fundamental insights into how genes function in humans, how they evolved, and how they contribute to diseases. Our recent research has demonstrated that studying genes in species distantly related to humans has the potential to develop novel drugs, including treatment for type 2 diabetes, and provides new potential markers and insight into cancers.

The Comparative Genome Biology group studies gene evolution in mammalian species, in particular monotremes (platypus and echidna). Monotremes have an extraordinary sex chromosome system that reveals novel genes and pathways involved in sex determination and differentiation in all mammals. Monotremes have undergone radical changes to their stomach anatomy and physiology, accompanied by massive loss or change of genes involved in digestion. As a result, studying monotremes provides the opportunity to identify the role of key genes involved in stomach function and metabolism in humans and other mammals. In 2016 we continued to make progress investigating the role of genes in the piRNA pathway in ovary and ovarian cancer. We also embarked on investigations into how the interaction and methylation pattern of the Igf2 region has changed in ovarian cancer compared to normal cells. A highlight was our publication about the evolution of the dual function and evolution of monotreme GLP-1 in gut and venom.

### Group Members

**Research Leader:** Frank Grützner  
**Visiting Research Fellow:** Dan Kortschak  
**Lecturer:** Tasman Daish  
**PhD Candidates:** Jasmina Gerbert, Ellen Gillett, Reuben Jacob, Eunice Lee, David Stevens and Nicole William  
**RRI Collaborators:** Stefan Hiendleder, Martin Oehler, Carmela Ricciardelli and Darryl Russell  
**External Collaborators:** Peter Donnelly (Oxford University), Briony Forbes (Flinders University), Henrik Kaeissman (University of Lausanne), James Turner (Medical Research Council London) and Wesley Warren (University of Washington)
The prevalence of type 2 diabetes continues to rise worldwide, is increasingly evident in children, and is reaching pandemic levels. The notion that it is due to obesity, resulting from excessive energy consumption and reduced physical activity, is overly simplistic. Circadian desynchrony also promotes obesity and impairs glucose tolerance in mice, and is a feature of modern human lifestyles. Intermittent fasting and time restricted feeding have emerged as a tool that can reset peripheral clocks and improve glucose metabolism in animal models. The Obesity and Metabolism group seeks to identify optimal and sustainable eating patterns that will prevent the development of type 2 diabetes in at-risk populations. We aim to provide new data regarding the long-term health benefits of periodic fasting in human health, through preclinical models to help understand the molecular basis for these improvements.

In 2016 we completed an intervention trial in 90 women examining the metabolic benefits of alternate day fasting diets, demonstrating that these diets are as effective as calorie restriction diets in improving metabolic health. We are examining whether we can reduce fasting lengths and still receive benefit. Additionally, we completed a trial examining if a 14 hour overnight fast improves glycaemia in men at risk of type 2 diabetes. With collaborators at UniSA, we are also examining whether not eating at night can reverse the metabolic consequences of shift work.

Group Members
Research Leader: Leonie Heilbronn
Postdoctoral Fellow: Amy Hutchinson
PhD Candidates: Rajesh Chaudhary, Bo Liu and Prashant Regmi
RRI Collaborators: Rob Norman and Rebecca Robker
External Collaborators: Siobhan Banks and Alison Coates (University of South Australia), Grant Brinkworth and Manny Noakes (CSIRO), Michelle Keske (Menzies), Dorit Samocha-Bonet (Garvan Institute), Charmaine Tam (University of Sydney) and Gary Wittert (University of Adelaide)

Endometriosis affects 10% of women and adolescents, causing pelvic pain and infertility. Despite its prevalence, there are no reliable non-invasive diagnostic tests for endometriosis and therapies to treat pelvic pain and subfertility are limited and costly, and treat symptoms, rather than cure disease.

The Endometriosis group seeks to provide better diagnostic and therapeutic options for women with endometriosis by improving our understanding of the basic biology of endometriosis, developing manipulable models of the disease and then conducting clinical trials.

In 2016 this group published 5 Cochrane reviews determining the best way to non-invasively diagnose endometriosis and concluded that imaging tests such as MRI and Ultrasound show some promise as triage tests for endometriosis, but surgery remains the most sensitive method of diagnosis.

They discovered 2 microRNAs that alter the progression of endometriosis in a mouse model of endometriosis and are assessing the effect of a deficiency of these microRNA in human tissues. They have conducted a clinical trial assessing the effect of an oral GnRH antagonist on endometriosis pain. To explore methods of improving fertility in women, a randomised controlled clinical trial assessing a new growth factor containing IVF media for patients with poor embryo development has been completed. Collaborations with other research groups exploring the underlying pathology of pregnancy low and embryo implantation problems have been forged to help women carry a pregnancy to term.

Group Members
Research Leader: Louise Hull
Specialist Surgeon: Susan Evans
Clinical Lecturer: Vicki Nisenblat
PhD Candidate: Kavita Panir
RRI Collaborators: Robert Norman, Sarah Robertson, John Schenken, David Sharkey and Hannah Brown
External Collaborators: Neil Johnson, Cindy Farquhar and Cris Print (University of Auckland)
Breast cancer is the most common type of cancer in Australian women, affecting 1 in 8 before the age of 85. While breast cancer treatment has improved, little progress has been made towards reducing incidence. Lactation mastitis is even more common, and is an inflammatory breast disease that affects 1 in 4 breastfeeding women. The disease causes localised pain and is frequently accompanied by the rapid onset of systemic symptoms including fever, muscle aches and fatigue. The challenges posed by this disease often lead women to cease breastfeeding, leaving their infants at increased risk of respiratory and gastrointestinal diseases as babies, and a number of non-communicable diseases such as heart disease and diabetes as adults.

The Breast Biology and Cancer group works closely with surgeons and oncologists at The Queen Elizabeth Hospital to understand how hormones and immune cells affect breast function. The group seeks to better understand the biological mechanisms that underpin breast cancer risk factors, including menstrual cycling, pregnancy and mammographic density, to aid in the prevention and early detection of breast cancer.

A key focus in 2016 was understanding how immune cells and inflammatory factors affect breast density. Breast density is an important risk factor in the development of breast cancer, however little is known about the biological mechanisms that cause highly dense tissue to be at increased risk. We demonstrated that inflammation within the breast can drive increased density and cause increased risk of cancer in an animal model. This research paves the way for new approaches to reducing breast density and preventing breast cancer.

**Group Members**

**Research Leader:** Wendy Ingman

**Postdoctoral Scientists:** Danielle Glynn and Pallavi Dasari

**Research Officer:** Leigh Hodson

**Research Nurse:** Kathryn Mildren

**PhD Candidates:** Sarah Bernhardt, Siti Noor Din, Sally Sun, Joe Wrin, Vahid Atashgaran and Maddison Archer

**RRI Collaborators:** Simon Barry and Sarah Robertson

**External Collaborators:** Lisa Amir (LaTrobe University), Kara Britt (Peter MacCallum Cancer Centre), Andreas Evdokiou and Mark Hutchinson (University of Adelaide), Fiona Pixley (University of Western Australia), Tim Price and David Walsh (The Queen Elizabeth Hospital) and Rik Thompson (Queensland University of Technology)
We now understand that modifications to the molecular constituency of either the egg or sperm not only impact the viability of the resultant embryo, but also program growth in utero which may influence disease risk in adulthood. Obesity and various lifestyle factors have been shown to change molecular marks in gametes, and it is estimated that the youth of today will be the first generation to live shorter lives than their parents. Understanding the pathways of transmission of parental environmental insults to the next generation is essential for developing strategies to intervene.

The Gamete and Embryo Biology group is uncovering the functional pathways in the transmission of parental health cues to the next generation, and seeks to identify the characteristics of “good” eggs and sperm. Our research program principally focuses on how obesity and sub-fertility impact the metabolic health and epigenetic marks in gametes and embryos that alter the growth and development of subsequent offspring.

In 2016, we demonstrated in animal models that females with overweight fathers had alterations to genes in the ovarian cells (associated with reduced fertility), and amplified metabolic disturbances when exposed to high-fat diets as adults. We completed a systematic review demonstrating that obese men are more likely to be sub-fertile and their partners experience more miscarriages. We also showed that when both parents were obese there is an additive negative impact on embryo development and offspring health.

Group Members
Research Leader: Michelle Lane
Research Fellow: Nicole McPherson and Tod Fullston
Postdoctoral Fellow: Francesca Bell
Research Assistant: Lauren Sandeman
PhD Candidates: Alexander Penn and Helena Shehadeh
Honours Students: Cassandra Carbone, Rachael Collett and Dania Ruminski-Smith
Affiliate Member: Deirdre Zander-Fox
RRI Collaborators: Julie Owens, Sarah Robertson and Rebecca Robker
External Collaborators: John Aitken (University of Newcastle), Rob McLachlan (PHMRI), Moira O’Bryan (Monash University) and Gary Wittert (University of Adelaide)

Approximately 1 in 10 couples will experience infertility and more than 1 in 10 women suffer from Polycystic Ovary Syndrome (PCOS), which is the most common condition of female reproduction. Environmental impacts such as poor nutrition, obesity, pollutants and stress significantly influence reproductive potential, and fertility treatments are being increasingly utilised by patients at earlier stages than in the past. PCOS is on the rise, and sufferers may experience associated sequelae such as metabolic syndrome, diabetes and cardiovascular disease.

The Reproductive Endocrine and Medicine group is part of the NHMRC Centre of Research Excellence (CRE) for PCOS and are seeking international consensus on evidence based guidelines for PCOS. We’re looking at the reproductive life journey of couples who access fertility treatment in a clinic where IVF is freely available, and seek to develop the best methods to determine the most appropriate treatment for infertility. Our CRE for PCOS is collaborating with more than fifteen major groups around the world to develop evidence based guidelines. In November 2016, we held an international meeting in Victoria to set the scene for international guidelines to be developed over the next two years, and are looking at models of care for PCOS with Monash University. Additionally, we presented our results on the human growth hormone study which showed no material advantage of using growth hormone for poor responders on IVF, and commenced our study on the life journey of couples of reproductive conditions who present to a fertility clinic.

Group Members
Research Leader: Rob Norman
Research Fellows: Tania Chechurova
RRI Collaborators: Leonie Heilbronn, Louise Hull, Neil Johnson, Ben Mol, Rebecca Robker and Ray Rodgers
External Collaborators: Bart Fauser (University of Ultrecht), David Handelsman (ANZAC Institute), Rodger Hart (University of Western Australia), Joop Laven (Rotterdasm University), Lisa Moran (Monash University), Lois Salamonsen (Hudson Institute), Qiao Jie (Beijing), Chen Zhi-Jiang (Shanghai and Shangdong) and Helena Teede (Monash University).
Human embryonic stem cells (ESCs) offer considerable promise for curing a range of intractable diseases and injuries, for which no effective treatment currently exists, and constitutes a significant health burden estimated to cost billions of dollars globally. It is now generally accepted that human ESCs are not the same as those originally isolated in mice. As such there is a question mark over their potential to provide effective treatments which has led researchers to suggest that the full potential of ESCs can only be realised if cells like that originally isolated in mice are used.

The Reproductive Biotechnology group have isolated a new pluripotent cell type (Inner Cell Mass Stem Cells) which differs from those isolated in mice and humans, in that it is isolated earlier in embryo development from the undifferentiated inner cell mass, rather than the epiblast. As such we believe it may have additional advantages for developing cell based therapies. Our current research is focused on characterising this cell type, including examining its therapeutic potential as a treatment for Type 1 diabetes. Our method is covered by a patent which has been granted in Australia and the United State and is pending in other territories. We formed the start-up company ICMStemcell Pty Ltd to commercialise our research, with future work focused on isolating this cell type in humans and examining its therapeutic potential.

**Group Members**

**Research Leader:** Mark Nottle  
**Research Fellows:** Ivan Vassilev  
**Research Assistants:** Stephen McIlfatrick and Jess Zemtis  
**Honours Student:** Staci Jennings  
**Summer Student:** Anmoi Sainin  
**Affiliate Member:** Sean O’Leary  
**RRI Collaborators:** Toby Coates, Stefan Hiendleder, Michelle Lane, David Parsons and Paul Thomas  
**External Collaborators:** Peter Cowan (St Vincents Hospital), Emmanuelle Cozze (University of Padua), Wayne Hawthorne and Philip O’Connell (Westmead Millennium Institute), Nam Kim (Chungbuk University), Andrew Lew (Walter and Eliza Hall Institute), Simon Robson (Harvard Medical School) and John Paul Soullou (Universite de Nantes)

Ovarian cancer is a devastating disease and the leading cause of death from gynaecological malignancies. It affects approximately 1 in 90 women in Australia with over 70% of patients presenting with advanced stage. Despite improvements in surgery and chemotherapy, ovarian cancer mortality rates have not changed markedly over the last decade. To significantly improve ovarian cancer survival rates, identification of ovarian cancer biomarkers for early detection is essential, paired with improved molecularly targeted therapeutics.

The Reproductive Cancer group seeks to understand the mechanisms involved in ovarian cancer spread, resistance to chemotherapy and the identification of novel biomarkers for early detection. Recent work focused on understanding the role of the extracellular matrix molecule hyaluronan (HA), in the development of ovarian cancer chemotherapy resistance. We found that HA production is elevated in chemo-resistant primary ovarian cancer cells, and the HA inhibitor, 4-methylubelliferone (4-MU) could increase the cytotoxic effect of carboplatin. We also demonstrated that the cytoskeletal protein, keratin 5 is associated with chemotherapy resistance and progression in serous ovarian cancer. Developing strategies to target keratin 5 may prevent recurrence and chemotherapy resistance in serous ovarian cancer patients.

Next steps are to investigate whether a protein and autoantibodies recently identified in plasma can be used as diagnostic markers for serous ovarian cancer in independent cohorts, and whether annexin A2 inhibitors are effective at inhibiting growth and invasion using recently developed in vivo models of ovarian cancer.

**Group Members**

**Research Leader:** Martin Oehler and Carmela Ricciardelli  
**Senior Scientist:** Anne Macpherson  
**Postdoctoral Researcher:** Noor Lokman  
**Research Assistant:** Anita Oehler  
**Honours Student:** Rachel Ho  
**RRI Collaborators:** Frank Grutzner, Ray Rodgers and Darryl Russell  
**External Collaborators:** Peter Hoffmann and Florian Weiland (University of Adelaide), Stuart Pitson (University of South Australia), Andrew Ruszkiewicz (SA Pathology) and Andrew Stephens (Monash University)
In pregnancy, the woman’s immune cells must adapt to support and assist healthy pregnancy. This requires an active state of immunological tolerance to be established to allow embryo implantation, and development of the placenta and fetus. Many common reproductive and pregnancy disorders — including unexplained infertility, recurrent miscarriage, preeclampsia and preterm birth — have their origins in immune and inflammatory disturbances.

The Reproductive Immunology group explores the mechanisms that ‘prime’ the female immune system before and during conception, to assist embryo implantation and placental development. We focus on how contact with the seminal fluid elicits a sequence of events that stimulate generation of cells called regulatory T cells (Treg cells), that are anti-inflammatory, protect the implanting embryo, and promote vascular adaptation for placental development.

In 2016, we identified specific molecules in the seminal plasma of men that interact with cells in the reproductive tissues of women, to influence the immune adaptation for pregnancy. Cytokines, hormones and non-coding microRNAs are identified as important players. We have begun to explore why some men may have insufficient immune-regulatory activity — including the effects of obesity, environmental toxins and age.

Additionally, we progressed work to investigate new drug compounds for tackling preterm birth. By suppressing pro-inflammatory events induced by infection or other insults in late gestation, small molecules that block Toll-like receptor 4, and or peptide antagonists of IL-1 signalling, are showing substantial promise in inhibiting the upstream steps that otherwise ultimately lead to premature birth.

The Ovarian Cell Biology group is investigating the biological mechanisms by which ovarian cells endow the oocyte with the capacity to form an embryo and then trigger its timely release. This information is essential for understanding the foundations of reproduction and the earliest stages of embryogenesis. Using both genetic and dietary mouse models of obesity, we have shown that the detrimental effects of obesity on female reproduction and embryo development commence with dramatic alterations in oocyte quality.

In 2016 their research received a new boost of funding from the NHMRC, which will enable their lab to grow and advance their work, which is determining how maternal nutrition prior to conception influences obesity susceptibility in children, and to uncover the most effective methods for preventing the obesity-inducing signals in the oocyte from altering embryogenesis.

These discoveries are leading to a new understanding of female fertility and will have applications for the development of infertility treatments, therapies for optimising animal reproduction, and non-steroidal contraceptives. Further, identifying biological determinants of offspring obesity risk and their reversibility provides much needed evidence for women’s health policies.

**Group Members**

**Research Leader:** Associate Professor Rebecca Robker

**Research Fellow:** Kentyn Diener

**Senior Postdoctoral Researchers:** Lachlan Moldenhauer and David Sharkey

**Postdoctoral Researchers:** Peck Chin and John Schajinken

**PhD Candidates:** Dexter Chan, Ella Green, Tom Kieffer, Kayita Panir, Hanan Wahid and Bihong Zhang

**Research Officer:** Camilla Dorian

**Honours Student:** Holly Groome

**RRI Collaborators:** Simon Barry, Louise Hull, Wendy Ingman, Rebecca Robker and Jeremy Thompson

**External Collaborators:** Sylvain Chemtob (University of Montreal), Mark Hutchinson (University of Adelaide), David Olson (University of Alberta) and Kenner Rice (National Institute of Health, Washington)
Reproductive health significantly impacts a woman’s wellbeing throughout her life, irrespective of her choice to have children. In addition to producing eggs, the ovary’s hormones govern cyclical changes regulating somatic and psychological health at puberty, across the menstrual cycle, during pregnancy, and in parturition, lactation and menopause. Very common disorders of the ovary such as polycystic ovary syndrome affect up to 18% of women of reproductive age, and some women experience failure of the ovary, premature menopause, and ovarian cancers.

The Ovarian Developmental Biology group studies the cell biology of the ovary to understand how the ovary functions, and to discover what can wrong in disease. Ovarian cells carry out many of the unique functions of the ovary including growth of the follicle and hormone production, and if these cells do not function properly, infertility and hormone imbalances can result.

In 2016 we examined expression of genes in adult ovaries and fetal ovaries to identify genes which appear to be co-regulated. In particular, we found four PCOS-related genes to be highly expressed critically early in the developing ovary, indicating that PCOS may be entrained before birth. Continuing our collaboration with Dr Hugh Harris, we are testing the hypotheses that follicle behaviour changes with aging, leading to a deterioration of the eggs. Additionally, in collaboration with Dr Lisa Martin of Monash we discovered the function of enzymes involved in the synthesis of steroid hormones, which is providing us with new drug targets.

Ovarian follicles coordinate input from the maternal system and oocyte secreted factors to guide oocyte maturation. This interaction impacts the endocrine health of women and ultimately the lifelong health of offspring.

The Ovarian and Reproductive Cancer Cell Biology group focuses on defining the molecular pathways in the ovary required for the development of high competence oocytes which lead to healthy embryos and offspring. Ovarian follicles coordinate input from the maternal system and oocyte secreted factors to guide oocyte maturation, and this interaction impacts the endocrine health of women, and the developmental trajectory of the embryo and the fetus. These pathways are essential to the proper growth of ovarian follicles and their oocyte cargo are ideal targets for developing contraceptives that directly block ovulation. Cancers of the reproductive organs also respond to hormones which regulate their initiation and growth through similar pathways. The group seeks to harness this knowledge to improve reproductive health and to advance treatments for infertility and cancer.

In 2016 our group published a number of studies which characterised novel aspects of the molecular control of oocyte development and ovarian function. We demonstrated that a range of environmental and lifestyle stressors influence ovarian somatic cell function, and in turn, impact oocyte and embryo health. The mechanisms by which stressed oocytes signal to somatic cells and the response intended to prevent damage continue to be investigated. These stress response mechanisms are important in the initiation and progression of cancers of reproductive organs which are emerging from our recent research.
Neurological disorders are amongst the most common condition in children. The Neural Development group seeks to uncover the genetic causes of neurological disorders with a particular interest in epilepsy and intellectual disability, which affect approximately 3% of the population. Using mouse models and stem cells, the group seeks to understand the disease mechanism that underpins these debilitating conditions. Using CRISPR/CAS9 genome editing, the group established novel mouse models for neurological disease genes, which are providing unique insights into the genetic control of brain development and the biological basis of mental retardation and epilepsy. In 2017 the group will continue to expand their expertise in genome editing, and will analyse existing mouse models of epilepsy and intellectual disability to investigate disease mechanisms and explore new therapies.

**Group Members**
- **Research Leader:** Paul Thomas
- **Postdoctoral Research Fellow:** Stefka Tasheva
- **Research Assistants:** Sandie Piltz and Melissa White
- **PhD Candidates:** Ruby Moffat, Daniel Pederick, Louise Robertson and Ella Thomson
- **Masters Student:** Chandran Pfitzner
- **Honours Student:** Connor Larson
- **RRI Collaborator:** Jozef Gecz
- **External Collaborator:** Robin Lovell-Badge (Francis Crick Institute)

---

Accompanying oocyte maturation and fertilisation are dynamic molecular and biochemical processes that have a major impact on subsequent embryonic and fetal development, as well as adult health. The maturing oocyte and newly fertilised egg is extremely sensitive to the microenvironment within the maternal reproductive tract, and this is reflected in a process of ‘resetting’ of its epigenetic code. If the metabolic microenvironment surrounding the oocyte and embryo is altered as a result of IVF, diet and lifestyle factors, this will influence the epigenetic mechanisms that ultimately control the growth rate and development potential of the resulting fetus.

The Early Development group seek to explain how environmental stress impacts the metabolic and epigenetic development of the embryo, to produce new tools to measure the changes, and to successfully develop interventions to reduce the impact. In 2016 we continued to focus on the influence of hyperglycemia and hypoxia on oocyte and early embryo development.

In addition, our work within the ARC Centre of Excellence for Nanoscale BioPhotonics focused on transfer of optical technologies into the early embryo development field. From the application of new fluorophores, we are mapping the metabolic heterogeneity between individual blastomeres of embryos, revealing that whole embryo metabolic analysis often masks the variability between individual blastomeres. This will be further enhanced in 2017 with the establishment of a hyperspectral microscope in our laboratory. Additionally, we continued to explore the potential of autofluorescence measurements as novel biomarkers of oocyte and early embryo developmental competence, and further developed our understanding of the role of haemoglobin in oocytes and embryos.

**Group Members**
- **Research Leader:** Jeremy Thompson
- **Postdoctoral Researchers:** Hannah Brown and Melanie McDowall
- **Senior Research Officer and Laboratory Manager:** Lesley Ritter
- **Visiting Scientist:** Karen Kind
- **RRI Collaborators:** Michael Davies, Louise Hull, Michelle Lane, Mark Nottie, Sarah Robertson, Rebecca Robker and Darryl Russell
- **External Collaborators:** Andrew Abell, Hayley McGrice and Yvonne Stockes (University of Adelaide), Michael Barry, Rob Norman and Ryan Rose (Fertility SA), Jose Buratini (Universidade Estadual Paulista), Pablo Certica (University of Buenos Aires), Michel DeVos and Johan Smitz (Vrije Universiteit Brussel), David Gardner (University of Melbourne), Brant Gibson (RMIT), Robert Gilchrist (University of New South Wales), Ewa Goldys and Nicki Packer (Macquarie University), Jen Kelly and Alan Tilbrook (SARDI), David Mottershead (Keele University), Simon Walton (Australian Reproductive Technologies) and Deirdre Zander-Fox (Repromed)

---

**Annual Report 2016**
The Health of Women and Babies group seeks to improve health for women and babies by answering questions of major importance in the field of maternal and perinatal health; generating research evidence of the highest quality; and ensuring that research findings are incorporated into health care practice.

The multidisciplinary research team has strong local, national and international collaborations in maternal and perinatal research, with strategic commitment to research, education and training. High quality and timely maternal and perinatal research is conducted, evaluated and translated into clinical practice and health policy.

In 2016 the group continued to coordinate and collaborate in the conduct of major randomised clinical trials and studies including the MAGENTA Trial - administering magnesium sulphate at 30 to 34 weeks gestational age for fetal neuroprotection; STRIDER Trial - NZaus - Sildenafil Therapy In Dismal Prognosis Early-Onset Intrauterine Growth Restriction; and My Baby's Movements Trial – maternal awareness of fetal movements to prevent stillbirth.

Additionally, we are conducting a major translational health project funded by the Cerebral Palsy Alliance, the WISH Project (Working to Improve Survival and Health for babies born very preterm). We support authors within the Australian and New Zealand Satellite of the Cochrane Pregnancy and Childbirth Group who published 11 new protocols, 13 new reviews and 16 updated reviews in The Cochrane Library.

### Group Members

**Research Leaders:** Caroline Crowther and Philippa Middleton

**Research Fellows:** Shanshan Han, Zohra Lassi and Thach Tran

**Clinical Trials Manager:** Pat Ashwood

**Data Managers:** Vincent Ball and Sasha Zhang

**PhD Candidates:** Rehana Salam and Emily Shepherd

**Research Assistants:** Michaela Gooding and Elise Thompson

**Research Officers:** Melissa Ewens and Mary Paleologos

---

### Obstetric Medicine

**Professor Bill Hague**

*Improving outcomes for pregnant women with medical complications*

Over 10% of pregnant women experience medical complications. Complications may predate pregnancy, or develop during or after pregnancy, with some cases threatening the lives of both mother and baby. While early identification and appropriate therapy is vital, the research base for some therapeutic decisions is limited with insufficient evidence to support interventions.

The Obstetric Medicine group seeks to develop and evaluate interventions for two major medical disorders of pregnancy; gestational diabetes and preeclampsia, together with the most common liver disorder of pregnancy, intrahepatic cholestasis.

In 2016, the Treatment Of Booking Gestational diabetes Mellitus (TOBOGM) trial started recruitment. The Folic Acid Clinical Trial (FACT) completed recruitment and the data is at the cleaning stage. For the Metformin in Gestational diabetes (MiG) follow-up studies, two honours students completed preliminary work in the assessment of the 12 year olds, in collaboration with Drs Julia Pitcher and Luke Schneider.

Additionally, we collaborated with Prof Catherine Williamson (UK) on a major project to genotype women with previous severe early onset cholestasis in relation to their bile acid transporters, as well as completing a 10-year review of women with intrahepatic cholestasis at the Women’s and Children’s Hospital and the Lyell McEwin Hospital.

### Group Members

**Research Leader:** Bill Hague

**Research Coordinator:** Suzette Coat

**PhD Candidate:** Mansi Dass Singh

**Honours Students:** Jago MacDonald Van Dam and Oliva-Paris Quinn

**RRI Collaborators:** Jennifer Couper, Jodie Dodd, Ben Mol, Julie Owens and Julia Pitcher

**External Collaborators:** Hanneke de Vries (Free University Hospital), Michael Fenech (CSIRO), Anand Hardikar (University of Sydney), Laura Mage (University of British Colombia), Marc Rodger, Mark Walker and Shi-Wu Wen (University of Ottawa), Janet Rowan (Auckland Hospital), David Simmons (University of Western Sydney) and Catherine Williamson (King’s College London)
Lifelong Health Research

Professor Jodie Dodd

Start early, stay healthy, stop obesity

In Australia, 64% of adults and 25% of children are overweight or obese, representing a considerable health and economic burden for the community. Maternal overweight and obesity has been identified as a risk factor for infant and childhood obesity.

The Lifelong Health group recruit women into studies investigating dietary and physical activity interventions during pregnancy that may impact pregnancy and birth outcomes, and long-term health outcomes for children.

We have demonstrated that modest improvements in diet and physical activity of pregnant women with a BMI above the healthy range, led to a reduction in the risk of an infant being born with a birth weight above 4 kg.

In 2016 we completed follow-up assessments of 3 to 5 year old children born to women who participated in the LIMIT randomised trial; which assessed a diet and lifestyle intervention of 2,200 pregnant women who were overweight or obese. Anthropometric data was obtained from 75% of the children, with data to be analysed and published in 2017.

In 2017, we will continue current pregnancy lifestyle intervention studies and follow up children at six and 18 months, and we will finalise protocols for weight loss studies for overweight and obese women planning pregnancy.

Group Members

Research Leader: Jodie Dodd

Clinical Researchers: Chad Anderaen, Rosalie Grivell and Andy McPhee

Clinical Trials Manager: Andrea Deussen

Senior Statisticians: Jennie Louise and Lisa Yelland

Research Coordinator: Angela Newman

Research Dietitian: Shanshan Han

Data Manager: Sasha Zhang

Research Assistants: Lauren Cates, Ashlee Fairclough, Lavern Kannieappan, Erin Keen and Caroline Sheppard

PhD Candidates: Cecelia O’Brien, Cesey Nottage, Amanda Poprzecny and Tulika Sundernathan

Honours Students: Rebekah Clark and Rebecca Greco

Epigenetics and Genetics

Professor Stefan Hiendleder

Understanding epigenetic and genetic mechanisms and programming in prenatal development to optimise outcomes

Prenatal growth trajectory and birth weight are strongly associated with developmental capacity and health throughout life. We know that prenatal growth and weight at birth are determined not only by nucleotide sequence of genes, but also by epigenetic mechanisms such as imprinting, which regulate gene expression and phenotype at a higher level.

The Epigenetics and Genetics group focuses on dissection of the complex molecular genetic architecture of prenatal growth trajectory and birth weight. We uncover novel epigenetic and genetic effects on prenatal growth and their interactions with environmental factors.

In 2016 we used an animal model to determine drivers of largely sex-specific fetal overgrowth that manifests at birth and impacts postnatal growth and development. We found non-mendelian and sex-specific polar over-dominance effects, i.e. molecular, endocrine and phenotypic expression patterns depending on inheritance of maternal or paternal alleles, that drive fetal phenotype from mid-gestation onwards. Our observation of complex X dominance, and other novel interaction effects, in the IGF and Thyroid hormone axes, help to explain sex-specific fetal growth patterns and polar over-dominance in birthweight.

Our current work focuses on collaborative bioinformatic analyses of gene and miRNA expression networks in key tissues that control placental and fetal phenotype.

Group Members

Research Leader: Stefan Hiendleder

Postdoctoral Researcher: Dana Thomsen

PhD Candidates: Amanda Camp, Consuelo Estrella and Entesar Shuaib

Summer Students: Marie Breuer, Judith Fischer, Merle Drechsel and Birte Mertens

RRI Collaborators: Karen Kind, Kathy Gatford, Rory Windrim (Mt Sinai Hospital), Berthold Koletzko (Ludwig-Maximilians University), Debbie Lawlor (Bristol University), Pitta Luoto (UKK Institute for Health), Fionnuala McAuliffe (University College Dublin), Dorte Moller Jensen (Odense University), Susan Phelan (California Polytech State University), Lucilla Poston (King’s College London), Kristina Renault (University of Copenhagen), Phil Robinson (Women’s and Children’s Hospital), Wendy Scheil (South Australian Pregnancy Outcome Unit), Mette Tanvig and Christina Vinter (University of Southern Denmark), Shakila Thangaratinam (Queen Mary’s University London) and Liliana Voto (Juan A. Fernandez Hospital)

Affiliate Members: Jonathan Karnon, Maria Makrides and Prashanthan Sanders

External Collaborators: Armin Bogaerts (Limburg Catholic University), Emma Carlssen and Nina Gekker (University of Copenhagen), Roland Devlieger (University Hospitals KU Leuven), Jan Dickinson (King Edward Memorial Hospital), Matt Gillman (Harvard Pilgrim Health Care), Mark Kibby (Birmingham Women’s Hospital), John Kendrick, Greg Ryan and Rory Windrim (Mt Sinai Hospital), Berthold Koletzko (Ludwig-Maximilians University), Debbie Lawlor (Bristol University), Pitta Luoto (UKK Institute for Health), Fionnuala McAuliffe (University College Dublin), Dorte Moller Jensen (Odense University), Susan Phelan (California Polytech State University), Lucilla Poston (King’s College London), Kristina Renault (University of Copenhagen), Phil Robinson (Women’s and Children’s Hospital), Wendy Scheil (South Australian Pregnancy Outcome Unit), Mette Tanvig and Christina Vinter (University of Southern Denmark), Shakila Thangaratinam (Queen Mary’s University London) and Liliana Voto (Juan A. Fernandez Hospital)
Cerebral Palsy is a neurodevelopmental disability affecting posture and movement control for 1 in every 500 children. This disability greatly affects quality of life for those affected and their families. Its prevalence has not changed during the past 50 years and costs Australia billions of dollars per year. Previously, it was incorrectly believed that most cases of cerebral palsy followed trauma and low oxygen levels around birth. Now epidemiological evidence shows that most of the neuropathology has its origins well before labour in pregnancy, or at conception. The Australian Collaborative Cerebral Palsy Research group is investigating the contribution of genetic variants and epigenetic factors during fetal development and infancy in cerebral palsy causation. The group have recruited almost 500 families with a cerebral palsy child to the Biobank, and are now focusing on the genetic analysis and interpretation of the data. We are using genomics (WES and WGS sequencing), transcriptomics (RNA sequencing), epigenetics and cell (primary neurons and stem cells) and animal modelling (zebrafish) to address the aetiology of this heterogeneous group of disorders.

In 2017–18, the Cerebral Palsy Alliance will fund the collaboration with the epigenetics group at Murdoch Children’s Research Institute to apply multi-omics to differentiate between the genetic and epigenetic components of cerebral palsy for 15 families enrolled with identical twins, where only one twin is affected.

Emeritus Professor Alastair MacLennan AO

Uncovering the genetic causes of cerebral palsy via new generation sequencing technologies

Medical procedures around the world are often conducted without evidence that interventions are beneficial to the patient and will not cause harm. This is unfortunately common, and such practices may have been conducted for years, or even decades, with limited questioning as to the effectiveness of treatments. The Evidence Based Women’s Health Care group believes all medical interventions require an underlying knowledge base, demonstrating treatments are expected to do more good than harm. The group aims to provide insight on the effectiveness of all medical interventions in reproductive health, ideally through large international collaborations in randomised clinical trials, to provide insight on the available evidence tailored to the individual patient for both patients and doctors. In 2016, our research findings which challenged current practice included:

> The finding that a single fasting plasma glucose measurement, rather than a serial measurement, can predict whether women are at increased risk of having a large for gestational age baby when testing for gestational diabetes
> Demonstration that a 6-month structured intervention program to facilitate weight loss preceding infertility treatment, did not improve rates of vaginal birth of healthy singletons at term during 24 months of follow-up
> Demonstration that induction of labour with oral misoprostol versus a balloon catheter are equivalent in safety and effectiveness
> Reports that routine hysteroscopy does not improve livebirth rates in infertile women with a normal transvaginal ultrasound of the uterine cavity scheduled for a first IVF treatment

Evidence Based Women’s Health Care

Professor Ben Mol

Evaluation of the effectiveness of health care for women and implementation of best practice

Group Members

Research Leaders: Alastair MacLennan and Jozef Gazcz

Postdoctoral Researchers: Mark Corbett and Clare van Eyk

Study Coordinator: Jesia Berry

Research Officer: Kelly Harper

Research Assistants: Mahalia Frank and Hannah Macdonald

Affiliate Members: Christopher Barnett, Eric Haan, James Rice, Ray Russo and Suzanna MacLennan

RRI Collaborator: Ben Mol

External Collaborators: Jeff Craig (Murdoch Children’s Research Institute), Michael Krue (University of Arizona), Mathew Bambridge and Richard Gibbs (Baylor College) and Daniel Geschwind (UCLA & UCSF)

External Collaborators:

Professor Siladipta Bhattacharya (University of Aberdeen), Arni Coomarasamy (University of Birmingham), Tony Duan (Shanghai Tongji University), Bill Grobman (Northwestern University), Justus Hofmeyr (University of Witwatersrand), Rodolfo Pacagnella (University of Campinas), Shakila Thangaratnam (Blizard Institute), Homan Tuong (Vietnam National University), Jie Qiao (University of Beijing) and Xiaoke Wu (Heilongjiang University of Chinese Medicine).
The four main complications of pregnancy - preeclampsia, preterm birth, intrauterine growth restriction and gestational diabetes - affect 1 in 4 first pregnancies and are life threatening to the mother and/or baby in up to 6% of pregnancies. Globally more than 300,000 women die each year from complications of pregnancy and childbirth, with 99% of these in developing nations. Additionally, there are 15 million preterm births annually and this is considered the greatest factor contributing to the 6 million children who die before their 5th birthday. There are currently no screening tools in clinical practice to identify pregnant women at risk, largely because of a poor understanding of the pathogenesis of pregnancy complications and the complex inter-relationships in causal factors.

The Placental Development group have established several pregnancy cohorts, assembling large databases and biobanks, with their current research focused on: the molecular profile of the placenta across gestation at the genome and epigenome levels; identifying molecular profiles in maternal blood that reflect placental health; molecular mechanisms by which fetal sex impacts pregnancy outcome; and how maternal micronutrient status impacts placental function and pregnancy outcome. In 2016 after a decade of research and development, the group filed a PCT on their algorithms that predict risk for pregnancy complications. The patent was licensed by Karygen Health, and together we are progressing a screening test for use in the antenatal clinic. Our molecular expertise together with our knowledge of the placenta and pregnancy underpinned the award of a NIH NICHD Human Placenta Project Grant in late 2016.

**Group Members**

**Research Leaders:** Claire Roberts and Gus Dekker  
**Research Fellow:** Tina Bianco-Miotto  
**Postdoctoral Researchers:** Prabha Andrawera, Jessica Grieger, Amanda Higet, Tanja Jankovic-Karasoulos, Jessica Phillips, Shalem Leemaqz and Dale McAninch  
**Visiting Scientist:** Gabriela Leghi  
**Visiting PhD Candidate & Clinical Research Assistant:** Petra Verburg  
**Research Assistant:** Dylan McCullough  
**Research Midwives:** Julia Dalton, Samantha Pahl and Maria Viscione  
**PhD Candidates:** Julia Dalton, Benjamin Mayne, Dee McCormack and Rebecca Wilson  
**Technical Officer:** Caitlin McCullough  
**Honours Students:** Emma McBean, Michelle Plummer and Alexandra Samantha  
**RRI Collaborators:** John Lynch, Helen Marshall, Ben Mol, Michael Sawyer and Sarah Robertson  
**External Collaborators:** Louise Kenny (University College Cork), Lesley McCowan (University of Auckland) and Alicia Smith (Emory University)
Psychosocial health. This can lead to reduced development, affecting both cognitive and life is associated with impaired child neuro-
Poor health during pregnancy and in early circumstances; for example, women living in explo-
Determined biological and social determinants of health and wellbeing that have immediate consequences as well as enduring legacies. The LIGHT group characterises and explores the health of women in a range of biological and social determinants of poor health in women and the implications for their lives and identity, as well as the health of children in the next generation.

In 2016, our work program included a review of the international literature on night shiftwork undertaken by women and influences on reproductive health, specifically difficulty conceiving and miscarriage. Preliminary evidence suggests that night shift work may give rise to menstrual cycle disturbances and could contribute to endometriosis. We investigated the health of the surviving twin when one of the pair dies in early gestation (6-8 weeks) within a large group of mothers who conceived with assisted reproductive technologies. We found that the surviving twin had an increased risk of major congenital malformations, providing another reason for single embryo transfer to be promoted worldwide as best practice.

Group Members
Research Leaders: Michael Davies and Vivienne Moore
Teaching and research academic: Lynne Giles

Perinatal Health and Child Development

Dr Nicolette Hodyl

Improving health outcomes for mothers and babies by providing them with the best start to life.

Poor health during pregnancy and in early life is associated with impaired child neuro-
development, affecting both cognitive and psychosocial health. This can lead to reduced academic achievement and labour market success, as well as negative health behaviours, and difficulties with interpersonal relationships across the life course. The risk for these poor outcomes is strongly linked with socio-
economic disadvantage. Intervening to reverse the negative impact of these exposures requires early identification of “at risk” children. The Perinatal Health and Child Development group seeks to identify and protect against the impact of adverse exposures in pregnancy and early life on both maternal health and child development. We work closely with clinicians to integrate clinical, epidemiological and basic science measures to understand mechanisms and identify early indicators that precede poor outcomes. Ultimately this will facilitate early interventions that improve child health.

In 2016 we commenced a randomised controlled trial comparing two doses of iron for pregnant women with iron deficiency or anaemia to assess iron status, maternal psychosocial health and birth outcomes. In collaboration with Prof Claire Roberts, we commenced a follow-up study of ten year old children of mothers involved in the SCOPE birth cohort.

In the Women’s and Children’s Neonatal Unit, we recruited neonates who required a blood transfusion to compare the efficacy of a new washed blood product. This study incorporates a basic science component to understand the mechanisms leading to poor outcomes, including the measurement of inflammatory and endothelial activation biomarkers.

Group Members
Research Leader: Nicolette Hodyl
PhD Candidates: Natalie Aboustate, Rebecca Collins, Amy Garrett, Amy Keir and Tara Crawford
Masters Students: Megan Bater, Tijana Gajic and Kathryn Martinello
Affiliate Member: Bernd Froessler
RRI Collaborators: Chad Andersen, Julia Pitcher, Michael Ridding, Claire Roberts and Michael Stark
External Collaborators: Angela Clow (University of Westminster), Andrew Lawrence (SAA Pathology), Oliver Schubert (Lyell McEwin Hospital) and David Torpy (Royal Adelaide Hospital).
The early environment, before and shortly after birth, influences an individual’s risk of developing major non-communicable diseases including diabetes, cardiovascular disease, impaired neurological function and allergy. Importantly, the effects of adverse prenatal exposures are not always permanent or irreversible, opening the way for interventions during early life to improve outcomes.

The Early Origins of Health and Disease group seeks to optimise the lifelong health of the next generation by understanding how early life exposures cause long-term changes in health. We are developing interventions to reduce the risk of non-communicable disease with two main approaches: developing and assessing interventions during pregnancy and postnatal life to improve outcomes after an adverse early life exposure; and developing interventions to improve placental development and function that will reduce the risk of a fetus being subjected to a restricted in utero environment or preterm birth.

In 2016 we evaluated the metabolic benefits of exercise training in adulthood, after intrauterine growth restriction (IUGR). Before training, IUGR progeny were similarly or more active than control progeny, suggesting that poorer metabolic control after IUGR is unlikely to be due to being more sedentary. We found that adult exercise training did not give the same benefits for glucose control and insulin sensitivity in IUGR adults as it did in normal individuals. This suggests that exercise interventions may need to be provided earlier in life to “reset” the individual and improve adult metabolic health.

### Group Members

**Research Leaders:** Kathryn Gatford and Julie Owens

**Emeritus Professor:** Jeffrey Robinson

**PhD Candidates:** Patricia Grant, Dane Horton, Hong Liu and Amy Wooldridge

**RRI Collaborators:** Jodie Dodd, Stefan Hiendleder, Karen Kind, Julia Pitcher and Claire Roberts

**Key Collaborators:** Robert Bischof and Jane Black (Monash University), Vicki Clifton (Mater Medical Research Institute), Karen Kind and Beverly Muhlhausler (University of Adelaide), Debbie Lawlor, Glenn McConnell (Victoria University), Karen Morris (University of NSW), Tim Moss (Hudson Institute of Medical Research), Caroline Relton (Newcastle University) and Rebecca Simmons (University of Pennsylvania)

---

**Circadian Physiology**

**Professor David Kennaway**

*Understanding how circadian rhythms regulate metabolism, reproduction and fetal programming of adult disease*

Circadian rhythms regulate sleep, metabolism and reproduction, and can be disrupted by shift work, jet lag, advanced or delayed sleep wake syndrome and non-24 hour sleep-wake disorder. Shift workers are at greater risk of obesity, diabetes and metabolic syndrome, and there is emerging evidence to suggest shift work impacts upon fertility and pregnancy outcomes, where the long-term impact upon the developing fetus is unknown. This is of concern given that 16% of all Australian workers, including 140,000 women of reproductive age, undertake shift work.

The Circadian Physiology group aims to understand the impact of circadian rhythm disruption, before and during pregnancy, on fertility, fetal development and the long-term metabolic health of offspring. We use both rodent and large animal models for a mechanistic analysis of the impact of maternal circadian rhythm disruption upon the fetus at the stage of development most susceptible to disruption.

In 2016 in collaboration with Dr Kathy Gatford, we commenced assessing pregnancy outcomes and metabolic programming in sheep exposed to simulated shift work in utero. We exposed our first cohort of ewes to a simulated shift work protocol whereby the timing of light exposure, food access and activity is manipulated such that the sheep experience three “night shifts” per week. We demonstrated that exposure to this protocol leads to disrupted behavioural, endocrine and molecular rhythmicity of the pregnant ewe. Studies are now underway to assess the impact from birth through to young adulthood.

### Group Members

**Research Leader:** David Kennaway

**Research Fellow:** Tamara Varcoe

**Research Officers:** Hong Liu and Mark Salkeld

**RRI Collaborators:** Michael Davies and Kathy Gatford

**External Collaborators:** Tim Kuchel (SAHMRI) and Glenn McConnell (Victoria University)
Experiences throughout life constantly shape and rewire the brain. This occurs through changing the strength of existing neural connections and developing new connections, and is known as neuroplasticity. Neuroplasticity underlies our ability to learn and remember new skills, to forget information, and to recover from injuries to the brain. While this ability is lifelong, the brain is at its most plastic in fetal life and early childhood. This facilitates the rapid learning of our early development, but it also makes the brain more vulnerable to adverse experiences and injury in early life. During this time the brain is less able to adapt appropriately to experiences and reduces the ability to recover from injury in later life.

NeuroPAD seek to understand how experiences and injuries alter human brain motor and cognitive function throughout the lifespan, and to develop effective therapies and interventions to ameliorate the negative consequences. During 2016 NeuroPAD conducted research on three major projects; examining changes in brain plasticity following ischemic stroke; uncovering whether preterm birth is associated with impairments in brain plasticity and function; and exploring several neurophysiological markers for detecting early cognitive impairment.

Genetic Epidemiology

Professor Lyle Palmer

*Investigating the epidemiology and genetic epidemiology of the origins of health and disease*

The burden of disease in pregnancy, birth and childhood is increasing, both clinically and economically. In order to disentangle the complex genetic and environmental determinants of key phenotypes in early life and childhood, large-scale and comprehensive population-based resources are required. The Genetic Epidemiology group seeks to understand the genetic and environmental determinants of complex disorders such as preterm birth, pre-eclampsia, growth in utero, and development over childhood (ie growth, lung function and blood pressure trajectory). We approach these questions from a life course epidemiological perspective. Our focus is on applying multidisciplinary approaches using combined statistical, epidemiological, genetic, molecular, informatic and clinical disciplines to better understand and treat important diseases. Highlights of the year in 2016 include; the publication of the first genome-wide association meta-analysis of blood pressure across infancy and childhood; and the acceptance of our first paper in precision radiology. Our focus in 2016 was to construct a population-based resources based upon SA-linked administrative data. This work progressed rapidly, and includes the creation of a genealogical resource to link SA families within the core SA data linkage holdings and an SA Twins Register.

Neuromotor Plasticity and Development (NeuroPAD)

Professor Michael Ridding and Dr Julia Pitcher

*Investigating how early life events affect the development of the human brain and its ability to learn and remember, and to recover from injury or illness*

NeuroPAD seek to understand how experiences and injuries alter human brain motor and cognitive function throughout the lifespan, and to develop effective therapies and interventions to ameliorate the negative consequences. During 2016 NeuroPAD conducted research on three major projects; examining changes in brain plasticity following ischemic stroke; uncovering whether preterm birth is associated with impairments in brain plasticity and function; and exploring several neurophysiological markers for detecting early cognitive impairment.

Group Members

**Research Leaders:** Michael Ridding and Julia Pitcher

**Research Fellow:** Mitchell Goldsworthy

**Postdoctoral Researchers:** Brenton Hordacre and Luke Schneider

**Paediatric Neurologist:** Nicholas Smith

**Visiting Scientist:** Zhimai Lyu

**Research Officer:** Joanne Collins

**PhD Candidates:** Rebecca Collins and Sam Darvishi

**Research Assistants:** Amy Garrett and Lynton Graetz

**Honours Students:** Jessica Martin, Samantha Newell, Olivia-Paris Quinn and Jago Van Dam

**RRI Collaborators:** Jodie Dodd, Bill Hague, Nicolette Hodyl and Michael Stark

**External Collaborators:** Angela Clow (University of Westminster), Paul Fitzgerald (Monash University), Lorimer Moseley (University of South Australia), John Rothwell (University College London) and Ulf Ziemann (University Tubingen)
Events, illnesses and treatments in the newborn period can have a profound and long-term effect on growth, development and life-long health. Integrating clinical and basic science research projects is critical to advancing our understanding of the major morbidities that complicate preterm birth.

The Neonatal Medicine group integrates basic and clinical research to inform best practice and to ensure neonatal care provided within the Women’s and Children’s Hospital is world class. The group operates in a family-centred philosophy towards the care of the newborn infant, which has fast-tracked improvements in day-to-day care. Our research operates within four themes: oxygen physiology, neonatal nutrition, transfusion medicine and neurodevelopmental outcomes.

2016 saw the further development of our research program, particularly focusing on multi-disciplinary involvement and active engagement with major stakeholders. Our research streams continued to attract national and international attention with significant publications focusing on oxygen physiology and neonatal nutrition with SAHMRI.

Our neurodevelopmental research program continued to expand with successful partnerships established with Miracle Babies who are supporting work in our own nursery aimed at improving outcomes in those born preterm through targeted parental involvement, and with the Department of Education and Independent Schools organisations focusing on a Reggio Emelia philosophy to the care of the family as a whole.

**Group Members**

Research Leader: Michael Stark
Clinical Partners: Chad Andersen and Andrew McPhee
Consultant Neonatologist: Amy Keir
Masters Students: Megan Bater and Kathryn Martinello
PhD Candidates: Natalie Aboustate and Tara Crawford
RRI Collaborators: Jodie Dodd, Nicolette Hodyl, Ben Mol and Claire Roberts

Fluorescent In Situ Hybridization of long non-coding RNA in the ovarian follicle.

Dr Sonja Frolich, Prof Darryl Russell.
How does a healthy immune system balance a swift response to fight-off pathogens, with maintaining tolerance to harmless challenges such as food, normal body tissues, and the fertilised egg in pregnancy? A rare but vital subset of immune cells known as regulatory T cells (Tregs) is believed to play a critical role. Tregs are essential for immune tolerance, and Treg defects are implicated in autoimmune disorders, infertility and pregnancy disorders, cancer and other diseases. The Molecular Immunology group conducts research to understand and characterise Tregs under normal conditions, with a view to understanding what goes wrong with these cells in immunological disorders. We have launched a new initiative to map all of the genetic risk of autoimmune disease to the genes that are dysregulated using Chromatin Conformation Capture. This approach is used because the majority of the genetic variation in these diseases is in noncoding regulatory regions, and the targets of these regions cannot be predicted by bioinformatics alone. Understanding the impact of these alterations will inform new therapies to correct defects, including immunotherapy.

As part of a biomarker discovery program we have identified a novel biomarker on human Treg cells, named Pt16, and we are currently testing its ability to identify stable Tregs, or to be utilised as a diagnostic tool for loss of Treg function in disease. We are developing a Pt16 Treg cell therapy that could be administered to patients to reset or redirect the immune system to prevent autoimmune disease, to promote tolerance to pregnancy, or to prevent transplant rejection.

**Group Members**

**Research Leader:** Simon Barry

**Postdoctoral Research Fellows:** Veronika Bandara, Cheryl Brown, Christopher Hope and Timothy Sadlon

**PhD Candidates:** Kristen Malatesta, Vincent Wong and Ying Ying Wong

**Honours Student:** Nicole Craig

**Affiliate Member:** Stephen Pederson

**RRI Collaborators:** Jennifer Couper, Wendy Ingrman, Sarah Robertson and Darryl Russell

**External Collaborators:** Marc Beyer and Joachim Schultz (LIMES, Bonn), Dan Campbell and Thomas Duhen (Benoraya), Greg Goodall (Centre for Cancer Biology), Randall Grose (SAHMRI), Giovanna Lombardi and Tim Tree (King’s College London), Kellie MacDonald (QIMR), Raymond Steptoe (Diamantia Institute) and Kathryn Wood (Oxford University)

---

Type 1 diabetes is a major cause of morbidity and mortality in young Australians. It is caused by autoimmune destruction of the pancreatic beta cells, the only insulin secreting cell type in the body. The Transplantation group performs clinical islet cell transplantation as a part of South Australia’s only Nationally Funded Centre for Islet Cell Transplantation. This is currently the only treatment option for type 1 diabetes with hypoglycemic unawareness. In the laboratory we investigate new sources of insulin-secreting tissue for transplantation as well as novel ways to protect transplanted pancreatic beta cells from destruction by the immune system. This involves 3D printing, material science and use of specialized endothelial progenitor cells (EPC) and T regulatory cells.

During 2016 we generated insulin-secreting tissue from porcine embryonic stem cells with collaborators. This is a potentially exciting infinite source of beta cells for transplantation and the treatment of type 1 diabetes. Defined differentiation protocols have been developed and the resulting cells characterised for their insulin-secretion capacity. The group also continued work on novel means to alter the immune system and protect pancreatic beta cells by exploring the IGF-II pathway and transducing pancreatic beta cells with programmed death ligand-2 (PDL-2), a T cell death ligand which deletes both allo-reactive and auto-reactive T cells.

**Group Members**

**Research Leader:** Toby Coates

**Principal Medical Scientist:** Christopher Drogemuller

**Senior Medical Scientist:** Svjetlana Kireta

**Senior Postdoctoral Researchers:** Darling Rojas-Canales and Plinio Hurtado

**Senior Scientists:** Jodie Nitschke and Danielle Penko

**Clinical Researchers:** Rob Carroll, Shilpa Jesudason and Chen Au Peh

**Technical Officer:** Julie Johnston

**PhD Candidates:** Ernesto Hurtado Perez, Francis Kette, Bron Lett, Sebastian Stead and Kisha Sivanathan

**Masters Students:** Kyung Kang and Juewan Kim

**RRI Collaborator:** Mark Nottie

**External Collaborators:** Shane Grey (Garvan Institute of Medical Research) and Claudine Bonder (University of South Australia)
The incidence of type 1 diabetes in childhood has increased worldwide, doubling in Australia over the last 20 years; suggesting the modern changing environment plays a role in type 1 diabetes. The specific environmental factors that contribute to and protect against type 1 diabetes are unknown, although it is likely that exposures in pregnancy and very early life are critical. The Diabetes group conducts clinical and laboratory research focusing on:

- Environmental exposures that drive diabetes
- Immune regulatory function
- The protection of blood vessel health in children and adolescents

Our type 1 diabetes clinic is part of the Australian JDRF register with 697 SA patients being part of this national effort to monitor the health of these children over time. We have ongoing input into international guidelines for the management of type 1 diabetes in children.

In 2016, the ENDIA pregnancy to birth cohort produced the first results on the microbiome/virome/nutrition during gestation. Additionally, we completed studies of the benefits of metformin in children with type 1 diabetes who are overweight, and the impact of daily activity and dietary sodium on blood vessel health.

In 2017 we aim to: continue to discover the best medications to prevent blood vessel and renal disease in individuals with type 1 diabetes; lead and recruit into the ENDIA cohort study; reveal interactions between the immune system and the gut that drives type 1 diabetes; and develop new insulin pumps.

**Group Members**

| Research Leader: Jennifer Couper |
| Clinical Academic – Paediatric Endocrinologist: Alexia Peña |
| Adolescent Physician: Jemma Anderson |
| Post-Doctoral Research Fellow: Oana Maftei |
| Clinical Pharmacist: Catherine Leggett |
| Paediatric Sonographer: Roger Gent |
| Centre of Research Excellence Project Manager: Megan Penno |
| ENDIA Study Project Manager: Rebecca Thomson |
| Clinical Researcher: Priya Augustine |
| Clinical Research Recruitment Coordinator: Kelly McGorm |

**Research Officers:** Roger Gent and Christopher Hope

**Research Nurses:** Sarah Beresford, Meredith Krieg, Alison Gwiazdzinski and Danielle Edwards

**Paediatric Phlebotomist:** Ben Ramoso

**Research Dietititans:** Sarah Toome and Rachel Battersby

**PhD Candidate:** Jessica Phillips

**Masters Student:** Myf Geyer

**RRI Collaborators:** Simon Barry, Jodie Dodd and Lynne Giles

**External Collaborators:** National: Fergus Cameron (Royal Children’s Hospital), Peter Colman (Royal Melbourne Hospital), Maria Craig and Kim Donaghe (University of Sydney), Elizabeth Davis, Tim Jones and Aveni Haynes (Telethon Kid’s Institute), Grant Morahan (Harry Perkins Institute), Mark Harris (University of Queensland), Len Harrison, Tony Papenfuss and John Wentworth (Walter and Eliza Hall Institute), Michael Horowitz and Chris Rayner (Royal Adelaide Hospital), Bill Rawlinson (University of New South Wales), Peter Vullermin (Barwon Health), Richard Sinnott (University of Melbourne) and Maria Makrides (SAHMRI), International: Joe Petrosino (Baylor College of Medicine), Jayne Danska (Sick Kids Toronto), David Dunger (University of Cambridge) and Matthew Doogue (University of Otago).
Developmental & Genetic Immunology

Professor Antonio Ferrante

Cellular signalling pathways in childhood allergy and inflammatory disorders

Children afflicted with autoimmune and inflammatory diseases experience life-long pain and disability. A powerful approach in the prevention and management of inflammatory reactions is to target the intercellular and intracellular communication signals that dictate aggressive cellular behaviour in the tissues of patients with disorders such as allergy, juvenile arthritis, diabetes and cystic fibrosis.

The Developmental and Genetic Immunology group aims to identify signalling molecules that regulate immune cellular functions in inflammation. We seek to categorise the interactive network between the intercellular signalling inflammatory mediators, their receptors and the intracellular signalling pathways, which control the initiation, manifestation and resolution of the inflammatory disease.

Neurogenetics

Professor Jozef Gecz

Investigating the genetics and biology of human neurodevelopmental disabilities

Intellectual disability, epilepsy, autism and cerebral palsy are life-long neurodevelopmental disabilities which affect more than 4% of children. Precise diagnosis and the knowledge of the underlying disease mechanisms are the first steps towards better management and future treatment for these disorders.

The Neurogenetics group seek to provide children living with neurodevelopmental disabilities precise molecular and clinical diagnosis to facilitate individualised health care. As part of this effort we identify novel genetic and biological determinants of normal develop-ment. We study our patient genomes using latest genomic technologies to pinpoint the responsible driver mutations in known or novel genes. Once identified we study these mutations using sophisticated stem cell and neuron models as well as small animal models.

Our 2016 research on the intricacies of T cell maturation during the neonatal period and allergy development in children, has established a basis for T cell deficiency as a physiological immaturity of the neonate with plasticity for healthy development through an environmental/nutritional influence on T cell development from an immature Th2 cytokine profile to a mature Th1 profile. We identified that PKCz is a key signalling molecule regulating this development which is fine-tuned by nutrients operating via an epigenetic mechanism. This immaturity of the PKCZeta expression in neonates ensures phenotypic plasticity during early immune development but also provides a window of opportunity to intervene in a child’s life for healthy outcome.

Group Members
Research Leader: Tony Ferrante
Senior Scientists: Alex Quach and Nick Gorgani

Principal Scientist: Charles Hi
Clinical Researcher: Tatjana Banovic
Postdoctoral Researcher: Anthony Polliard
PhD Candidates: Marwah Basin Khalih, Jovanka King, Khaled Perveen and David Shields
Research Assistant: Annabelle Small
Masters Students: Yaseen Mohamed, Hasmita Patel, Trishi Putty, Annabelle Yap and Xei Zheng
Honours Student: Any Ngo
Trainees in Lab Medicine: Asmita Patel, Nikida Patel and Shannon Glovik
RRI Collaborators: Simon Barry, Jennifer Couper, Jozef Gecz and Declan Kennedy
External Collaborators: Catherine Abbott (Flinders University), Paul Anderson and Howard Morris (University of South Australia), Peter Hofmann and Susanna Proudman (University of Adelaide), Suresh Mahaligam (Griffith University), Susan Prescott (University of Western Australia) and Harald Renz (Phillips University Marburg)

In 2016 we identified several novel genes crucial for normal human brain development, including KCNA2 in episodic ataxia and pharmaco-responsive epilepsy; CLCN4 in syndromic intellectual disability, altered behaviours and seizure disorders in males and females; POGZ in intellectual disability and autism or USP9X in females with developmental delay and congenital malformations. After 25 years of investigations we resolved a large Australian family with more than 120 individuals, 23 of these affected with mild intellectual disability, through the identification of a non-coding regulatory mutation in a synaptic protein DLG3. In 2017 we will harvest our established genome editing technologies to manipulate pluripotent stem cells, human or mouse, to be able to model identified human disorder mutations.

Group Members
Research Leader: Jozef Gecz
Postdoctoral Fellows: Lachlan Jolly and Mark Corbett
Research Officers: Atma Ivancevic, Duyan Pham and Raman Sharma
Research Assistants: Renee Carroll, Alison Gardner, Brett Johnson Marie Shaw, Renee Schulz and Annie Sun
PhD Candidates: Deepit Domingo, Claire Homan, Kirsty Kolic, Debrah Renders and Stanley Tan
Overseas Visitor: Sunita Koirala (Kathmandu, Nepal)
RRI Collaborators: Alastair MacLennan, Cheryl Shoubridge and Paul Thomas
External Collaborators: Sam Berkovic and Ingrid Scheffer (University of Melbourne), Evan Etchler (Washington University), Dan Geschwind and Miles Wilkinson (University of California, Los Angeles) and Vera Kescheier (Max Planck Institute)
Prevention and management of food allergy and allergic disease

In westernised and developed countries there is an evolving epidemic of allergic disease that primarily affects children under 5 years of age. Recent studies have shown that one in ten Australian children aged 12 months have an egg allergy - the highest documented rate in the world. The Allergy group’s goal is to understand the immunological mechanisms associated with the prevention and management of food allergy (in particular egg allergy), and to understand the role of early-life egg exposure in the development of tolerance to egg.

During 2016 multiple trials were completed looking at early versus late introduction of egg into an infant’s diet, the possible therapeutic benefits of heat-treated egg, and fish oil supplementation in pregnancy. The Starting Time for Egg Protein randomised controlled trial demonstrated that early introduction of egg does not prevent egg allergy and hence is different to peanuts where there is evidence to suggest early introduction can prevent peanut allergy. This evidence will now be translated into infant feeding advice and contribute to the international literature on this topic.

Improving monitoring of vaccine safety

When a new vaccine or seasonal flu vaccine is licensed for use, safety information about potential rare reactions is incomplete. The current system of surveillance for these events lacks the capability to detect these reactions in a timely way. The Vaccine Safety group aims to address the current deficiencies in surveillance by exploring health provider reporting, active sentinel surveillance and e-Health, including data linkage.

In 2016, a collaboration with the Global Vaccine Safety Team at the World Health Organisation continued, which included a project with the Adelaide Health Technology Assessment Team to complete systematic reviews on vaccine safety and the development of communication material for global dissemination. Current projects include linked data from the Australian Childhood Immunisation Register with the National Death Index and state-based morbidity data, and the development of an SMS-based real time surveillance system for all vaccines in all ages. Additionally, the group is collaborating on a number of studies including sentinel surveillance, examining convulsions after vaccination, and the association between food allergy and the pertussis vaccination.

Group Members

Research Leader: Michael Gold
Head of Discipline: Nigel Stocks
Senior Researcher: Annette Braunack-Mayer
Postdoctoral Research Fellow: Merryn Netting
Affiliate Senior Lecturer: Karen Best
Research Coordinator: Gabriella Lincoln
Research Officer: Alexis Wheeler
Research Nurses: Christine Health and Mary Walker
PhD Candidate: Katherine Duszynski
RRI Collaborators: John Lynch and Helen Marshall
External Collaborators: Katie Allen and Mimi Tang (Murdoch Children’s Research Institute), Madhava Balakrishna (World Health Organisation), Maria Makrides (SAHMRI), Priscilla Nyambayo (Medicines Control Authority of Zimbabwe), Nicole Pratt (University of South Australia) and Susan Prescott (Telethon Kid’s Institute)

Professor Michael Gold

Michael leads two research groups in the areas of allergy and vaccine safety
Sleep disordered breathing in children is common, with as many as 10% of children reported to snore on a regular basis. The severity of sleep disordered breathing (SDB) ranges from primary snoring, to the more severe obstructive sleep apnea and a reduction in blood oxygen levels and increase in carbon dioxide profile. Even relatively mild condition has significant daytime effects on neurocognitive domains and behaviour.

The Sleep Disorders group seeks to understand the impact of poor sleep on the health of the developing child. Our multidisciplinary team of researchers primarily focuses on the effects of sleep disordered breathing on neurocognition, cardiovascular development, and immune, metabolic and nervous system function. We are also one of the first groups to evaluate the effect that SDB has on the oral microbiota in children. Our strong collaboration with the University of Adelaide’s, School of Dentistry has also allowed us to examine the contribution that dental/facial morphology plays in the onset of the disorder.

During 2016 the team focused on: assessing the effects SDB has on the physiology of the developing child, including evaluation of cardiovascular, autonomic nervous system and inflammatory response and changes in oral microbiota and dento/facial morphology; post-operative neurocognitive evaluation of children who had previously been assessed and treated with adenotonsillectomy; and recruiting participants into a multicentre study looking at the efficacy of adenotonsillectomy treatment for SDB in young preschool children.

Group Members
Research Leader: Declan Kennedy
Co-Research Leaders: Kurt Lushington and James Martin
Medical Scientist: Anna Kontos
Principal Scientist: Yvonne Pamula
Honours Student: Charmaine O’Reilly
RRI Collaborators: Jennifer Couper and Antonio Ferrante
External Collaborators: Mathias Baumert and Scott Willoughby (University of Adelaide), Roger Gent (Women’s and Children’s Hospital) and Quenten Schwarz (University of South Australia)
Health and developmental gaps appear early in life, with significant variability between children. To provide all children with the best start to life, early intervention is crucial to improve health and developmental trajectory, especially for disadvantaged children.

The BetterStart Child Health and Development group aims to understand how genetic, social and environmental factors interact to enhance children’s physical, mental, social and emotional health, and their cognitive ability and academic achievement. Our focus is on interventional epidemiology spanning health and development from the perinatal period into adolescence.

Our research in 2016 spanned data-linkage studies of perinatal factors and learning outcomes, and child protection. Observational research included the importance of quality child care, the role of self-regulatory abilities on academic achievement, using contrasting study designs to improve causal inference, and the prediction of poor child development from routinely collected perinatal data.

Our newly funded NHMRC CRE EMPower: Health systems, adversity and child wellbeing will spearhead development of several pragmatic randomised controlled trials, and with core funding from the SA Department of Premier and Cabinet, we will build even greater capacity in data linkage and routine cost-effective evaluation of health, care and education services for children.

Infections such as whooping cough, meningococcal disease and influenza still cause death and disability in young infants. One in 10 children who are diagnosed with meningococcal disease will die from the infection and a further 40% will live with a life-long disability.

The Vaccines and Infectious Disease group aims to improve protection and outcomes for children from these serious infections. We investigate and measure the dual benefit of immunisation strategies optimising protection for babies, children and pregnant women against serious infectious diseases through improved immunisation strategies.

In 2016, we secured funding for the BPartOff study, which will enrol up to 60,000 years 10,11 and 12 high school students in SA, to assess the impact of the Meningococcal B vaccine on carriage of the meningococcus bacteria in adolescents. The results of this study will be used to inform MenB vaccine policy in Australia and internationally.

**BetterStart**

**Professor John Lynch**

*Providing children with the best start in life*

**Group Members**

**Research Leader:** John Lynch

**Postdoctoral Researchers:** Catherine Chittleborough, Angela Gialamas, Janet Grant, Luke Graeskiowam, Dandara Stark, Murthy Mittinty, Alicia Montgomery, Rhiannon Pilkington, Alyssa Sawyer, Helena Schuch and Lisa Smithers

**Affiliates:** David Gonzalez-Chica, Amelia Maika and Anna Pearce

**RRI Collaborators:** Gus Dekker, Nicki Hodyl, Ben Mol, Claire Roberts and Michael Sawyer

**External Collaborators:** Aloisa Barros (University of Pelotas), Deborah Cobb-Clark and Steff Schurer (University of Sydney), George Davey Smith and Neil Davies (University of Bristol), Pernille Due (Danish National Public Health Institute), Steve Guthridge (Northern Territory Government), Louisa Jorm, Kathleen Falster (University of NSW), Tony Blakely (University of Otago), Catherine Law, Russell Viner (Institute of Child Health) and Sven Silburn (Menzies Institute)

**Vaccines and Infectious Diseases**

**Professor Helen Marshall**

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

In 2016, we secured funding for the BPartOff study, which will enrol up to 60,000 years 10,11 and 12 high school students in SA, to assess the impact of the Meningococcal B vaccine on carriage of the meningococcus bacteria in adolescents. The results of this study will be used to inform MenB vaccine policy in Australia and internationally.

**Group Members**

**Research Leader:** Helen Marshall

**Clinical Researchers:** Sue Evans and Suja Matthew

**Research Project Managers:** Chris Heath, Michelle Clarke, Susan Lee and Mark McMillan

**Research Coordinators:** Louise Goodchild, Kathryn Riley, Jane Tuckerman and Mary Walker

**Paediatric Trainees:** Alex Gordon and Marianne Yanni

**PhD Candidate:** Bing Wang

**Honours Students:** Hasseen Mohammed and Shugla Noor

**Affiliate Members:** Christina Boros and Nan Vasiliunas

**RRI Collaborators:** Simon Barry, Gus Dekker, Jodie Dodd, Lynn Giles, Mike Gold, John Lynch, Andy McPhee, Ben Mol, Alexia Pena, Claire Roberts and Michael Snape, Peter McIntyre and Robert Booy (University of Sydney), Martin Maiden, Jenny McLennan, Peter McIntyre and Robert Booy (University of Otago), Catherine Law, Russell Viner (Institute of Child Health) and Sven Silburn (Menzies Institute)

**External Collaborators:** Ross Andrews (Menzies Research Institute), Hossein Afzali and Annette Braunack-Mayer (University of Adelaide), Ray Borrow (Public Health England), Jim Buttery and Terry Nolan (University of Melbourne), Margie Danchin (Murdoch Children’s Research Centre), Adam Finn (University of Bristol), Ann Koehler (SA Health), Stephen Lambert (Queensland Children’s Medical Research Institute), Andrew Lawrence (SA Pathology), David Lynn and Steve Wesselingh (SAHMRI), Kristine Macartney, David Gonzalez-Chica, Amelia Maika and Anna Pearce

**Affiliates:** David Gonzalez-Chica, Amelia Maika and Anna Pearce

**Postdoctoral Researchers:** Catherine Chittleborough, Angela Gialamas, Janet Grant, Luke Graeskiowam, Dandara Stark, Murthy Mittinty, Alicia Montgomery, Rhiannon Pilkington, Alyssa Sawyer, Helena Schuch and Lisa Smithers

**Affiliates:** David Gonzalez-Chica, Amelia Maika and Anna Pearce

**RRI Collaborators:** Gus Dekker, Nicki Hodyl, Ben Mol, Claire Roberts and Michael Sawyer

**External Collaborators:** Aloisa Barros (University of Pelotas), Deborah Cobb-Clark and Steff Schurer (University of Sydney), George Davey Smith and Neil Davies (University of Bristol), Pernille Due (Danish National Public Health Institute), Steve Guthridge (Northern Territory Government), Louisa Jorm, Kathleen Falster (University of NSW), Tony Blakely (University of Otago), Catherine Law, Russell Viner (Institute of Child Health) and Sven Silburn (Menzies Institute)
Cystic fibrosis is a relatively common chronic illness that reduces quality of life, and typically limits lifespan to young adulthood. The disease is autosomal recessive and occurs when two faulty copies of a gene known as CFTR are inherited, one from each parent. Over 2,000 different CFTR mutations have now been identified. The CFTR defect affects many organs, but it is the lung disease that produces most of the mortality and morbidity.

The Cystic Fibrosis Airway Research group aims to develop an effective genetic therapy to prevent or cure cystic fibrosis airway disease. Research activities are focused on achieving effective lentiviral CFTR vector gene delivery, transducing airway stem cells in-situ to enable extended gene expression, upscaling our gene vector production techniques, optimising the gene vector, and developing new delivery methods. The effectiveness of pharmaceutical and genetic therapies for cystic fibrosis is hard to quantify, so the group is also developing rapid and accurate X-ray imaging based outcome measures for assessment of airway disease, and to test the effectiveness of novel therapeutics including their gene therapy. 2016 saw the beginning of a 3-year NHMRC-funded project examining the effectiveness and persistence of lung gene transfer in live animals. We trialed a bioreactor system designed to boost gene vector production capabilities, to meet the needs of our gene transfer development projects. Using gene editing techniques we created CF-carrier rats that when bred should produce rats with the most common mutation found in humans, for testing gene therapy treatments of emerging or established CF lung disease.

**Group Members**

**Research Leader:** David Parsons  
**Senior Scientist:** Martin Donnelley  
**Postdoctoral Researchers:** Patricia Cmielewski, Nigel Farrow, Nathan Rout-Pitt and Chantelle McIntyre  
**PhD Candidates:** Ryan Green, Alexandra McCarron and Harsha Padmanabhan  
**Masters Student:** Dr Thomas Goddard  
**Administrative Assistant:** Bernadette Boog  
**RRI Collaborators:** Simon Barry, Mark Nottle and Paul Thomas  
**External Collaborators:** Ivan Bertoncello and Jonathan McQuater (University of Melbourne), Ric Boucher and Rob Tarran (University of North Carolina), Andrea Fouras, Kaye Morgan and Karen Siu (Monash University), Albert Juhasz, Ivan Lee and Euan Smith (University of SA), Tim Kuchel (SAHMRI), Maria Limberis (University of Pennsylvania), Kentaro Uesugi (JSDTI), Naoto Yagi (JASRI) and Roger Yazbek (Flinders University)
Optimal physical and mental health is important for strong and resilient communities. Unfortunately, many mothers and children experience sub-optimal health and wellbeing; 13% of new mothers experience significant symptoms of depression, while at any single point in time, 14% of children and adolescents experience mental health problems. What is concerning is the repeated finding that only a minority of those experiencing problems receive help from professional services. There is a strong requirement to develop new cost-effective interventions that will improve the health and wellbeing of mothers and their children in the general community.

The Child and Adolescent Mental Health group works closely with clinical staff in the community child health service in South Australia to develop and evaluate new population-level interventions that have the potential to improve the health and wellbeing of the community. The effectiveness of interventions is assessed in clinical trials conducted as part of routine service delivery in the community child health service. In 2016 we developed a new intervention (the eMums Plus program) that is designed to help mothers with mild to moderate depression and parenting problems. The program builds on our previous experience of combining the professional skills of community nurses and the capacity of the Internet to reach large numbers of mothers in the general community. During 2017 we will work in partnership with the Child and Family Health Service to pilot test this new program.

Group Members
Research Leader: Michael Sawyer
Senior Project Officer: Jennifer Clark
PhD Candidate: Amy Kaim
Research Assistant: Christy Reece
RRI Collaborators: John Lynch, Ben Mol and Claire Roberts

Associate Professor Cheryl Shoubridge
Defining molecular and cellular pathways for intellectual disability and seizures, and developing effective interventions

Approximately 1 in 50 people worldwide suffer from intellectual disability, with the cost to Australia conservatively estimated at $14 billion annually. Intellectual disability is described as significantly impaired cognitive functioning, coupled with a deficit in adaptive behaviour with onset before age of 18. Children with intellectual disability often experience other symptoms such as early onset and recurrent seizures.

The Intellectual Disability Research group seeks to understand the molecular mechanisms and impact of naturally occurring mutations in genes causing intellectual disability and seizures, with the aim of developing effective therapies to improve the quality of life for patients and their families. These genetic disorders individually are often considered rare, but collectively, contribute to a significant health burden for the community.

We have modelled several intellectual disability genes using cell-based investigations and mouse models to unravel the mechanisms that contribute to the clinical features we see in our patients. In 2016, we reported changes to genome wide gene expression in a mouse model to map the molecular pathways that are disturbed early in brain development; and successfully generated a mouse modelling the knock-out of an intellectual disability gene, one that causes phenotypes in boys and girls.

We are extending our investigations to establish the molecular targets and pathways that lead to improvements in seizure frequency; and will utilise our knock-out mouse model to evaluate the role of this intellectual disability gene in the normal development and the function of neurons in the brain.

Group Members
Research Leader: Cheryl Shoubridge
Postdoctoral Researchers: Matilda Jackson, Kristie Lee and Aneta Zysk
PhD Candidate: Tessa Mattiske
Honours Students: Oliver Dearsley and Laura Redpath
RRI Collaborators: Jozef Gecz and Claire Roberts
External Collaborators: Gaelle Friocourt (INSERM), Nigel Jones and Terance O’Brien (University of Melbourne) and Jeffrey Noebels (Baylor College of Medicine)
To continue to be a world-leader in the areas of reproduction, pregnancy and child health research, the Institute invests in people, networks and facilities.

Core Facilities

**Adelaide Research Assay Facility**  
**Prof David Kennaway**  
The Adelaide Research Assay Facility (ARAF) provides specialised, high-throughput and high-sensitivity assays of physiologically important analytes for academic researchers and commercial customers Australia-wide. ARAF provide services and consultation for specialised measurements of analytes in human or animal biological fluids or cell culture / tissue extracts. These cover broad research areas including but not limited to endocrinology, neuroscience, physiology, immunology, pathology and cancer.

In 2016 the facility analysed plasma and saliva samples for 4 groups in the RRI, University of Adelaide researchers at Roseworthy, and groups at SARDI, UniSA, and Flinders, Melbourne, Monash and Sydney Universities.

**Bioinformatics Facility**  
**Dr Jimmy Breen**  
Bioinformatics enhances the Institute’s capability in next-generation sequencing and systems biology approaches to basic science and clinical research investigating human and animal reproduction and development. Strategies to design and analyse transcriptome, deep-sequencing, genome and proteome data sets are a powerful approach to generating fundamental knowledge on systems and processes in biology and disease. Bioinformatic methods allow researchers to follow a complementary path in their research that promotes exploratory analysis and hypothesis generation, as well as focused analysis of previously identified targets of interest. This can provide stronger and more clinically applicable results from a research program, and yield publication, funding, and patent outcome improvement.

**Biostatistics Facility**  
**Dr Emma Knight**  
The Biostatistics Facility provides expert advice in research design, statistical analysis and presentation of data. This service complements researcher expertise through the provision of effective statistical analysis that delivers clear and precise answers to their questions.

In 2017, biostatistics will continue to be afforded to research leaders to improve the likelihood of securing future NHMRC grants and to provide general research design advice for continuing and new research projects.

**Cohort and Intergenerational Studies Facility**  
**Prof Claire Roberts**  
The Cohort and Intergenerational Studies (CIS) Facility underpins the strategic utilisation of unique Adelaide generated longitudinal studies - both cohorts and randomised controlled trials - established before or at birth, or in childhood. CIS and its resources enhance collaborations, support novel interrogations of accrued data and enable pooling of studies. This will advance research to address complex challenges in reproductive and paediatric health, now and into the future.

CIS aims to align, maintain and enhance cohorts, databases and related resources, stimulate research that addresses prioritised complex challenges in reproductive and paediatric health, and increase participation in national and international consortia.

**Gene Silencing and Expression Facility**  
**Jason Gummow**  
The Gene Silencing and Expression (GSex) Facility provides gene manipulation services to Australian researchers in a fully equipped PC2 laboratory. The facility offers custom production of lentiviral, AAV and retroviral vectors, and stock viruses for purchase by the microlitre. In addition, customers can access CRISPR, non-viral vector and other cell and molecular biology services.

In 2016, GSex increased production and has now produced over 150 viral vectors since the core was established. These viruses have been used to infect immortal cell lines and primary cell cultures. GSex demonstrated the effectiveness of both lentivirus and AAV in mouse cumulus oocyte complexes and cancer cell lines in rodents and humans. Additionally, the facility demonstrated robust reporter expression following human T-cell infection.

**SA Genome Editing Facility**  
**Prof Paul Thomas**  
The SA Genome Editing (SAGE) Facility uses cutting edge genome editing technology to generate mutant mice for a wide range of applications. Utilising new CRISPR/Cas9 system technology, the facility offer a number of services including generation of custom knock out, point mutation and tagged alleles. SAGE’s services are highly accessible offering a significantly reduced cost and fast turnaround compared to traditional ES cell methods - providing researchers an edge when applying for grants and publishing in high impact journals.
Since operations began in 2014, 13 mutant lines have been produced with another seven projects underway. In 2017 SAGE aims to grow its understanding of CRISPR/Cas9 and its variants, as well as expanding services on offer to include production of conditional alleles.

2016 Funding Programs

Engaging Opportunities
This newly created program seeks to support the development of new relationships with key stakeholders to jointly address research priorities; sharing identification and ownership of the problem being addressed, and the path to understanding and progressing a solution.

It has been recognised that collaboration with groups such as health consumers, clinicians, business, industry, government and not-for-profits will lead to more robust and relevant research projects, quicker development of solutions, and more effective communication of discoveries, than working independently as individual researchers. This program resulted in the development of 6 new partnerships with key stakeholders.

Investment for Success
This program aims to increase the Institute’s NHMRC funding by developing highly competitive (but as yet unfunded) project grant applications, into more competitive applications for the next rounds submission. The investment enables proof-of-concept studies, experiments or analysis, to ensure rapid publication of a pivotal paper or increase scientific quality, significance and innovation. 

In 2016, 7 projects were included in this program, with two participants going on to achieve NHMRC project grant funding.

Career Development Fellowship
This fellowship funds the salary of ‘Emerging Star’ early career researchers for one year, supporting their career development to enable competitiveness for an NHMRC Career Development Fellowship or similar. In 2016 the fellowship was jointly awarded to:

> Dr David Sharkey Seminal fluid and immune adaptations for pregnancy in women
> Dr Kylie Dunning Understanding how somatic cells of the ovarian follicle promote mammalian oocyte development

Innovation Seed Funding
This pilot program supports early and mid-career researchers to collaborate across research groups and themes and to explore novel research questions. Its goal is to harness and progress new ideas towards competitive, fundable research that addresses significant knowledge gaps. This program supported 7 collaborative projects in 2016, bringing together more than 40 members.

High Performance Researcher
Facilitated by an external specialist, this program seeks to up-skill early and mid-career researchers by providing them with the tools required to forge a successful career in research. This is achieved through a series of professional development workshops, and external support for the Institute’s next generation of research leaders.

Exchange
The Exchange Program seeks to build collaborations with international researchers, with the aim of increasing research connections and capacity, and facilitating access to international funding, databases and expertise. This program funds Institute members to work with collaborators overseas, as well as funding international collaborators to spend time with the Institute in Adelaide.

Travel Grants
Supporting researchers to travel so they can present and share their research findings at national and international conferences and meetings is essential for research dissemination, career development and building a strong track record. Attendance at key conferences enables important networking with peers, and the opportunity to develop future collaborations. In 2016 the Institute awarded $31,000 to 33 members who took part in 19 conferences.

Visiting Speakers
The Visiting Speakers Program supports external research leaders to visit the Institute, and encourages collaboration between Institutions, providing insight and new perspectives on our research priorities. Visitors present a seminar to members and meet with relevant researchers to discuss common research interests.

Mentoring
Each year the Institute runs a year-long mentoring program, matching senior researchers with early or mid-career researchers. This program seeks to strengthen networks, build relationships, develop career pathways and enhance resumes, providing mutual benefit for both the mentee and mentor.
2016 Success stories

Our programs continued to deliver significant benefit, with particular noteworthy accomplishments including:

B Part of It

In 2016, Prof Helen Marshall received funds through the RRI Exchange Program to visit the UCL Institute of Child Health in London, to progress her collaborative research with Helen Bedford in the areas of immunisation, child health and meningitis. While in the UK on this exchange, Helen met with Glaxo Smith Kline and secured funding to run the B Part of It study in South Australia.

South Australia has the highest rate of the potentially life threatening Meningococcal B (Men B) disease in the country, with young adults aged 15-24 years being most at risk of carrying the virus. In partnership with SA Health, Helen initiated the largest Men B herd immunity study in the country, to establish whether when a significant proportion of a population is immunised against the disease, society can prevent the transmission of that disease from one person to another and protect those who are not immune.

Vaccinations in high school students in years 10, 11 and 12 will occur in the first half of 2017.

Successful NHMRC project grants

The RRI’s Investment for Success program aims to increase the Institute’s success in achieving NHMRC funding by developing highly competitive (but as yet unfunded) project grant applications into more competitive applications for the next round of submissions.

In 2016 the following members received NHMRC grants for projects that were developed in this program:

> **A/Prof Rebecca Robker** received $1.5m for her research: *Re-energising the preimplantation embryo to extend lifetime health*

> **Prof Simon Barry** received $1m for his research: *Identification of the conformation dependant targets of autoimmune disease linked variation in human regulatory T cells.*

2016 Scholarships

Repromed Reproductive Health Scholarship

The Institute partnered with Repromed in 2016 to establish the Repromed Reproductive Health Scholarship. The inaugural recipient for this honours scholarship was **Joseph Femia**.

Joseph’s interests in immunology, particularly where the immunological interplay can affect maternal health and pregnancy outcomes, is what steered him towards an honours year on the research project: *The Role of Stress-induced TRAIL on Pari-conception Programming in Offspring Health.*

His project investigated the role of an inflammatory embroyotoxic cytokine, TNF-related apoptosis inducing ligand (TRAIL) in pregnancy, and how it alters embryo and fetal development.

“We began investigations into TRAIL’s role on embryo development in vitro, using a new model. We also established knock-out mice strains for both TRAIL and its receptor, and analysed the breeding outcomes to observe if loss of TRAIL or its receptor affected pregnancy,” said Joseph.

Additionally, Joseph generated preliminary in vivo data on the role of TRAIL in fetal development upon exposure to an inflammatory or stress stimulus.

“Our findings suggest that TRAIL may have a differential impact depending on sex, and now that the knockout breeding colonies are developed, this can be explored further,” explained Joseph.

Stress response cytokines are elevated in many common inflammatory diseases, including diabetes, obesity and infection, all of which are linked with pregnancy disorders and health problems later in life for the offspring.

“The long term goal of research in this area is to understand the role of TRAIL in embryo and fetal development; this could lead to improved pre-conception planning and may open new opportunities to develop diagnostics and pharmaceuticals to improve infertility treatment options,” explained Joseph.

Joseph is continuing in the path of a career in health and will commence a postgraduate medical degree in 2017.

“While I will undertake a medical degree, I am very much interested in pursuing research throughout my career. I am excited to know that my research findings are adding to the body of knowledge in this area and will have real applications in the future,” said Joseph.

“I would like to thank Repromed, my supervisors, the Robertson and Brown labs and the Robinson Research Institute for this scholarship. The honours year is stressful and time consuming, and the financial support this scholarship provided me was invaluable,” said Joseph.

**Joseph’s supervisors during his honours year were Prof Sarah Robertson, Dr Hannah Brown and A/Prof Jeremy Thompson.**
Yasmyn Gordon

Jeffrey Robinson Honours Scholarship

In 2016, the Institute awarded the Jeffrey Robinson Honours Scholarship to Yasmyn Gordon.

During her undergraduate degree, Yasmyn's combination of genetics and biochemistry majors led to a keen interest in pre-implantation and early embryo development, and also in targeting cancers with unique characteristics to develop personalised treatments.

Yasmyn undertook an honours year working within A/Prof Darryl Russell's Ovarian and Reproductive Cancer group and A/Prof Rebecca Robker's Ovarian Cell Biology group, on the research project: Measuring Mitochondrial Stress Responses in Cancer Cells.

“We wanted to compare various aspects of mitochondrial respiration (aerobic energy production) in cancer cells utilising different pathways to maintain their immortality, and how their respiration changed in response to stress and other treatments,” explained Yasmyn. Immortality is one of the defining hallmarks of cancer, as is their typically altered metabolism. These aspects are of great interest in cancer treatment, and cancer cells typically display an altered metabolism compared to ‘normal’ cells.

“My research looked at targeting the cancer cell’s unique metabolism to disrupt their energy supply, in combination with targeting their mechanisms to maintain immortality. Together these present a great opportunity for targeted cancer treatments”, said Yasmyn.

Yasmyn thoroughly enjoyed her honours year and her increasing independence in the lab through taking responsibility for her experiments.

“I loved being part of a research team and getting to know different people. I learnt many valuable things from my team both in and out of the lab,” reflected Yasmyn.

“The year overall was full of new experiences and challenges, but it really helped me grow as a scientist and a person.”

Yasmyn plans on continuing her research and will commence a PhD in 2017 and can see a research in career in the future.

“Long term, I would love to lead a lab with a focus on reproductive health and pre-implantation embryo development”, said Yasmyn.

Yasmyn’s supervisors during her honours year were A/Prof Darryl Russell, A/Prof Rebecca Robker, Dr Sonja Frölich, and Dr Linda Wu.
Advisory Board

Prof Jock Findlay AO (Chair)  Prof Mike Brooks  Prof Alastair Burt  A/Prof Naomi Dwyer

Dr Susan Evans  Prof Julie Owens  Prof Sarah Robertson  Prof Andrew Zannettino

Early and Mid-Career Researcher Council

Dr Tina Bianco-Miotto  Dr Jimmy Breen  Dr Martin Donnelley

Dr Tod Fullston  Dr Megan Penno
Executive Committee

Prof Sarah Robertson (Chair)
Prof Simon Barry
Prof Jenny Couper
Prof Jodie Dodd
Marcus Goddard
Prof Helen Marshall
Prof Claire Roberts
A/Prof Rebecca Robker
Prof Ray Rodgers
A/Prof Darryl Russell
A/Prof Michael Stark
Member list

Thank you to all of the Institute’s members who have contributed to another successful year.

**Members**
Abdelhafez Gadalla, Mustafa
Aboutaste, Natalie
Anaastasi, Sarah
Andraweera, Prabha
Archer, Maddison
Ashwood, Pat
Atashgaran, Vahid
Augustine, Pyria
Awadalla, Maged
Bail, Vincent
Bandara, Veronika
Banovic, Tatijana
Barry, Simon
Basim Khalah, Marwah
Bastian, Nicole
Bater, Megan
Berest, Sarah
Bernard, Sarah
Binggeli, Tina
Bonder, Claudine
Bonner, Wendy
Boog, Bernadette
Borqvist, Ash
Braunack-Mayer, Annette
Breeds, William
Breuer, Marie
Brown, Hannah
Brown, Cheryl
Camp, Amanda
Carneiro, Gustavo
Carroll, Renee
Carroll, Rob
Cash, Sarah
Cates, Lauren
Champion, Stephanie
Chan, Hon Yeung
Chaudhary, Rajesh
Chechurova, Tanya
Cheow, Tiffany
Chin, Peck
Chittleborough, Catherine
Clark, Jennifer
Clark, Rebekah
Clarke, Michelle
Coates, Toby
Collins, Rebecca
Collins, Joanne
Copping, Katrina
Corbett, Mark
Couper, Jennifer
Craig, Nicole
Crawford, Tara
Crowther, Caroline
Daish, Tasman
Dalton, Julia
Darvishi, Sam
Dasari, Pallavi
Dass Singh, Mansi
Davies, Chris
Davies, Michael
Dearsley, Oliver
Dekker, Gus
Deussen, Andrea
Diener, Kerri
Dinh, Doan Thao
Dodd, Jodie
Domingo, Deepthi
Donnelly, Martin
Dorian, Camilla
Drechsel, Merle
Drogemuller, Christopher
Dunning, Kylie
Duszynski, Katherine
Earl, Rachel
Estrella, Consuelo
Evans, Susan
Evans, Sue
Ewens, Melissa
Fairclough, Ashlee
Farrell, Lucy
Farrow, Nigel
Fatohi, Anwar
Femia, Joseph
Fernandez, Renae
Ferrante, Antonio
Fischer, Judith
Frank, Mahalia
Fraser, Louise
Frolich, Sonja
Fullston, Tod
Gajic, Tijana
Gardner, Alison
Garrett, Amy
Gatford, Kathryn
Gebert, Jasmina
Gecz, Jozef
Gent, Roger
Geyer, Myf
Giamas, Angela
Giles, Lynne
Gillet, Elen
Glynn, Danielle
Goddard, Thomas
Gold, Michael
Goldsworthy, Mitchell
Goodchild, Louise
Gordon, Alex
Gorgani, Nick
Grant, Pat
Green, Ryan
Green, Ella
Grey, Shane
Grieger, Jessica
Groome, Holly
Grunzner, Frank
Grzeskowiak, Luke
Gundsambuu, Batjargal
Haag, Dandara
Hague, William
Haines, Bryan
Han, Shanshan
Harper, Kelly
Hartani, Monica
Hatzidodros, Nicholas
Heath, Christine
Hilbourn, Leonie
Hiendeler, Stefan
Highet, Amanda
Hill, Charles
Ho, Rachel
Hosdon, Leigh
Hodyl, Nicolette
Homan, Claire
Hope, Chris
Hordacre, Brenton
Horton, Dane
Huang, Shuo
Hull, Louise
Hummitzsch, Katja
Hurtado, Plinio
Hurtado Perez, Ernesto
Hutchison, Amy
Inman, Wendy
Ivancevic, Atma
Jackson, Matilda
Jacob, Reuben
Jankovic-Karasoulos, Tanja
Jennings, Staci
Jesudason, Shilpa
Johnson, Brett
Johnston, Julie
Jolly, Lachlan
Jureidini, Jon
Kaczmarek, Adrian
Kain, Amy
Kang, Kyung
Kannesappan, Lavern
Kedzior, Sophie
Keen, Erin
Keir, Amy
Kelly, Jasmine
Kennaway, David
Kenny, Declan
Kette, Francis
Kieffer, Tom
Kim, Juewan
Kind, Karen
King, Jovanka
Kireta, Svetlana
Knobbs, Sylvie
Koc, Kristy
Kontos, Anna
Kortschak, Dan
Krieg, Meredith
Lane, Michelle
Larson, Connor
Lastra, Zohra
Lee, Eunice
Lee, Su-san
Leemaqz, Shalem
Leigh, Gabriela
Lett, Bron
Lim, Megan
Lincoln, Gabriella
Liu, Hong
Liu, Bo
Lokman, Noor
Louise, Jennie
Lushington, Kurt
Lynch, John
Lyu, Zhimai
Macdonald, Hannah
MacDonald Van Dam, Jago
MacLennan, Alastair
MaPherson, Anne
Malatesta, Kristen
March, Wendy
Marshall, Helen
Martin, Jessica
Martin, James
Martineau, Kathrin
Mathew, Suja
Mattske, Tessa
Mayne, Benjamin
McAninch, Dale
McBean, Emma
McCarron, Ali
McCormack, Catherine
McCullough, Caitlin
McCullough, Dylan
McDowall, Melanie
McGorm, Kelly
McIlpatrick, Stephen
McIntyre, Chantelle
McLennan, Hanna
McMillan, Mark
McPherson, Nicole
Mertens, Birte
Middleton, Philippa
Mildren, Kathryn


300. Makrides, M. (2016). Understanding the effects of docosahexaenoic acid (DHA) supplementation during pregnancy on multiple outcomes from the DMOmO trial. OCL - Oilsseeds and fats, Crops and Lipids, 23(1).

Docosahexaenoic acid and preterm birth. *Annals of Nutrition and Metabolism*, 69, 30-34.


Support the Robinson Research Institute

For more information about the Institute visit: adelaide.edu.au/robinson-research-institute
Support Us

Personal details

Name: ...............................................................................................
Address: ...........................................................................................
.............................................................................................................
State: ...............................................
Postcode: ........................................
Telephone: ...............................................................
Email: ...............................................................................................

Donation

Yes! I would like to make a donation of $_______ to the University of Adelaide to progress the research of the Robinson Research Institute.

I enclose:
☐ Cash  ☐ Cheque
☐ Credit Card  ☐ Visa  ☐ Mastercard

Card number
__________________________  ____________________________  ____________________________  ____________________________

Security Code  Expiry Date
__________________________ / __ __

Name on card
...............................................................................................................................

Signature
...............................................................................................................................

All donations to

External Relations
The University of Adelaide
Reply Paid 498
Adelaide SA 5001

Privacy Statement
The primary purpose of information collected is for processing and receipting your gift. Secondary purposes may include updating your donation records, stewardship and for future fundraising approaches. If you do not wish the information provided here to be used for these secondary uses please let us know. If you have any privacy concerns or would like to verify information held about you please contact 08 8313 5800. The University of Adelaide’s privacy policy can be found at: www.adelaide.edu.au/policies/62/