ROBINSON RESEARCH INSTITUTE

THE UNIVERSITY of ADELAIDE

Annual Report 2022

Healthy children from the start

Robinson Research Institute

make history.

Contents

Key stats

461 publications

50 Research Leaders

40 current clinical trials and cohorts

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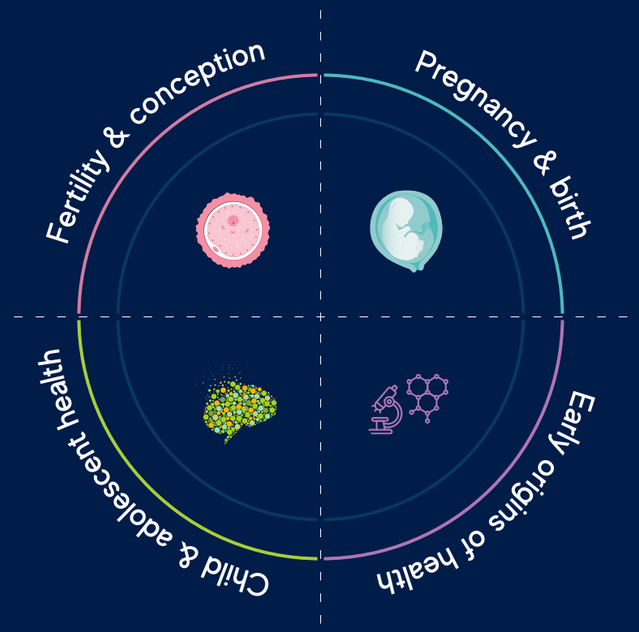
The Institute at a glance

From when life first emerges to children developing into adolescents, a myriad of factors from genetic dispositions to social or environmental factors, challenge human health and healthy reproduction.



The Robinson Research Institute (RRI) is leading internationally renowned research across four guiding themes: Fertility and Conception, Pregnancy and Birth, Early Origins of Health, and Child and Adolescent Health.

More than 45 research teams are uncovering how events and circumstances before birth and during early life impact an individual's healthy development, their susceptibility to disease and their resistance to adversity. Through our discoveries, we are developing effective interventions to protect children and improve their health prospects throughout life.

Welcome

From the Deputy Vice-Chancellor (Research) and the Pro Vice-Chancellor (Research Excellence)

The University of Adelaide has a strong commitment to research excellence that is distinguished by its international standing, dedication to innovation and excellence in research and teaching. More than 4000 research staff and students are working together, supported by modern infrastructure and an innovative culture, to tackle research challenges and deliver positive impacts both locally and globally.

As a University we have a long history of 'collaborative innovation' that benefits our partners, our state, our nation and the global community. It is a value that we hold dearly and one that is central to our goal of making history.

The Research Institutes are a fundamental element of our approach to collaboration both within the University and externally with our many partners. The Institutes provide critical opportunities for our staff and students to take a multidisciplinary approach to responding to sector and community challenges.

In 2022 this approach was demonstrated in the Robinson Research Institute through the development of EndoZone, an evidence-based website co-created with those affected by endometriosis. The site, which tailors information to the unique symptoms of the users, is a fantastic resource for not only those impacted by the disease but also for clinicians and researchers. EndoZone is one of a number of projects that demonstrate the value of a University working in partnership with community to deliver positive outcomes.

The University of Adelaide is proud of the achievements of the Robinson Research Institute as it continues to pursue research that makes a difference to people's lives.

Professor Laura Parry
Pro Vice-Chancellor
(Research Excellence)
The University of Adelaide

Professor Anton Middelberg
Deputy Vice-Chancellor
(Research)
The University of Adelaide

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Bright minds for a bright future

Future Making Fellows

The University of Adelaide's Future Making Fellowship is awarded to high-calibre, early-career or mid-career researchers.

Associate Professor Zohra Lassi

2022 Future Making Fellowship

2018 NHMRC ECR Fellowship; Public Health and Health Services Fellow

2022 South Australian Young Tall Poppy Science Award

Associate Professor Lassi leads the Reproductive, Maternal, Newborn, Child and Adolescent Health Continuum of Care research group. Her current research program aims to improve adolescent sexual and reproductive health by promoting evidence-informed and co-designed service delivery and policymaking across healthcare and education settings.

Dr Kylie Dunning

2022 Future Making Fellowship

2019 The Hospital Research Foundation Mid-Career Fellow

2022 Rising Star Award – Society for the Study of Reproduction, U.S.A.

From devices to diagnosis, Dr Dunning, leading the Reproductive Success group, is revolutionising reproductive science using light. With a focus on how oocytes (eggs) and embryos create energy, Dr Dunning pioneered the paradigm-shifting research describing the requirement for lipid metabolism by the oocyte and early embryo. She is now using this knowledge and expertise with cutting-edge imaging and diagnostic technologies to deliver the next generation of tools for fertility clinics and the agricultural industry.

Early and Mid-Career Fellowships

Dr Lachlan Jolly

Dr Jolly is heading up the Neurobiology Research Group and was awarded the First 1,000 Days of Life Mid-Career Fellowship in 2022.

This 5-year fellowship is funded by the Women's and Children's Health Research Fund, a joint initiative of the Women's and Children's Health Network, SAHMRI and The University of Adelaide. His research investigates the genetic, molecular, cell and developmental processes that underpin brain development. As part of translating his research work, Dr Jolly created an online community group, Genetic Disorders involving the USP9X Gene, bringing together parents and families of children from around the world with an ultra-rare genetic cause of intellectual disability.

"I honestly cannot explain what a difference this group has made to my life in just one day! It has been a very lonely 3 years and at last, I can have contact with people that understand! "

Parent and Group member of "Genetic Disorders Involving the USP9X Gene"

Dr Nicole McPherson

Dr McPherson was awarded an ARC Discovery Early Career Research Fellowship and runs the Male Reproductive Life Course Group in the Freemasons Centre for Male Health and Wellbeing and Discipline of Reproduction and Development at the University of Adelaide.

Dr McPherson's research examines the biology of how disease risk is transferred via sperm and uses this knowledge to develop tests of risk and interventions for use in IVF practice and for family planning.

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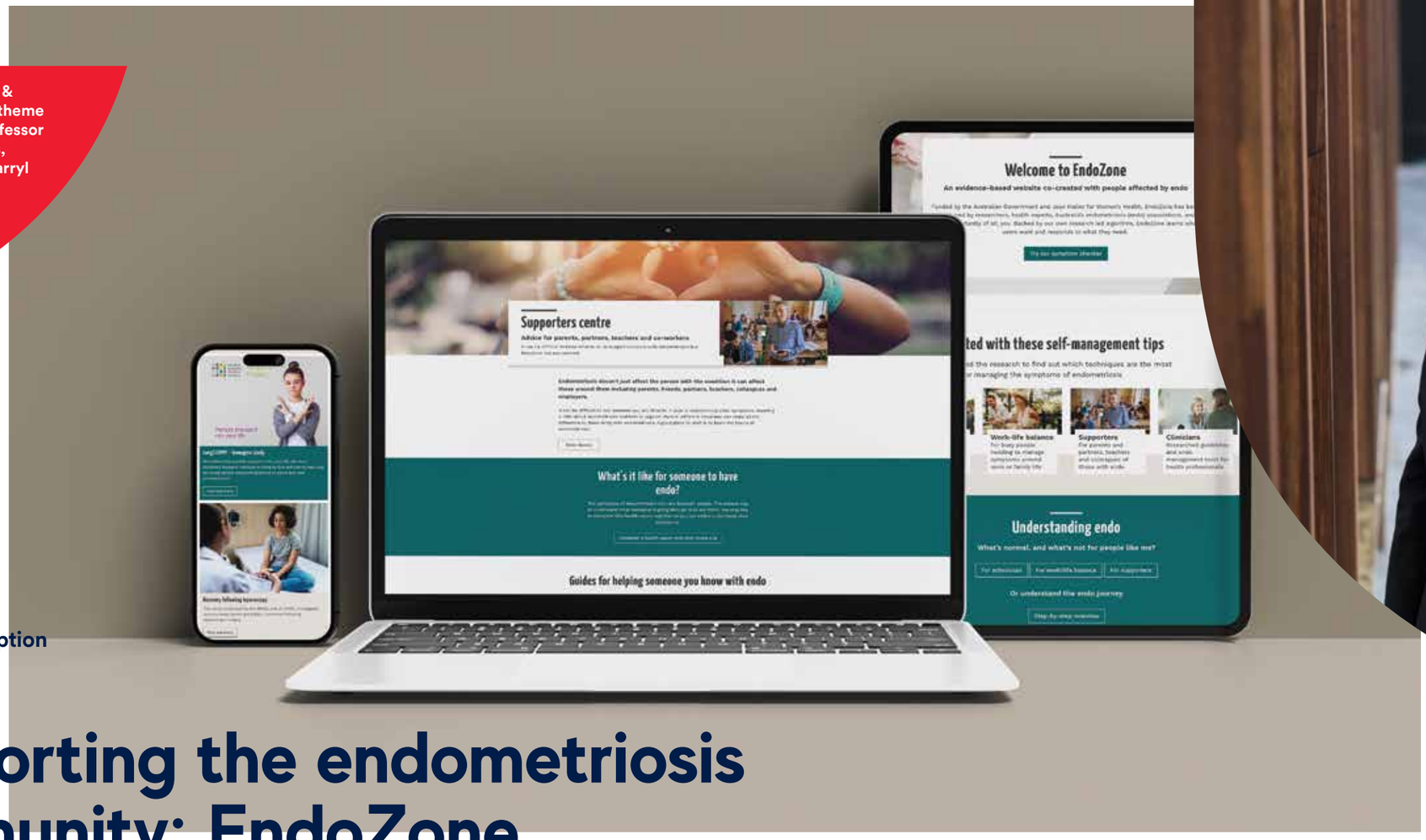
The Fertility & conception theme is led by Professor Ray Rodgers, Professor Darryl Russell and Professor Louise Hull



Fertility & conception

Supporting the endometriosis community: EndoZone

"I consulted 22 gynaecologists before I was formally diagnosed with endometriosis at the age of 47. "

Sarah (Name changed for privacy reasons)

In Australia, one in seven women and those assigned female at birth, have endometriosis.

Endometriosis occurs when tissue similar to the lining of the uterus grows outside the uterus. This leads to inflammation and endometriosis lesions forming in the pelvic region and (rarely) elsewhere in the body. For some people, it is a long road of pain and painful experiences until patients are diagnosed with endometriosis and then gain access to appropriate management. On average, it takes 6.4 years from experiencing symptoms to receiving a diagnosis. For some, the journey is even longer.

In March 2022, EndoZone.com.au launched. Led by Fertility and Conception theme leader Professor Louise Hull , this digital platform was created to empower and support people affected by endometriosis and to help them make informed and timely decisions regarding their health.

Collaboration was at the heart of the project when establishing EndoZone. Funded by the Australian Government and Jean Hailes for Women's Health, the platform was co-created with the endometriosis community including Endometriosis Australia, EndoActive, Endometriosis Western Australia, Pelvic Pain Foundation of Australia, QENDO, people with, and those who support people with endometriosis, clinicians, researchers, health informatics specialists and IT developers.

Three hundred and forty-seven community members were polled as part of the research to set up the EndoZone platform. The highest priority (29%) was for better education and communication about endometriosis with doctors. People with the condition now have access to a platform that provides a wealth of regularly updated and evidence-based resources such as a symptom checker, information about diagnosis and treatment, self-management strategies, and stories from other people with the condition.

The website is backed by a research-led algorithm that provides recommended articles based on user symptoms and health information. The data collected from the digital informatics incorporated into the platform will also be used to inform future enhancements to the platform and research projects for the endometriosis community.

Not only does EndoZone inform people with endometriosis, it also brings together all stakeholders including clinicians, researchers, associations and supporters, knowing that collaboration between these groups is key in making a positive difference to improve the lives of people with endometriosis.

"EndoZone is unique because it has been co-designed with hundreds of people from around Australia who have endometriosis."

Professor Louise Hull, Robinson Research Institute and Principal Investigator of the EndoZone Project

Eight months after its launch, EndoZone had attracted over 33,000 users and recruited participants for over a dozen research studies. The team is continuing to advance the platform and provide patients and clinicians with relevant and timely information and resources to improve the quality of life for people with endometriosis.

Visit **endozone.com.au**

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Pregnancy and birth

Healthy hearts postpartum

Pregnancy is considered a “stress test” for a woman’s cardiovascular system. If their cardiovascular system fails to adapt appropriately, they may develop specific pregnancy-related conditions such as preeclampsia and are at an increased risk of developing heart disease later in life. According to data for 2021, coronary heart disease is second on the list of causes of death in Australian women.

Knowing this linkage and risk prompted the establishment of the COFFEE clinic (Cardiovascular Assessment After Obstetric Complications: Follow-up for Education and Evaluation) in 2018. Led by Associate Professor Margaret Arstall from The University of Adelaide and Director of Cardiology at the Lyell McEwin Hospital, the initiative recruits women who have had a pregnancy complication from the labour and delivery ward. Recruitment is facilitated through Professor Gus Dekker. Women attend their first COFFEE clinic when their baby is six months old, then again 12 months later, and again when their child is 5 years old. To date, more than 400 women have been followed up and cared for through the COFFEE clinic.

Left: Associate Professor Margaret Arstall, The University of Adelaide and Director of Cardiology at the Northern Adelaide Local Health Network

“The ultimate goal of the COFFEE clinic is to reduce the number of Australian women burdened by cardiovascular disease following a pregnancy complication, and to facilitate collaborative research projects that can improve screening and treatment options for women in the future.”

Dr Alison Care, Research Leader; Vascular Immunology of Pregnancy, Robinson Research Institute

The COFFEE clinic has a strong research focus and facilitates collaborative opportunities between various research groups from the Robinson Research Institute, linking research teams in cardiovascular and pregnancy related disciplines. These include collaborations with the Vascular Immunology of Pregnancy research group, led by Dr Alison Care. Together with Associate Professor Margaret Arstall, Professor Gus Dekker and Professor Claire Roberts, the team are investigating how the mother’s immune and vascular systems are different in women who have had complicated pregnancies. Additionally, in collaboration with Dr Prabha Andraweera, the team are working on understanding what causes preeclampsia and are looking to recruit women in early pregnancy and follow them throughout pregnancy and postpartum (via the COFFEE clinic) to monitor immune and vascular health in those who go on to develop a pregnancy complication compared to those who do not.

It is hoped this research will improve understanding of the causes of pregnancy complications, and also facilitate early screening that could result in a reduced risk of early heart disease and heart attacks in the target group.

The Pregnancy and birth theme is led by Dr Alison Care and Professor Gus Dekker

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The Early origins of health theme is led by Professor Rebecca Robker and Associate Professor Michael Stark

Paradigm shift on causes of cerebral palsy

Early origins of health

In 2022, approximately 34,000 people in Australia are living with cerebral palsy, a neurodevelopmental disorder that primarily affects a person's motor skills and muscle control. It can be caused by damage to the developing brain, often before or during birth, but it can also occur during infancy or early childhood.

Historically, cerebral palsy was considered largely the result of perinatal asphyxia – decreased oxygen to the baby's brain at birth. However, researchers from Robinson Research Institute (RRI) over many years have advocated that cerebral palsy is often caused by genetic changes that disrupt a child's control of movement and posture.

In recent work led by Dr Mark Corbett, the Australian Collaborative Cerebral Palsy Research Group at the Robinson Research Institute, has identified variants in gene CTNNB1 as a common genetic cause of cerebral palsy. Founded by Emeritus Professor Alastair MacLennan and now under the leadership of Professor Jozef Gecz and Dr Clare van Eyk, the group's research has demonstrated that about one third of children with cerebral palsy have a genetic basis for the condition, with around half of these children potentially benefiting from a change in management based on their genetic diagnosis.

The review of multiple genetic databases as part of the group's work also revealed the number of people living with CTNNB1 syndrome to be six times higher than previously known. This places CTNNB1 in the Top 10 most frequent causes of neurodevelopmental disorders. It is anticipated that the proportion of genetic causes of cerebral palsy will further increase in the future, as many genes associated with the disorder remain to be found.

The group's findings have profound implications for improving management and care of people affected by the disease and the research team is working with the leading consumer advocacy group "CTNNB1 connect & cure" to disseminate the new evidence to affected families. Knowing that early interventions can reduce the severity of disability and knowing that around half the children affected by a genetic cause would benefit from tailored care, researchers are calling for publicly funded access to genomic testing. The milestone reached in revealing genetic causes of the condition also opens the door for the development of new treatment and therapies.

"The presumption that cerebral palsy is due to difficulties at birth is often being rejected when there is access to modern genetic testing."

Dr Mark Corbett, Australian Collaborative Cerebral Palsy Research Group at the Robinson Research Institute and Neurogenetics Research Program at the University's Adelaide Medical School.

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Child and adolescent health

Continuous rise of psychiatric drugs in Australian children

"Very few psychiatric drugs are approved for children or teenagers in Australia, and none for depression. However, we found that 1 in 10 teenagers 15 to 18 years were prescribed antidepressants in 2018."

Julie Klau, PhD candidate in the Critical and Ethical Mental Health research group and lead author

The Child and adolescent health theme is led by Professor Jennifer Couper and Professor Simon Barry

Are we raising a nation of mentally ill children? The Critical and Ethical Mental Health research group at the Robinson Research Institute, led by Professor Jon Jureidini, dedicates their work to improving the understanding of, and responses to, mental health issues and mental disorders. Professor Jureidini and his team advocate for more ethical research and practice in mental health.

The group's recent research shows that in children 18 years and younger, GP-prescribed drugs used to treat attention deficit hyperactivity disorders (ADHD) almost doubled between 2011 and 2018, while the prescription of antipsychotics through primary care increased 63% and the prescription of antidepressants increased by 43%. Following this time frame, data from the Federal Health department shows a further increase from 2018 to 2022 across all age groups, with prescribed medication to treat ADHD more than doubling across the Australian population.

The steep increase in prescribed medication for children and adolescents through the primary care sector is cause for concern as there is little evidence about the long-term side effects these types of medication may have, and it leaves room to over-medicate and mask a cause that may need to be treated in a different way.

The steep increase in psychiatric drug prescriptions is not the only reason for concern. Children in more disadvantaged areas are up to three times more likely than those in advantaged areas to receive psychiatric drugs.

The Critical and Ethical Mental Health research group will focus their future research on investigating longitudinal trends and determinants of use, persistence, and outcomes of psychotropic medications in children and adolescents as well as searching for answers as to why the prescription of these medications, particularly in disadvantaged children, is increasing.

"Antipsychotics are associated with weight gain and metabolic problems, including diabetes. And antidepressants are associated with suicidal behaviour, especially in vulnerable teens."

Professor Jon Jureidini, Research Lead, Critical and Ethical Mental Health

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Awards and highlights

2022 Scholarships

History in the making

Jeffrey Robinson Honours Scholarship

Caitlyn Bugeja

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

In 2022, the recipient of this scholarship was Caitlyn Bugeja who undertook the honours project, *Identifying Therapies that Reduce Mitochondrial Mutation Transmission between Mother and Child*, under the supervision of Prof Rebecca Robker.

History in the making

Repromed Reproductive Health Scholarship

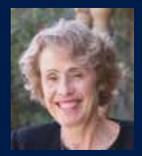
Kaitlin Beltakis

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

Repromed are a South Australian fertility treatment company offering a complete range of fertility treatments and options. The 2022 recipient of this scholarship was Kaitlin Beltakis who progressed her project: *The effect of granulocyte-macrophage colony-stimulating factor on the fertility of extended boar semen* under the supervision of Dr Nicole McPherson, A/Prof Mark Nottle and Dr Leanne Pacella-Ince.

Top awards

Australian Academy of Health and Medical Sciences



Professor Jennifer Couper was elected as a Fellow of the Australian Academy of Science for her contribution towards understanding the causes of type 1 diabetes. Fellows are elected by their peers, and Professor Couper's Environmental Determinants of Islet Autoimmunity (ENDIA) Study, which has recruited 1,500 participants, is just one of the ways she is making a difference.

Member of the Order of Australia

Professor Helen Marshall AM was named a Member of the Order of Australia for her significant service to medicine in the field of vaccinology and public health, research, and education.

Helen received many accolades over 2022, including being awarded South Australian of the Year and SA Woman of the Year.

Distinguished Fellow Award by the Society for the Study of Reproduction and Colin Matthew's Award by the Channel 7 Children's Research Foundation: Professor Sarah Robertson

Rising Start Award by the Society for the Study of Reproduction: Dr Kylie Dunning

New Investigator Award from the Society for Reproductive Biology: Evangeline Lovell

Roman Lecture by The Australasian Association for Clinical Biochemistry and Laboratory Medicine: Prof Maria Fuller

Paper of the Year by the Society of Endocrinology: Dr Prashant Regmi

Young Tall Poppy Award

From left: Professor Ray Rodgers, Interim Director RRI, Associate Professor Zohra Lassi, Her Excellency the Honourable Frances Adamson AC, Governor of South Australia

Associate Professor Zohra Lassi received the SA Young Tall Poppy Awards.

This award recognises Zohra's scientific achievements and commitment to sharing her research and passion for science with the wider community.

Annual Symposium

The RRI annual symposium brings together the Institute's research teams and staff to share their latest research. The 2022 event included sessions on ethics, community-centred research, and the health of global populations.

This annual flagship event brings together members of the RRI community to celebrate achievements from the year, to learn about research occurring across the Institute, and to provide a platform for forming new research collaborations and partnerships.

Awards presented at the RRI Symposium:

- **Director's Award:** Associate Professor Michael Stark
- **Excellence in Consumer Engagement Award:** Team EndoZone, led by Professor Louise Hull
- **Best PhD Rapid-fire presentations:** Rudrarup Bhattacharjee and Stephanie O'Hara

Dr Nicole McPherson, Senior Research Fellow, Male Reproductive Life Course group, Robinson Research Institute

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Top 10 publications 2022

During 2022, RRI members have published over 460 peer reviewed journal articles, reviews and other publications. Our Top 10, sorted alphabetically, illustrate the scope and impact of the institute's research outputs. Names in bold are RRI members.

Kayumi, S., Pérez-Jurado, L. A., Palomares, M., Rangu, S., Sheppard, S. E., Chung, W. K., **Jolly, L. A.**, Van Eyk, C. L., **Harper, K**, **Webber, D. L.**, **MacLennan, A. H.**, **Gecz, J.**, **Corbett, M. A.** et al. (2022). Genomic and phenotypic characterization of 404 individuals with neurodevelopmental disorders caused by CTNNB1 variants. Genetics in Medicine. doi: 10.1016/j.gim.2022.08.006

Klau, J., Bernardo, C. O., Gonzalez-Chica, D. A., **Raven, M.**, & **Jureidini, J.** (2022). Trends in prescription of psychotropic medications to children and adolescents in Australian primary care from 2011 to 2018. *Aust N Z J Psychiatry, 56*(11), 1477-1490. doi:10.1177/00048674211067720

Leung, D., **Price, Z. K.**, Lokman, N. A., Wang, W., Goonetilleke, L., Kadife, E., Oehler, M., Ricciardelli, C. Ahmed, N. (2022). Platinum-resistance in epithelial ovarian cancer: an interplay of epithelial-mesenchymal transition interlinked with reprogrammed metabolism. *J Transl Med, 20*(1), 556. doi:10.1186/s12967-022-03776-y

Marshall, H. S., Vesikari, T., Richmond, P. C., Wysocki, J., Szenborn, L., Beeslaar, J., . . . Perez, J. L. (2022). Safety and immunogenicity of a primary series and booster dose of the meningococcal serogroup B-factor H binding protein vaccine (MenB-FHbp) in healthy children aged 1-9 years: two phase 2 randomised, controlled, observer-blinded studies. Lancet Infectious Diseases. doi:10.1016/s1473-3099(22)00424-8 IF 70

McPherson, N., & **Greiger, J.** (2022). The science of preconception. *International Journal of Birthing and Parenting Education, 9*(2), 9-14.

Moore, V., **Rumbold, A.**, **Fernandez, R.**, **McElroy, H.**, Moore, L., **Giles, L.**, **Grzeskowiak, L.**, Roughead, E., **Stark, M.**, & **Davies, M.** (2022). Dispensing of clomiphene citrate to treat infertility: medication supplied and population prevalence of assisted pregnancies and multiple births. *Fertil Steril, 117*(1), 202-212. doi:10.1016/j.fertnstert.2021.08.030

Robertson, S. A., **Moldenhauer, L. M.**, **Green, E. S.**, **Care, A. S.**, & **Hull, M. L.** (2022). Immune determinants of endometrial receptivity: a biological perspective. Fertility and Sterility, 117(6), 1107-1120.

Safiri, S., Noori, M., Nejadghaderi, S. A., Karamzad, N., Carson-Chahhoud, K., Sullman, M. J. M., & **Avery, J.** (2022). Prevalence, incidence and years lived with disability due to polycystic ovary syndrome in 204 countries and territories, 1990-2019. Human Reproduction. doi:10.1093/humrep/deac091

Umehara, T., **Winstanley, Y. E.**, **Andreas, E.**, **Morimoto, A.**, **Williams, E. J.**, **Smith, K. M.**, **Russell, D. L.** & **Robker, R. L.** et al (2022). Female reproductive life span is extended by targeted removal of fibrotic collagen from the mouse ovary. Science Advances, 8(24), eabn4564. doi:10.1126/sciadv.abn4564 IF 14.4

Yang, R., Li, Q., Zhou, Z., Qian, W., Zhang, J., Wu, Z., **Norman, R. J.** & Qiao, J. et al (2022). Changes in the prevalence of polycystic ovary syndrome in China over the past decade. The Lancet Regional Health West Pac, 25, 100494. doi:10.1016/j.lanwpc.2022.100494

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