HUDSON
INSTITUTE OF MEDICAL RESEARCH

ANNUAL REPORT 2021

Our values

Excellence

Integrity and passion underpin our pursuit of scientific knowledge of the highest quality, while nurturing and inspiring the next generation of scientists.

Partnerships

Our collaborative research environment allows scientists to leverage partnerships for true knowledge gain and patient impact.

Innovation

We inspire and enable world-class researchers at the frontiers of science and medicine to find new, transformative solutions to our greatest health challenges.

Community

We care deeply about improving the health and wellbeing of our community and we are committed to rewarding its investment in science.

Our goals

Transformative medical research

We strive to improve the health of our community by undertaking outstanding medical research.

Exceptional people and culture

We are a destination of choice, recognised for supporting and developing our staff and students.

Enriching partnerships

We build and nurture meaningful partnerships to accelerate research discoveries to patient care.

Enabling success

We deliver a world-class research environment.

Lachy. See page page 23 for full story.

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Cover image: Lachy and his sister Isabelle. See page 23 for full story.

About us

A global bioscience medical research leader, Hudson Institute advances healthcare through groundbreaking, collaborative medical research discoveries, and the translation of these into real-world impact.

The scope and scale of our scientific expertise is unique. Our internationally recognised research programs deliver in five areas of medical need — inflammation, reproductive health and pregnancy, infant and child health, cancer, and hormones and health.

Our 443 scientists, clinicians and graduate students come from around the world to pursue one mission — to make medical research discoveries that save and change lives.

Located in the Monash Health Translation Precinct, our scientists work alongside clinical and industry colleagues and use advanced technology platforms to inform their discoveries.

Our expertise spans the complete translation pipeline from patient need, scientific discovery, clinical testing and commercialising new preventative approaches, therapies and devices for patients.

Our Institute is named after Professor Bryan Hudson AO, the Founding Director of Prince Henry's Institute, and Inaugural Chair of the Department of Medicine at Monash University.

Our themes


Inflammation


Reproductive health and pregnancy


Infant and child health


Cancer


Hormones and health

Monash Health Translation Precinct

Hudson Institute is located within the Monash Health Translation Precinct (MHTP), a major scientific research and medical innovation powerhouse in Melbourne's south-eastern corridor.

Together with our precinct partners, Monash Health and Monash University, we are a global leader in new technologies, medical research, healthcare and education. We achieve this through innovation and trusted relationships with industry and government.

- The Monash Precinct is the largest hub for employment and innovation in Victoria, outside Melbourne's Central Business District.
- Hudson Institute is a global leader in new technologies, advanced manufacturing, health and education.
- We achieve this through innovation and trusted relationships between education, industry, research, and government.
- We are an innovation ecosystem that collaborates to create innovative solutions that improve human life.

HUDSON INSTITUTE OF MEDICAL RESEARCH

MONASH University

Monash Health

Monash Children's Hospital

We

Expand the boundaries of knowledge to save and improve lives.

Make new scientific discoveries to improve people's health.

Collaborate with scientists and clinicians in Australia and around the world.

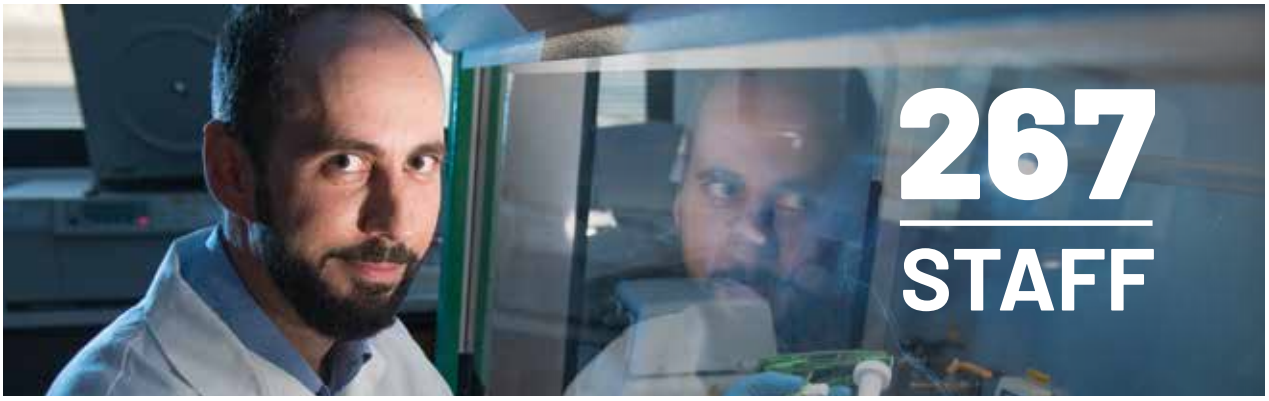
Help governments to improve healthcare and create jobs.

Help doctors save lives, providing insight for them to find the right clinical answers.

Provide scientific breakthroughs for development with industry.

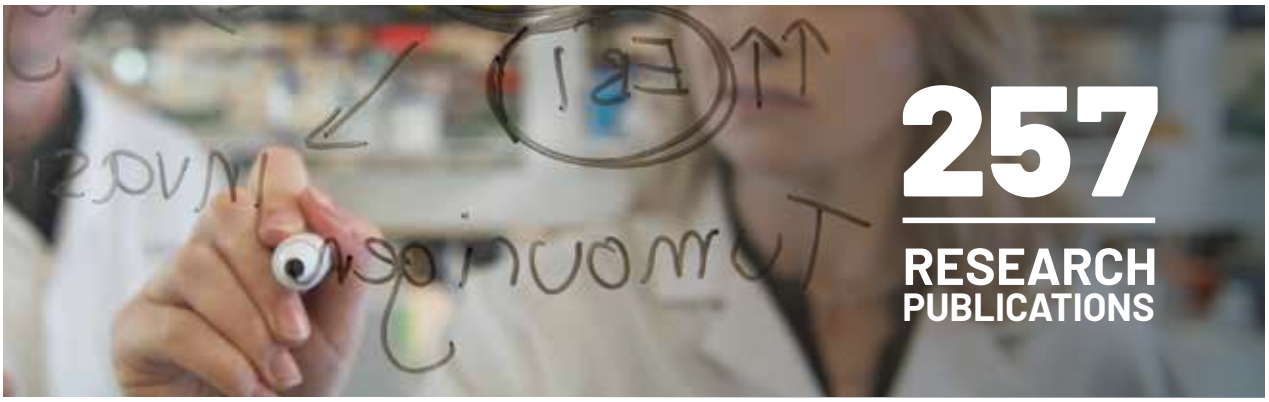
Prepare today's students for successful careers in science and medicine for tomorrow.

At a glance


267
STAFF

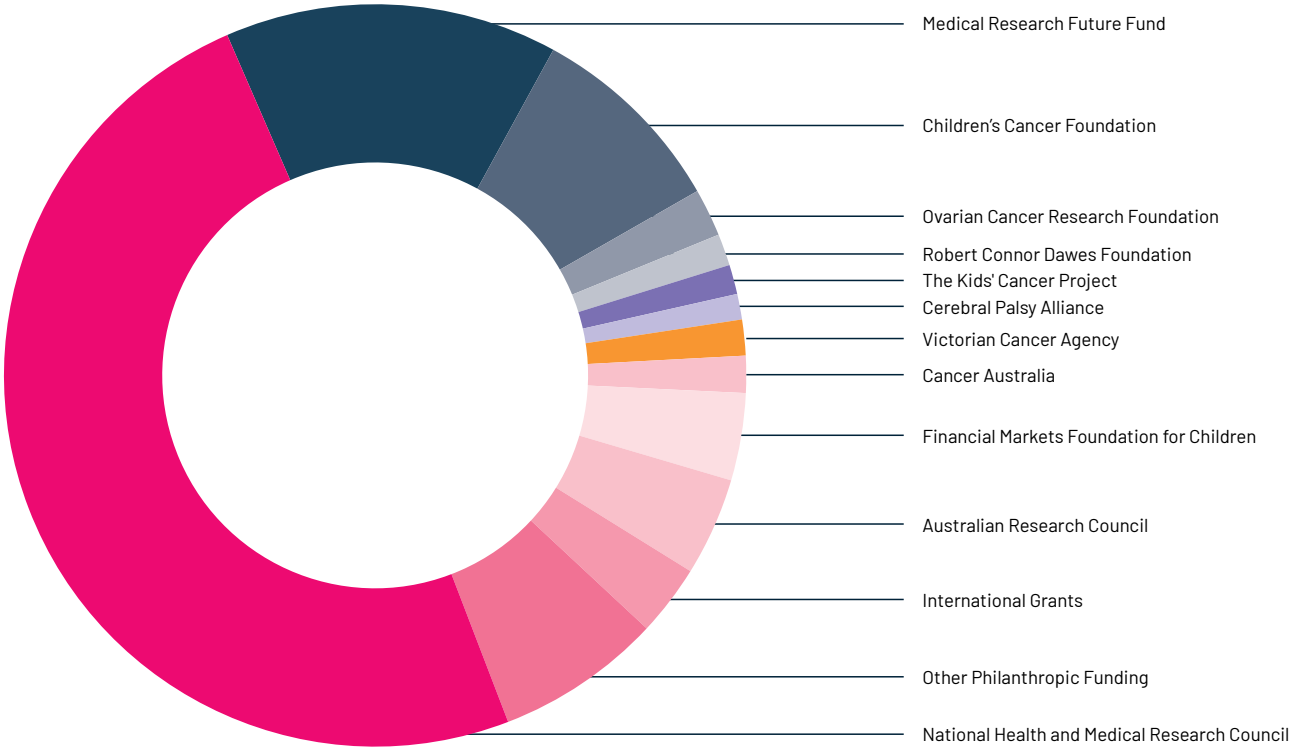

176
STUDENTS


43
RESEARCH
GROUPS


257
RESEARCH
PUBLICATIONS

Research outputs

Grant funding received in 2021



	$
National Health and Medical Research Council	12,956,938
Medical Research Future Fund	3,810,185
Children's Cancer Foundation	2,301,072
Australian Research Council	1,124,327
Financial Markets Foundation for Children	1,000,000
Ovarian Cancer Research Foundation	547,244
Cancer Australia	422,890
Victorian Cancer Agency	410,000
Robert Connor Dawes Foundation	363,386
The Kids' Cancer Project	337,283
Cerebral Palsy Alliance	292,506
Additional Philanthropic Funding	
Cancer Council Victoria	138,857
The Erdi Foundation	125,224
Children's Tumour Foundation	100,000
Cure Brain Cancer Foundation	80,000
Heart Foundation	71,800
The CASS Foundation	70,000
Additional grant funding	1,313,862
TOTAL	**1,899,743**
International Grants	
Department of Defense (USA)	667,173
Other international grants	146,118
TOTAL	**813,291**
TOTAL GRANT FUNDING	**26,278,866**

Publications

In 2021, Hudson Institute's researchers published extensively in international peer-reviewed journals.

Publication type	2019	2020	2021
Original research articles	203	210	188
Reviews	52	41	41
Editorials and commentaries	16	26	26
Books and book chapters	12	8	2

Director's report

2021 delivered yet another lesson in the value of research and health resilience. We were reminded of how crucial it is to safeguard the health of Australians through advances in science and medicine.

Our critical work to understand the damaging effects of inflammation is the driving force behind our plans for a *National Centre for Inflammation Research* — a world-class research and development hub focusing on the role of inflammation in acute and chronic disease that contributes to more than 50 per cent of deaths worldwide.

With $1 million provided by the Victorian Government in 2020, we were able to complete architectural planning and a compelling business case that is currently with the Victorian and Commonwealth governments for consideration. Additional philanthropic funding is being sought to complete the project.

Key to this project is our world-leading expertise in innate immunity and specialised knowledge of RNA sensing by the immune system. This capability is unique in Australia and central to the development of the mRNA and RNA manufacturing industry in Australia and the region.

Leadership changes

In 2021 we saw some significant leadership changes. After more than two decades as Head of the Centre for Innate Immunity and Infectious Diseases, Professor Paul Hertzog has stepped aside, passing the baton to Professor Brendan Jenkins as the incoming Head. I want to thank Paul for his dedicated leadership of the Centre, which has doubled in size under his guidance and become recognised internationally for its work in innate immunity and inflammation. I'm very fortunate to continue to have Paul's support as Deputy Director as we work towards realising our vision for the *National Centre for Inflammation Research* at Hudson Institute.

I am also thrilled to have Brendan's support as an outstanding leader of one of our largest Centres. Brendan began his appointment at the start of 2022.

Also, in 2021, Professor Stuart Hooper announced his intention to step aside as Head of The Ritchie Centre. Stuart has led The Ritchie Centre through a wonderful period of evolution, supporting such landmarks as the Financial Markets Foundation for Children's endowment of the Chair of Neonatology, and success at the highest level of competitive funding such as NHMRC Program Grants. I want to thank Stuart for his passionate commitment and leadership of The Ritchie Centre over many years. I am delighted that he intends to continue his outstanding research with us.

In the turmoil of 2021, I was continually reminded of the importance of health and medical research and how our community rallies to help the most vulnerable during these times.

To our supporters, I thank each one of you who has helped our research effort during the past year. We could not do it without you.

Professor Elizabeth Hartland
Director and CEO

Chair's report

Last year was challenging for everyone and Hudson Institute was no exception. However, through difficult times we showed that with versatility, resilience and collaboration, our scientists could continue developing new solutions to society's pressing health needs.

Indeed, the value of medical research to our healthcare system and economy has never been more apparent. In partnership with hospitals, universities and industry, Hudson Institute's scientists have been striving to understand, prevent and develop better detection and treatments for COVID-19 and many other diseases.

Scientific leadership and recognition

Throughout this seminal time for the medical research sector, it has never been more important to ensure that Australians have access to authoritative, evidence-based health advice. Many of our research leaders were once again called upon by the government and media for their expertise and advice.

Among these, our Director and CEO, Professor Elizabeth Hartland, was appointed to the Council of the National Health and Medical Research Council (NHMRC) by the Federal Minister for Health and Aged Care, the Honourable Greg Hunt. She joins 12 other leading medical researchers, academics, clinicians and administrators on the NHMRC Council, entrusted with the responsibility of guiding Australians' current and future medical research. Her three-year term began immediately.

Financial results

Financial contributions in 2021 remained uncertain for many organisations like Hudson Institute. I deeply appreciate the continued backing of our community of supporters that meant Hudson Institute exceeded its donor and philanthropic donations target. I would like to thank all our loyal and generous donors and foundations for their support.

On another positive note, commercial income remained strong. Among the highlights were our partnerships with Noxopharm and its wholly owned subsidiary, Pharmorage, to further develop RNA Therapeutics. A number of trials are underway and we are hopeful that they will lead to effective new vaccines and treatments for a range of illnesses, including the immediate and longer-term effects of COVID-19.

The value of medical research

More often than not it is difficult to learn the lessons of a major disruption such as COVID-19 until it is well over, but one thing has already become abundantly clear: Australia must learn from it so that we are be better prepared to face the inevitable future health challenges.

It is this imperative that drives our efforts to create the *National Centre for Inflammation Research*. With inflammation a crucial factor in more than 50 per cent of deaths from health diseases worldwide, including COVID 19, this facility will be an invaluable addition to the nation's good health arsenal.

We continue to work towards securing the funding required to turn our plans into reality.

Board stability

I am grateful to my fellow board members for their counsel and advocacy and to Professor Hartland and her executive team for their continued efforts in very uncertain times.

Thanks to our incredible supporters, business, governments, charitable organisations and individual donors, who stepped up to help fund emerging projects and longer-term research. To our newest donors, we are delighted you have joined the Hudson Institute community. We look forward to a long and mutually beneficial relationship.

Dr Robert (Bob) Edgar AM
Chair

Solving life's little mysteries

Professor Paul Hertzog has always loved the challenge of discovering how the body works. "You get to be a detective solving a mystery of your choosing," he says. "You can discover something, figure out how it works, and in medical research perhaps contribute to a life-changing medicine."

After 30 years as a leader in the immunity field, Prof Hertzog has passed the baton as Head of the Centre for Innate Immunity and Infectious Diseases (CiiiD) to colleague Professor Brendan Jenkins.

Since 2000, when he took on the Centre's leadership, Prof Hertzog has seen it double in size and become internationally recognised for its important work on innate immunity, infection and inflammation. This is largely due to his outstanding work on the innate immune system — the body's first line of defence against germs and cancer — and particularly the interferons, which are important proteins in this defence.

"The opportunity to build a place and a culture where we can share and nurture enthusiasm for the discovery and application of science has been very special," he says. "The timing to build this environment is perfect, with the amazing technical advances making this a great time to do science."

Building teams and capabilities

Prof Hertzog injected these attitudes when he first joined the Centre for Functional Genomics and Human Disease, CiiiD's predecessor, in 1992. The understanding of the innate immune system, the body's first response to disease, was undergoing a rapid revolution and it appeared Prof Hertzog and his team could be part of it.

CiiiD's identity took shape with his recruitment of outstanding group heads who shared a vision to create an environment for excellence in this field. Their success saw the Centre grow from 40-50 to over 120 inflammation researchers. Such an increase was testament to the calibre of these internationally renowned scientists.

The journey of a research trailblazer

Prof Hertzog received a PhD from the University of Melbourne in 1977 on cancer metabolism, then conducted post-doctoral research in the USA, England and at Monash University, where he began his work on interferons in the early 1990s.

One of his proudest achievements was producing a gene knockout model of the interferon receptor for the study of gene function at a whole-body level.

"This model has now been used by thousands globally to understand fundamentals of the immune system and to develop medicines such as Anifrolumab, a new treatment for systemic lupus erythematosus," says Prof Hertzog.

Paul was appointed at the highest NHMRC level of a Senior Principal Research Fellowship from 2007. He has published over 250 peer-reviewed papers in prestigious journals and in 2013 received the Milstein Award for Excellence in interferon and cytokine research, the highest honour in this discipline, for his discovery of a new cytokine.

His commitment to research translation has also seen substantial industry engagement and inventions from his work patented, including a novel immunotherapy to suppress metastasis and activate host immune responses to advanced ovarian cancer.

Nurturing the next generation

Prof Hertzog has supervised 42 PhD and 40 Honours students, recruited and nurtured 23 postdoctoral researchers and group heads - many of whom now form the Centre's backbone or hold roles in prestigious international Institutes.

Paul will continue as Hudson Institute's Deputy Director, and drive research through his leadership of the Regulation of Interferon and Innate Signalling Group, and as Chief Investigator in the NHMRC synergy program, Synnate, which will promote Australia's research capacity in host-microbiome immunology.

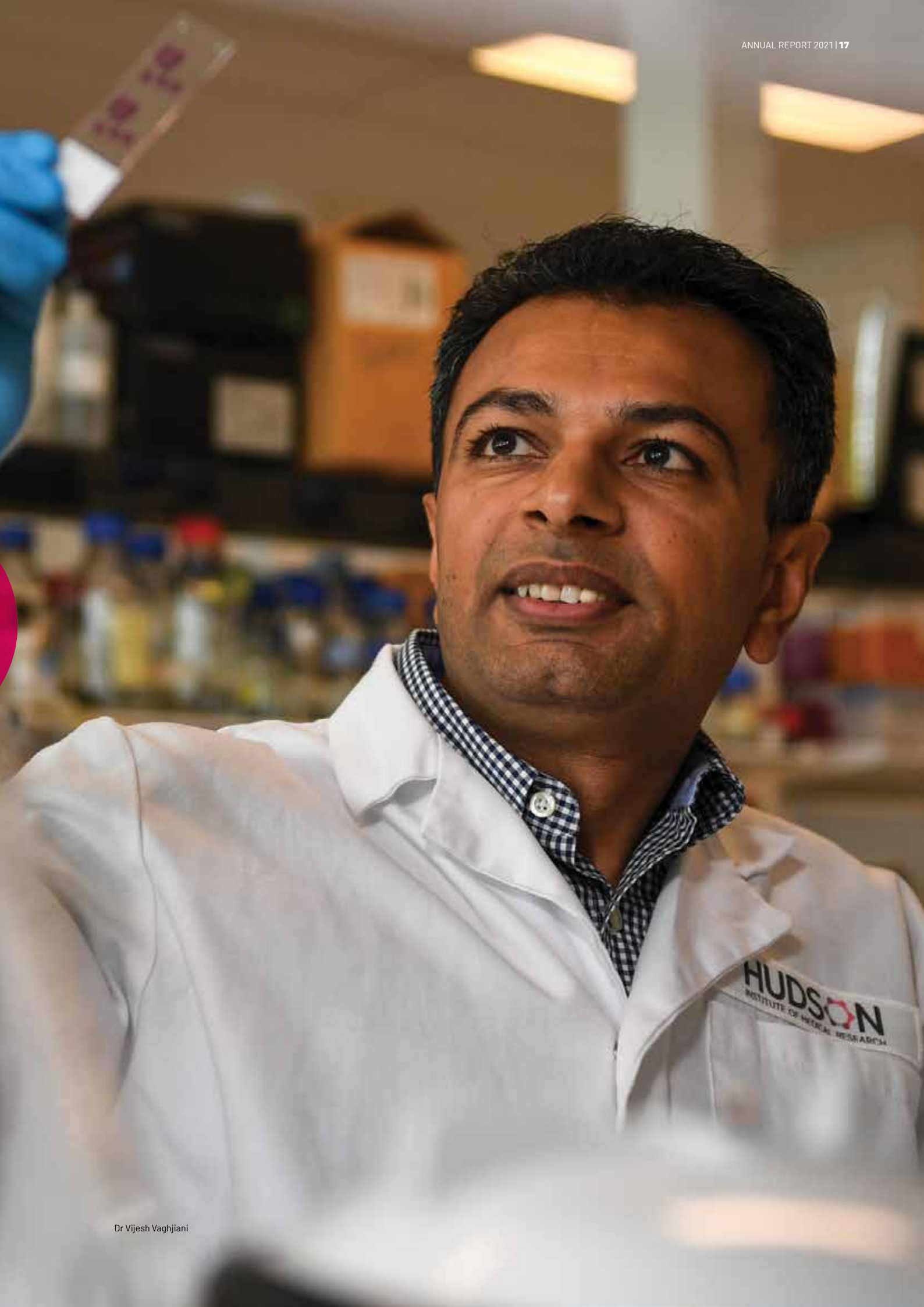
Still fascinated by the amazing technical advances in his time, Prof Hertzog loves the challenge of keeping up with and inspiring brilliant young minds.

"I love the enthusiasm of people who come through our doors, their intelligence, cultural diversity and their stories. It is a privilege that they choose to spend time with us."

L-R: Professor Paul Hertzog, Professor Brendan Jenkins

Research Impact

We would like to introduce you to some of the extraordinary scientists at Hudson Institute who are advancing healthcare through scientific discovery. Their interests range from the laboratory to the bedside, from the classroom to the doctor's office, and from the fields of inflammation, reproductive health and pregnancy, infant and child health, cancer, and hormones and health. These women and men are true innovators.



Dr Vijesh Vaghjiani

STOMACH CANCER

Published in *Gut*, September 2021

Stomach cancer paradigm shift

Researchers aim to beat cancer at its own game by identifying modulators of the innate immune system that drive it and applying the brakes before cancer takes hold.

Stomach cancer is the third most lethal cancer worldwide, with a five-year survival rate of less than 30 per cent. In 2021, Professor Brendan Jenkins and Dr Ruby Dawson challenged conventional thinking about how stomach cancer forms — the answers have created a paradigm shift in scientific thinking around how the immune system contributes to the development of stomach cancer.

Most stomach cancers are caused by uncontrolled activation of two arms of the immune system: the innate or first line of defence, and the adaptive or slower specific immune response. To date, scientists have focused on adaptive immune-based pathways and treatments, but these have yielded limited clinical results.

"To find new treatments we must identify new immune system genes to target, so we looked outside the box at the underexplored innate immune system," says Prof Jenkins.

The team's discovery, published in the prestigious *Gut*, identified a critical contributor to stomach cancer development, namely the underexplored innate immune system protein, AIM2.

Cancer trigger

"If you think of a cell as a finely tuned orchestra with instruments playing in harmony and taking cues from each other, we discovered that AIM2 is playing way too loud. This causes chaos that triggers cancer in the cell. We aim to restore the harmony," says Dr Dawson.

"Targeting immune regulators like AIM2 and potentially other related immune system regulators is an untapped strategy; it gives scientists new targets to use for drugs and the potential for a clearer picture of a patient's prognosis," says Prof Jenkins.

"This is a substantial advance in the molecular mechanisms underlying stomach cancer, offering enormous potential to dramatically improve treatments and stomach cancer survival."

Professor Brendan Jenkins

The discovery provides a major advance in the fundamental understanding of the molecular mechanisms governing stomach cancer and has enormous potential to influence future clinical management and dramatically improve patient outcomes.

Collaborators Monash Health; Cancer Research Institute, Japan; Duke-NUS Graduate Medical School, Singapore; Kanazawa University, Japan; National Cancer Institute, USA

Funders National Health and Medical Research Council (NHMRC)

30 per cent
Five-year survival rate

Third
Most lethal cancer worldwide

2200
Estimated cases each year

L-R: Professor Brendan Jenkins, Dr Ruby Dawson

PANCREATIC CANCER

Published in *Clinical Cancer Research*, August 2021

Never stop asking

Pancreatic cancer is predicted to be the second leading cause of cancer-related death by 2030. While other cancer survival rates are improving, pancreatic cancer has been virtually unchanged for four decades.

For the first time, our researchers have used genetic tumour profiling to diagnose pancreatic cancer. Lead pancreatic surgeon, Dr Daniel Croagh, along with clinical research fellow Dr Joanne Lundy and research group head Professor Brendan Jenkins, hope their new technique will offer earlier diagnoses and more treatment options for patients.

The challenge

Pancreatic cancer diagnosis is difficult because the pancreas sits behind other organs, making it notoriously difficult to perform a biopsy. Doctors must pass a scope from the mouth to the stomach to view the pancreas using ultrasound. Only after this invasive procedure can a biopsy be performed.

Sadly, biopsy samples are often too small to establish a diagnosis. As a result, patients must go through the trauma of multiple biopsies when the result is not clear.

Persistence pays

Refusing to accept the status quo, the team believed that cutting-edge genetic analysis of a small biopsy sample could establish a diagnosis first time. Their persistence paid off.

The team's trial, using cutting-edge genetic analysis of biopsy material, revealed that diagnostic accuracy can be improved. In fact, their results, published in *Clinical Cancer Research*, improved pancreatic cancer detection from 78 to 91 per cent.

"Patient samples are in fact large enough to be used for accurate first-time diagnoses and drug selection," says Dr Lundy.

The research opens the door for earlier diagnoses of pancreatic cancer as well as the tumour type, which could see patients like Concetta Vasille begin a tailored treatment sooner.

"Our hope is that survival rates will improve as more patients are offered genetic profiling," says Prof Jenkins.

Funders Pankind; Victorian Cancer Agency (VCA)

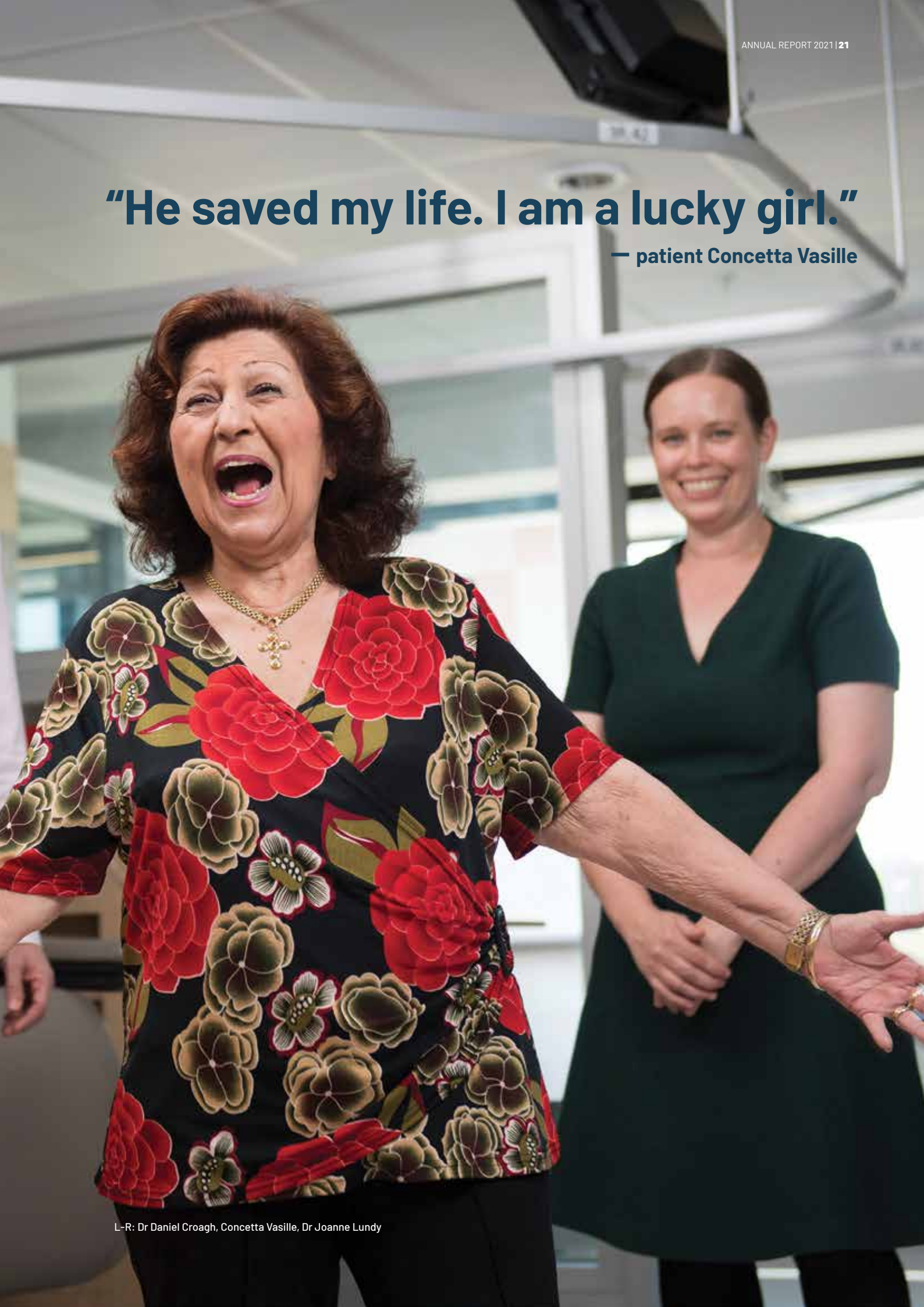
Collaborators Monash University; Monash Health

Conventional testing was unable to detect Concetta Vasille's pancreatic cancer. Despite this, Dr Croagh scheduled surgery and used genetic tumour profiling which returned positive results, reinforcing the decision to proceed. Concetta was in surgery the next day and post-operative tumour analysis confirmed pancreatic cancer.

"Concetta's case highlights that genetic analysis can provide a diagnosis when conventional testing is inconclusive," says Dr Croagh.

“He saved my life. I am a lucky girl.”

— patient Concetta Vasille



L-R: Dr Daniel Croagh, Concetta Vasille, Dr Joanne Lundy

RNA THERAPIES

Published in *Nucleic Acid Research*, June 2021

The RNA revolution

When he was 11 years old, Associate Professor Michael Gantier had a close shave with death. Failing to recover after having his appendix removed, he was rushed to emergency surgery where doctors discovered he had sepsis. He would have died within hours if they hadn't acted so quickly.

"The experience cemented my interest in science and how inflammation could be controlled to help patients," says A/Prof Gantier.

Today, he is leading research into RNA therapeutics, a rapidly expanding category of drugs with the potential to revolutionise treatments for many diseases, including those driven by inflammation.

"Our vision is to create long-lasting therapies for autoimmune diseases, including those currently considered untreatable."

Professor Michael Gantier

'X' factor propels

When A/Prof Gantier was doing his PhD 20 years ago, RNA therapeutics was an emerging field. But it was clear to him that its potential would revolutionise medicine.

But science time is slow — it takes a mountain of patience, global collaboration, and an Everest of funding to make progress. Over the past two decades, global RNA therapeutics researchers made solid headway, including scooping a couple of Nobel Prizes. Then came the real game-changer — the pandemic, and that elusive 'X' factor, funding, which enabled laboratory potential to be transformed into patient treatments.

"Thanks to the funds invested in vaccines for COVID-19, the mainstream use of RNA therapeutics is around 5-10 years ahead. It is now clear that RNA therapeutics, beyond vaccines, will grow to benefit millions of people," A/Prof Gantier says.

The challenge

A focus of A/Prof Gantier's research is understanding how RNA molecules interact with the immune system to help create RNA-based treatments for auto-inflammatory diseases such as lupus, psoriasis, Parkinson's and fatty liver diseases.

By examining how the immune system detects RNA molecules, A/Prof Gantier is bringing the incredible potential of RNA therapies closer to these patients. His unique body of work is the largest in this field and is being used globally to define how some RNA therapies can block key immune system sensors that normally alert our body to infections.

In 2021, he published the most comprehensive description of how RNA therapeutics interact with the immune system in *Nucleic Acid Research*. This important work has the potential to unlock the secrets of RNA's inflammatory effects, and to improve patient treatments in three areas

- **Vaccines** While mRNA vaccines are life-saving, they require multiple doses to be effective and come with side effects including fatigue and muscle pain. Long-lasting vaccines with fewer side effects could be possible.
- **Autoimmune disease** There could be treatments for many previously undruggable conditions.
- **Fewer treatments** Patients' quality of life could be improved greatly by replacing a daily cycle of drugs or weekly injections with six-monthly injections with RNA therapeutics.

A/Prof Gantier's vision also took a step closer to being realised with the signing of a commercial licencing agreement to develop RNA therapies for patients with autoimmune diseases. See page 37 for the story.

Funders NHMRC/ARC; Québec Fonds de Recherche du Québec, Canada

Collaborators Pharmorage Pty Ld; Integrated DNA Technologies

What is RNA?

DNA and RNA are a class of molecules called nucleic acids (the 'NA' in DNA and RNA). They contain and access the genetic information that controls which cells do what in our bodies. They are present in all forms of life, including bacteria and viruses, and are essential for our immune system to detect infections. In a cell, the main job of RNA is to convert information stored in DNA — our genetic blueprint or instruction — into proteins. This task is carried out by a specific type of RNA called 'messenger' RNA, or mRNA.

What are RNA therapeutics

RNA therapeutics are a rapidly expanding category of drugs that have the potential to revolutionise treatments for many diseases, including some that have previously been untreatable. The RNA (ribonucleic acid) molecule is essential in gene coding, decoding, regulation and expression. RNA therapeutics aim to modulate the immune system's response by tapping into a short RNA sequence to prevent the production of rogue proteins that can cause problems. The best-known examples of RNA therapeutics are mRNA COVID-19 vaccines.

Associate Professor Michael Gantier

Global experts guiding Victoria's mRNA future

Leading RNA researcher Dr Minni (Minna-Liisa) Änkö was enlisted to join an esteemed global panel of RNA biology and virology vaccine experts who will advise on Victoria's mRNA research and manufacturing capability.

Established in June 2021, mRNA Victoria's Scientific Advisory Group (SAG) comprises 10 global and local leaders in the fields of immunology, virology and infectious diseases. SAG Chair and Victoria's Lead Scientist, Dr Amanda Caples, will harness the group's significant knowledge to guide Victoria's mRNA future.

"The benefits of SAG will be widespread, from preparing for emerging threats which can be tackled with RNA-based treatments, to the creation of jobs in research and production. This is a crucial time for Australia's growing biotech industry and Victoria is at the centre, but there is a lot to be done," Dr Änkö says.

Dr Minni (Minna-Liisa) Änkö

L-R: Jeff Darmanin, CCF Executive Director, Professor Ron Firestein

CHILDHOOD CANCER

Uniting for childhood cancer

A world-class Melbourne collaboration is set to beat the worst childhood cancers.

More than 870 Australian children are diagnosed with cancer each year, and almost 100 of them on average will die. The Victorian Paediatric Cancer Consortium (VPCC) aims to change this. Funded by a three-year $9.6M Medical Research Future Fund (MRFF) grant, the VPCC unites leading Melbourne research, clinical and academic institutes to treat children's cancers with a low survival rate and reduce significant harm from treatments.

Co-led by Professor Ron Firestein (Hudson Institute) and Professor David Eisenstat (MCRI, RCH), the team will drive impactful and interdisciplinary research, improve medical care, and train the childhood cancer leaders of tomorrow.

The VPCC partnerships span discovery research and clinical innovation programs; integrated biobanking, data management and bioinformatics platforms; capacity building for training the next generation of researchers and clinicians; and annual scientific symposia and educational events.

The VPCC was made possible thanks to the tireless efforts of the Children's Cancer Foundation and funding from the Australian Government's Medical Research Future Fund (MRFF).

VPCC partners

Hudson Institute of Medical Research

Monash Children's Hospital

Monash University

Royal Children's Hospital

Murdoch Children's Research Institute

University of Melbourne

Peter MacCallum Cancer Centre

WEHI

The Children's Cancer Foundation

Lachy's story

Thanks to the VPCC, children like Lachy and their families will benefit from coordinated research and clinical care across Victoria, including targeted treatment options and reduced side effects.

Lachy was the perfect baby, until he developed fevers, vomiting and general tiredness at 18 months.

What followed was a nightmare for his family but ultimately gave them hope thanks to the Melbourne researchers who contributed to his state-of-the-art treatment.

Lachy had an 11 cm tumour in his abdomen, caused by a Stage IV neuroblastoma which had spread to his bone marrow. Five rounds of chemotherapy followed, then 11 hours of surgery to remove the tumour — which also removed a kidney — and a stem cell transplant to grow bone marrow. Next came two weeks of daily radiation therapy, and five rounds of immunotherapy. Lachy spent a month in hospital and lost his blond, wavy hair during 14 months of treatment.

Incredibly, he is now more than 18 months cancer-free, with a full head of curly hair, thanks to an amazing medical team. His parents, Ryan and Carly, and seven-year-old sister Isabelle can't praise them enough.

"It gives you hope, not just for your own child, but for others," Ryan says. "It also shows in the results — when we were diagnosed it was 50/50 — we knew medical research could make that better.

"Lachy still faces challenges, some hearing loss, the loss of a kidney and some long-term stuff associated with radiation and treatment, but he's here with us, he's happy and we're on the path to being cured," says Carly.

Lachy and his sister Isabelle

INFANT AND CHILD HEATH

Published in *Journal of Pineal Research*, June 2021

Preventing brain injury in babies

It's always been accepted that the time of birth is a period of high risk, but new research shows that the developmental period in utero can be problematic for some babies, particularly those with low birth weight.

Professor Suzanne Miller knows there are crucial times, either during pregnancy or at birth, when human existence is at its most fragile and injuries with life-changing effects can occur.

Prof Miller leads a dedicated team of researchers looking into every aspect of this time, to better understand the situations that can cause brain injury in babies and develop new treatments for those injuries when they happen.

"My career goal is to prevent cerebral palsy, which is caused by damage to the developing brain either during pregnancy or around the time of birth," she says.

"A decade or so ago it was considered that curing or preventing cerebral palsy was not possible, but huge progress has been made with interventions for high-risk babies and I now believe that both the incidence and severity of cerebral palsy can be reduced."

She is particularly interested in the physiology of how low birth weight, preterm birth and hypoxic ischaemic encephalopathy in full-term infants cause brain injury in babies.

A better start

A 2021 highlight was Prof Miller's discovery, published in the *Journal of Pineal Research*, revealing that melatonin can protect the newborn brain against a lack of oxygen. It was a result worth celebrating.

"Melatonin has potent antioxidant properties to fight against damaging free radicals. This important study showed that melatonin significantly enhances newborn brain protection and lays the foundations for a treatment which has strong implications for reducing neonatal death and disability," Prof Miller says.

In further work by PhD student Madeleine Smith, definitive answers were provided on the effectiveness of neural stem cells (NSCs) to treat neonatal brain injury, in a review published in *Stem Cells Translational Medicine*.

"Unlike other stem cell types, NSCs can integrate into damaged brain tissue, replacing dead neurons; the team analysed all available lab-based pre-clinical studies and found that NSCs can reduce brain injury and improve physical function after injury occurs," Prof Miller says.

"Day to day life as a biomedical scientist can be a hard slog and the eureka moments are rare, but goodness, when they come around, they are rewarding!"

Professor Suzanne Miller

Another promising finding — thanks to the work of Dr Tayla Penny and Dr Courtney McDonald, published in *Scientific Reports* — was that umbilical cord blood therapy could be equally effective in treating these brain injuries in both males and females, despite the differences in their brains.

Prof Miller and her team are striving to create more of these moments.

Characterising high-risk

"The term cerebral palsy describes a movement disorder, but it's important to remember that brain injury before or soon after birth is also the primary cause of more subtle cognitive, learning and behavioural dysfunctions that may affect many more Australian children," she says.

"The high incidence of disability, learning or behavioural problems that last an entire lifetime means that more research must be undertaken to characterise which infants are at high risk, and tailor treatments to reduce brain injury and improve quality of life."

There's a huge team effort at Hudson Institute to ensure that as many babies as possible get a healthy start to life, with every chance to realise their full potential.

Collaborators Cerebral Palsy Alliance; Monash Health; Monash Newborn; Monash University; University of Auckland

Funders Gates Foundation; Inner wheel Australia; NHMRC

Cerebral palsy facts

Every 15 hours, an Australian baby is born with a brain injury that underlies cerebral palsy. It is a permanent, lifelong condition with no cure. Around 34,000 Australians have cerebral palsy.

L-R Madeleine Smith, Dr Courtney McDonald, Dr Tayla Penny, Professor Suzanne Miller

ENDOMETRIOSIS

Published in *Reproductive Biomedicine Online*, April 2021

Ending endometriosis

Some scientific discoveries have the power to prevent years of pain and suffering. Professor Caroline Gargett and her team are within reach of making that dream a reality for millions of women.

Through their research, it's possible that a debilitating disease affecting one in nine women of reproductive age will be easier and, most importantly, faster to diagnose, meaning better treatments sooner.

At present the average time between symptom onset and diagnosis is seven to 10 years and the only way to confirm the presence of the disease is through invasive surgery, so anything which reduces that time and makes diagnosis easier is a game-changer.

In a study published in *Reproductive Biomedicine Online*, Prof Gargett's team was the first to show the role of endometrial stem/progenitor cells in the disease — establishing that they can escape through the fallopian tubes from the uterus into the surrounding pelvic cavity, where they have the potential to survive and grow into painful lesions.

Global impact

This is research with global impact, so it's fitting that Prof Gargett was recently recognised by the Endometriosis Foundation of America (EndoFound), which named her among the inaugural members of its Scientific Advisory Board. She is also on the International Scientific Committee of the Fondation Pour la Recherche sur l'Endométriose in France.

"Working with Dr Caitlin Filby and Katherine Wyatt, we found that the stem/progenitor cells and proteins in menstrual fluid are relatively constant between periods for any given woman," Prof Gargett says.

This study, published in *Human Reproduction, June 2021*, showed there's potential for menstrual fluid to be used to diagnose endometriosis.

Dr Filby believes a menstrual fluid endometriosis test could be one of the biggest changes ever seen in treatment of this disease. "This could dramatically change the diagnostic pathway for young women," she says.

"We would love to be able to offer women a simple and painless menstrual fluid test to confirm their suspicions of endometriosis."

Tailored treatment

Their latest findings, published in the *Journal of Personalized Medicine*, further expand the potential of menstrual fluid to be used for a range of treatment purposes. Dr Filby generated organoids, miniature endometrial organs, from menstrual fluid, which can be obtained non-invasively. In the future, menstrual fluid organoids may allow us to determine a treatment pathway tailored to each woman's specific symptoms, without the need for surgery.

That would make a huge difference in times like these, when the pressures COVID-19 has put on the medical system have made it much harder for women needing endometriosis surgery.

Prof Gargett says: "The surgeries women with endometriosis undergo are regarded as the lowest priority elective surgeries, so many women already waiting years for diagnosis and treatment prior to the pandemic, have continued to suffer in pain with little alternative to surgery.

"We would like to develop the first non-invasive test for endometriosis, reducing the time to diagnosis from 10 years to less than a year."

Professor Caroline Gargett

"Menstrual fluid donation provides an opportunity for women to contribute to important endometriosis research while surgeries are impacted by the pandemic," said Dr Filby.

"Our research also aims to determine how a woman's genetics may affect the function of endometrial epithelial progenitor cells, specifically how endometriosis risk genes affect their function."

Collaborators Epworth HealthCare; Monash Health; The University of Queensland

Funders Australian and New Zealand College of Obstetricians and Gynaecologists; NHRMC; EndoFound (USA)

L-R: Professor Caroline Gargett, Dr Caitlin Filby, Nicole Fernley

Nicole Fernley experienced excruciating pain from her first period as a 13-year-old. She was told this was normal. She sought help from numerous doctors and underwent many tests. It took 20 years for her diagnosis.

"All 13-year-olds should be taken seriously when they have period health concerns. Severe period pain is not normal. One in nine women have endometriosis — this common disease should not take 20 years of suffering to diagnose. Research to help patients is an urgent health priority," says Nicole.

176M

Affected worldwide

1 in 10

Women affected

7-10 YEARS

How long a diagnosis can take

Professor Ron Firestein

Published in *Molecular Cell*, December 2021

Putting the brakes on bowel cancer

For clinicians, detecting cancer is a victory in itself, but stopping its spread is crucial to a successful outcome.

For Professor Ron Firestein, 2021 brought welcome results in that endeavour, thanks to the discovery that disabling two proteins together robs bowel cancer cells of their ability to express genes necessary for growth and spread.

Australia has one of the highest rates of colon cancer in the world — one in 13 Australians will develop the disease in their lifetime — and it is the nation's second deadliest cancer.

The research, published in the journal *Molecular Cell*, marks a significant step in the understanding of how the transcription machinery process works in cancer cells.

"In total, this work has found the 'two brake pads' that when pressed together stops cancer gene expression and growth," Prof Firestein says.

"This research could have far-reaching impacts beyond bowel cancer, showing that cancer cells are fundamentally evasive and utilise multiple paths to become malignant," he says.

In a separate study with Dr Chunhua Wan, using Nobel Prize-winning genetic screening technology to identify new targets for bowel cancer tumours, the researchers discovered that a gene associated with leukaemia is also involved with bowel cancer.

Trialling two agents that inhibit the gene KMT2A, Prof Firestein and Dr Wan saw how they blocked bowel cancer growth and self-renewal, with very little damage to normal cells.

Realising that very similar drugs are currently in clinical trials to treat acute myeloid leukaemia, the team knew they had uncovered a promising potential treatment option, and published their important findings in *Sciences Advances*, May 2021.

"Due to limited therapeutic options, bowel cancer patients, especially those diagnosed at late stages, have very poor outcomes," Prof Firestein says. "These findings may pave the way to developing new targeted therapies for bowel cancer patients."

Targeted therapy is a relatively new way of treating bowel cancer. It has many advantages over conventional therapies such as chemotherapy and radiotherapy, as it only affects cancer cells, is better tolerated by patients, and has fewer side effects.

Funders Evans Family; NHMRC

Dr Liza O'Donnell

Published in The FASEB Journal, March 2021

Major step for male fertility

A world-first sighting of 'sneaky' sperm particles outside their usual 'home' in the testes offers hope for the 1 in 10 infertile men and new insight for cancer researchers.

Dr Liza O'Donnell's surprising discovery was that sperm-derived proteins can enter the bloodstream, providing the rationale for a simple blood test for infertile men, instead of an invasive biopsy.

"This new knowledge represents a major step forward to advance fertility diagnosis and treatment," says Dr O'Donnell.

The finding debunks the established belief that sperm-specific proteins are confined to testes' sperm-producing tubules. Instead, the team found that they are released into surrounding testicular fluid and can circulate in the blood.

"My first thought was 'uh oh, someone has made a mistake'!" says Dr O'Donnell. "But the findings were confirmed in different ways, and we can share this exciting discovery with the world."

Huge advances in proteomics technologies that measure thousands of proteins in biological fluids made the discovery possible. The findings may enable a blood test to measure sperm-producing capacity and guide sperm retrieval for IVF procedures.

"Other benefits include helping men who can't provide a sperm sample due to religious beliefs, and aiding research into male contraceptives and the environmental impacts on fertility.

"It could also inform cancer research and treatment. Many of the sperm-specific proteins found in the testes fluid are also known as cancer testis antigens, which are biomarkers and targets for cancer therapy," she says.

Collaborators University of Newcastle; WEHI; Justus-Liebig University, Germany

Funders NHMRC

L-R: Professor Mark Hedger, Dr Rukmali Wijayarathna

Published in *Andrology*, August 2021

A unique immune environment

Better understanding of the immune system, from how it protects itself from invaders to the ways it can sabotage itself, has brought enormous benefits to humanity.

It was a previous immune system discovery that led Dr Rukmali Wijayarathna to identify a significant cause of male infertility and, potentially, a new basis for male contraception. Her findings were published in the journal, *Andrology*.

Sperm grow in the testes, but it is in the organ known as the epididymis where they acquire the ability to fertilise an egg. The epididymis has a unique immune environment that prevents the body identifying sperm as 'foreign' and attacking them.

However, Dr Wijayarathna, a post-doctoral researcher working with Professor Mark Hedger, found that if there is a blockage in the tubes between the testis and the epididymis, that environment changes, making it hostile for sperm survival and maturation.

"Currently, 40 per cent of infertile men worldwide are diagnosed with unexplained or 'idiopathic' infertility, where the cause is unknown," she says.

"What we have identified is potentially not just a significant cause of previously unexplained infertility, it could also be a starting point in the development of new forms of male contraception."

While male infertility is on the rise, the need for effective male contraceptives remains unmet. These findings could have a significant impact on both those challenges.

Collaborators Justus-Liebig University, Germany; Oxford-Brookes University, UK; University of Virginia, USA

Funders NHMRC

Dr Jaclyn Pearson

Published in *Nature Communications*, August 2021

Last line in the fight against infection

The world is in the midst of another global health crisis, one that existed before COVID—19 — antimicrobial resistance.

Field leader Dr Jaclyn Pearson and her team are working on prolonging the effectiveness of a class of drugs, including antibiotics, that the World Health Organization calls 'the backbone of modern medicine'.

Dr Pearson's goal is to identify the key underlying mechanisms of disease caused by multidrug-resistant bacteria, in the search for alternative treatment options for serious infections.

"We now face a situation where common infections may again become untreatable," Dr Pearson says.

In August, Dr Pearson published a paper in *Nature Communications* identifying a group of antibiotic-resistant bacteria that are circulating in humans and livestock in Australia, known as monophasic Salmonella.

"The increase in antimicrobial resistance in Salmonella is co-occurring with increased disease severity in humans. As bacteria become more able to avoid current treatments, they can also cause more severe disease," she says.

"We need to know how this is happening and intervene to avoid a situation where we have no treatment options for life-threatening infections."

Collaborators Australian National University; Monash University; Royal Melbourne Hospital; The Peter Doherty Institute for Infection and Immunity

Funders NHMRC

Dr Kate Lawlor

Published in *Nature Communications*, May 2021

Taming inflammation

Chronic or acute inflammation can contribute to a range of ailments — some potentially deadly — including stroke, respiratory and heart disease, cancer, arthritis, asthma, dementia, multiple sclerosis, and diabetes.

In May, a study by Dr Kate Lawlor and collaborator Professor Vince James (WEHI) published in *Nature Communications* shed light on the potential triggers of inflammation.

The research focused on the cytokine, interleukin-1ß (IL-1ß), which is critical to clearing infections but is also associated with sepsis and driving autoinflammatory and inflammatory diseases including rheumatoid arthritis, Type 2 diabetes, and atherosclerosis.

Previous IL-1ß research had focused on understanding how it is activated and how inhibiting this process or neutralising IL-1ß could reduce inflammation. However, little was known about how the precursor IL-1ß protein is regulated.

The team discovered a key event that contributes to the depletion of inactive IL-1ß and limits access to the enzyme that activates IL-1ß. The discovery is a major step in understanding how IL-1ß levels could be manipulated to limit inflammatory responses and developing treatments for diseases associated with excessive inflammation.

Collaborators Monash University; University of Melbourne; WEHI

Funders NHMRC

L-R: Dr Jun Yang, Lisheng Yang

Published in *Hypertension*, June 2021

Finding the cause of high blood pressure

After watching her father struggle with hypertension (high blood pressure) for decades, endocrinologist Dr Jun Yang found he had a hormonal condition called primary aldosteronism (PA). PA affects one in 10 patients with hypertension, but less than one in 100 patients know they have the disease as it is often misdiagnosed as conventional hypertension. Patients can have PA for decades without knowing the cause, missing the right therapy and suffering preventable heart disease or stroke.

Collaborating with the University of Western Australia, University of Queensland and Baker Heart and Diabetes Institute to access large databases, Dr Yang's team found a strong relationship between aldosterone levels and high blood pressure from a young age. This research has generated evidence to support earlier testing for aldosterone excess as a cause of high blood pressure so that the underlying condition can be accurately diagnosed and treated to prevent future heart disease.

Since Dr Yang established PA treatment protocol in 2010 and the Endocrine Hypertension Service at Monash Health in 2016, PA diagnoses have increased 40-fold, from two to three cases per year prior to 2010 to over 90 cases in 2020. In addition to her research and clinic, Dr Yang is improving clinician awareness so that patients like her father are diagnosed and treated much sooner.

Collaborators Baker IDI; Barwon Health; Monash University; University of Queensland; University of Western Australia

Funders Heart Foundation; Rebecca Cooper Foundation

Dr Daniel Gough

Published in *Oncogene*, October 2021

Expect the unexpected

Lung cancer is the leading cause of cancer deaths, and small cell lung cancer (SCLC) is the 'worst of the worst' with high mortality rates and no improvements in treatment for almost 40 years.

Unfazed by the challenge, Dr Daniel Gough set out to understand the molecular drivers of SCLC — and in the process made a breakthrough that offers patients new hope.

In a study published in *Oncogene*, Dr Gough revealed that SCLC can show significant differences depending on the type of cell it originates in. This finding suggests that SCLC is not one disease but several, creating the potential for new forms of treatment.

Dr Gough says at present more than 95 per cent of SCLC patients succumb to the disease.

"Until now, SCLC was thought to arise from just one cell type — the rare neuroendocrine cells (PNEC). However, we found that a mutation of the common cancer gene MYC enables other lung cell types to form SCLC," Dr Gough says.

The discovery was a eureka moment: "When we looked down the microscope, we expected to see the most common lung cancer, adenocarcinoma, but instead found the overexpression of MYC had completely changed it to SCLC," Dr Gough says.

Funders Cancer Council Victoria; Victorian Cancer Agency

Collaborators Peninsula Oncology; Cancer Care Manitoba, Canada

L-R: Associate Professor Rebecca Lim, Mihiri Goonetilleke

Published in *Stem Cell Research and Therapy*, July 2021

Liver disease treatment on the horizon

Inflammation underpins hundreds of health conditions, contributing to more than half of all deaths worldwide.

One of the latest studies by Associate Professor Rebecca Lim and Mihiri Goonetilleke aims to develop treatments for the most common liver disease of all, non-alcoholic steatohepatitis (NASH). Its prevalence is hard to determine, but recent estimates show 12 per cent of the US population has NASH and it will be the leading cause of liver transplants in that country by 2025.

In a paper published in *Stem Cell Research and Therapy*, the team established that stem-like cells from the placenta have the potential to reduce the liver's inflammatory response to NASH.

"Currently there are no treatment options for NASH to prevent progression of liver disease, and ours is the first evidence that placental cells can control the liver's own response to this condition," Ms Goonetilleke says.

"Our next aim is to understand what patients with liver disease will benefit from these treatments and identify the types of liver injuries that are most likely candidates for placental cell therapy."

Collaborators Harry Perkins Institute of Medical Research; Monash Health; Monash University; QEII Medical Centre; The University of Western Australia

Funders Medical Research Future Fund; NHMRC

Associate Professor Rebecca Lim

Published in *Stem Cells Translational Medicine*, January 2021

Surviving to thriving

Groundbreaking cell therapy treatments are a step closer for some of our most vulnerable patients — preterm babies at high risk of serious lung disease.

Associate Professor Rebecca Lim is a global leader in cell therapy research, dedicating more than 10 years to understanding how stem cells from the amniotic sac could reverse the downward spiral of life-threatening diseases. This research culminated with a world-first cell therapy trial for extremely premature babies with severe lung disease.

Now A/Prof Lim and her team are running early phase clinical safety trials to take this treatment into neonatal wards, saving lives and improving lifelong health. She continues to challenge conventional thinking and look for solutions.

"While cell therapy is neonatal medicine's new frontier, translating research discoveries into treatments is our challenge," A/Prof Lim explains.

In a study published in *Stem Cells Translational Medicine*, her team overcame a major treatment hurdle that had been overlooked — that the system used to deliver cell therapy can reduce the number of cells delivered.

Their work will inform the first protocol for intravenous (IV) delivery of cell therapies to newborns,

"The goal is to find a dose that is well tolerated and effective in reducing the severity of lung disease and other complications, such as cerebral palsy," A/Prof Lim says.

"This work is putting Australia on the map for stem cell research."

Collaborators Monash University; Royal Women's Hospital; University of Melbourne

Funder NHMRC

PHILANTHROPY

Thank you to our supporters

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We also acknowledge the support of the Victorian State Government through the Operational Infrastructure Support Program, and the Australian Government.

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Australian and New Zealand Bone and Mineral Society

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Australian Government, Medical Research Future Fund

Australian Health Research Alliance

Australian Research Council

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Cancer Australia

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Cerebral Palsy Alliance

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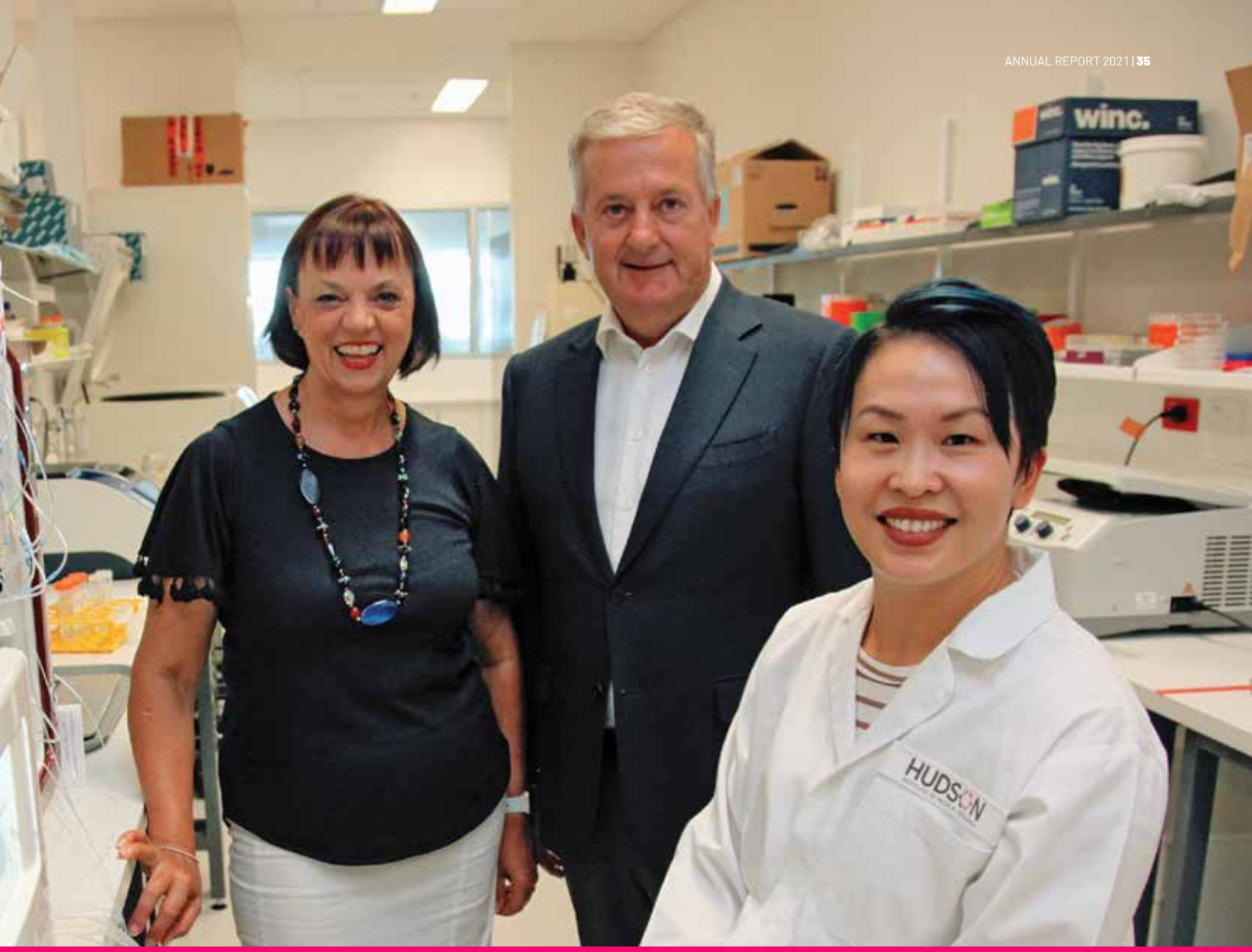


L-R: Cathy Garrard, Nigel Garrard, Associate Professor Rebecca Lim

The gift of hope

Nigel and Cathy Garrard will never even know the names of many of the people whose lives they have transformed through one simple act of generosity.

Here at Hudson Institute, some extra special gifts have the power to change thousands of lives for generations to come.

In an act that could have far-reaching benefits, Nigel and Cathy Garrard have provided one of those gifts — funding world-leading science with the potential to extend and improve the lives of children born very prematurely.

"For us the decision was easy. We knew the difference we could make by helping to fund Associate Professor Rebecca Lim's life-changing medical research," Nigel and Cathy say.

Thanks to this funding, brilliant researchers like A/Prof Lim are developing new treatments for some of the most common and debilitating conditions faced by these babies as they grow and develop.

"There are unique challenges when dealing with premature infants. They are tiny, their organs haven't fully matured, the equipment is tiny and every single intervention can significantly affect the patient, so we have to be extremely careful," A/Prof Lim says.

Sadly, the same treatments that are required to help tiny babies keep breathing — ventilation and steroids — can have damaging impacts in the long term, such as Bronchopulmonary dysplasia (BPD).

After initially having success reducing these problems through cell-based treatments A/Prof Lim has gone further.

She is now working on new ways of delivering life-changing treatments that could help these children avoid developing chronic lung and other conditions in the first place.

There is also a possibility the same techniques could be used for a range of conditions previously thought untreatable.

Excellent science takes time, but this has the potential to be a game-changer. And none of it would have happened without a single, extra special gift.

TRUSTS AND FOUNDATIONS

Our loyal supporters

Hudson Institute is grateful for the ongoing support of our generous trusts and foundations who form part of our wider community, helping to connect our Institute and scientists with patients who inform our research

L-R: Professor Ron Firestein, Jeff Darmanin, CCF Executive Director

Children's Cancer Foundation

It is hard to imagine a diagnosis that impacts a whole family more than cancer in a child. Hudson Institute's childhood cancer research is far-reaching, and now with the creation of the Victorian Paediatric Cancer Consortium (VPCC), we're combining forces with Melbourne's best medical minds and top institutions. A huge key to that development is the Children's Cancer Foundation (CCF) whose tireless work helps to fund, promote and propel our work throughout Australia and beyond. Generous Children's Cancer Foundation funding has provided sponsorship of an annual international Childhood Cancer Research Symposium, hosted by Hudson Institute, as well as the second phase of the Hudson-Monash Paediatric Precision Medicine Program.

L-R: Lucinda Nolan, CEO OCRF, Clare O'Neil MP, Federal Member for Hotham and Shadow Minister for Senior Australians and Aged Care Services, Dr Maree Bilandzic, Dr Andrew Stephens, Professor Elizabeth Hartland, Peta Murphy MP, Federal Member for Dunkley

Ovarian Cancer Research Foundation

The search for a major breakthrough in early detection of ovarian cancer continues here at Hudson Institute, and when that breakthrough comes, the Ovarian Cancer Research Foundation (OCRF) will be at the top of the list of organisations responsible. For many years the OCRF has been a consistent funder of our research teams, allowing our scientists to explore new avenues of hope in detection and treatment of this devastating illness. The latest funding goes to Prof Ron Firestein's team working on functional genomic approaches for identifying new ovarian cancer therapeutic targets, and Dr Andrew Stephens' ovarian cancer tissue bank.

L-R: Scientists Claire Sun, Shazia Adjumain (back), Thy Hoang (front), Nicole Chew and Paul Daniel, who raised nearly $10,000 for RCD

Robert Connor Dawes Foundation

The Robert Connor Dawes Foundation (RCD) is one young man's legacy in action, and Hudson Institute is proud to be a recipient of funding that helps us maintain and advance our work on paediatric brain tumours — the illness that claimed Connor's life at just 18 years old. With the Foundation's help, our scientists are going beyond genomic sequencing to identify new targeted therapies for paediatric cancers of poorest survival. Thanks to RCD funding, our work continues in mapping functional genomic dependencies for rare childhood brain cancer, and PhD student Shazia Adjumain is thriving with help from the Gideon Gratzer Scholarship.

Elly Green

Cerebral Palsy Alliance

Hudson Institute's work with the youngest Australians is the focus of the Cerebral Palsy Alliance's (CPA) funding. Our researchers study the crucial days and minutes before and after birth to establish the causes of cerebral palsy and to minimise its impact when it does occur. Our scientists also look further, studying the many effects this condition can have throughout a lifetime and how they impact each other. CPA knows that our success can be measured in the harm that's avoided and in protection of quality of life. It is CPA funding that powers PhD student Elly Green's three-year project, focused on preventing brain injury in premature babies.

Long-term support from an epidemiology leader

After a 50-year career in science, including leadership of the chronic disease epidemiology team in Queensland, Margaret Bright has remained connected to Hudson Institute as a supporter and has maintained great affection for the research and its reputation among scientists. Her initial contact with Hudson Institute was through an endocrinology role in the Professorial Unit at the Royal Women's Hospital, where she encountered Professor Bryan Hudson (former Director) and his team.

Central to this connection is Hudson Institute's strong focus on excellence, its remarkable history and continued integration of women in research and leadership roles. Margaret herself paved the way for other women, including being a role model to her four daughters.

She was the first woman to graduate in Agricultural Science at La Trobe University, after being part of the original intake in 1968. After completing a Master of Science in reproductive endocrinology at the University of Melbourne, Margaret embarked on a successful career in laboratory research, regional health data, and more recently, epidemiology.

"Establishing a career in research is competitive and not an easy feat, let alone in an industry where women make up a much smaller percentage of the workforce. I'm proud to support Hudson Institute for its focus on female leadership in STEM and its outstanding women's health research," says Margaret.

Hudson Institute is sincerely grateful for the ongoing contributions of Margaret Bright and other long-term supporters. Their generosity ensures more women can flourish in STEM and their transformative research in areas like women's health can continue to benefit patients for many years to come.

Margaret Bright

A legacy to support childhood research

"Hopefully not sounding pompous, I can think of no more worthy pursuit than medical research, particularly to benefit children, and am glad one day to be able to contribute in some way."

Christopher

We were humbled in 2021 to receive notification of a planned gift in Will from our supporter, Christopher, specifying his desire to support research into childhood cancers.

Christopher's generous gift is earmarked to support the work of Associate Professor Ron Firestein, who leads Hudson's Centre for Cancer Research and is Head of Research and Chief Investigator in the Hudson Monash Paediatric Precision Medicine (HMPPM) Program.

The HMPPM Program is focused on improving treatment for childhood cancer patients with the greatest unmet clinical need.

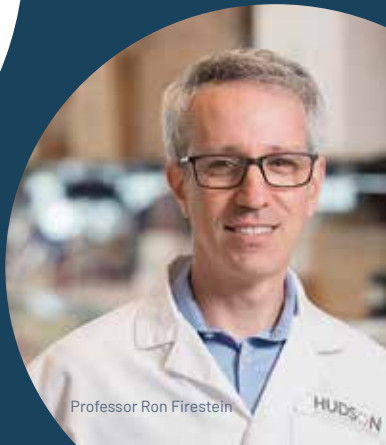
"A generous gift like Christopher's will allow for more flexibility and innovation in the research we are doing at the Centre for Cancer Research, which could be a true game-changer for advances in childhood cancer," says A/Prof Firestein.

As part of this program, a living biobank of paediatric brain tumours and solid cancers has also been established, enabling researchers here and elsewhere to trial and develop targeted treatments and improve clinical outcomes, survival rates and quality of life (limiting side effects) for children with cancer.

Christopher's foresight to leave a gift in his Will could assist with the discovery and development of new therapies for the treatment of childhood cancers at Hudson and via the HMPPM Program.

"I chose childhood cancers because of the serious consequences on young lives," he says.

Hudson Institute benefits from the generosity and vision of supporters like Christopher, which enable continued focus on new treatments, trials and therapies.



Professor Ron Firestein

Rob Merriel,
Chief Commercialisation Officer

Business development and commercialisation

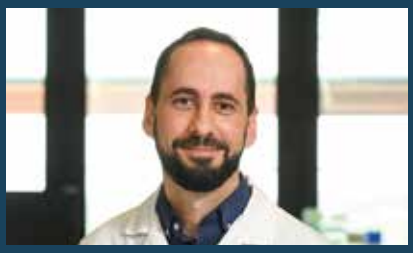
While the pandemic impacted other revenue streams, 2021 commercialisation income through agreements was strong, showing the importance of diversification of the Institute's revenue sources.

Business development and commercialisation ensures the Institute's scientific discoveries move from the lab to clinical trials and ultimately patients' treatments or diagnosis. Working with industry, academic and government partners, research is protected, commercialised and developed for future use.

The value of commercial agreements rose from $5.4 million in 2020 to $7.1 million in 2021, a 31 per cent increase. Four patents protecting our discoveries were granted in nine countries; while three provisional patent applications were progressed to PCT or International Phase; and five new provisional applications were filed.

Significant 2021 commercial collaborations included Epsila Bio, Noxopharm (Pharmorage), Invion, Medical Research Commercialisation Fund, Cartherics, Lateral Pharma, and companies associated with Morningside Ventures.

Hudson Institute was actively involved in four start-up companies during 2021, executed three new IP licences, and term sheets were agreed for new start-up initiatives. That activity resulted in a 10 per cent increase in finalised contracts and agreements in 2021.



Associate Professor Michael Gantier

Associate Professor Michelle Tate

Associate Professor Ashley Mansell

RNA technology licensing deal

Cutting-edge ribonucleic acid (RNA) technology, with the potential to reduce inflammatory side effects of drugs and make them easier to manufacture, has been developed by Hudson Institute and secured through an exclusive global licensing deal.

RNA technology has come to the fore during the COVID-19 pandemic with the approval and use of mRNA-based vaccines — it is seen as a key contributor to future drug development for not only vaccines, but other diseases as well.

The licence is for RNA drug discovery and mRNA vaccine manufacture with Australian clinical-stage drug development company Noxopharm Ltd, through its wholly owned subsidiary, Pharmorage Pty Ltd.

Leading RNA researcher Associate Professor Michael Gantier's RNA technology was developed over 15 years and targets key immune sensors at the root of unwanted inflammatory responses.

"We discovered a new class of inhibitors that can outcompete immune sensing of therapeutic RNAs like those used in mRNA vaccines. That means fewer inflammatory side effects, optimum therapeutic potential without reducing manufacturing efficiency," says A/Prof Gantier.

Pharmorage will use the technology to pursue the development of drugs to treat inflammatory and autoimmune diseases and improve the safety and efficiency of mRNA vaccines.

Lateral Pharma

There are currently few effective drugs available to treat severe viral lung infections, which can be fatal when our body's immune system overacts. New drugs that dampen damaging inflammation and reduce the impact of respiratory viral infections are desperately needed.

In partnership with Lateral Pharma Pty Ltd, Associate Professor Michelle Tate and her team are developing novel drugs to treat severe viral lung infections that can be dangerous in children and the elderly, including influenza and the common cold (respiratory syncytial virus; RSV). Viral infections require the virus to infect its host by attaching to and replicating within the host cells. While current antiviral drugs target the virus itself, Lateral's drugs are unique because they target a newly discovered pathway that enables host cells to dampen inflammation and stop the virus from replicating. They do this using naturally derived protective proteins to fight the virus.

Critically, these first in class drugs display both anti-inflammatory and anti-viral efficacy in preclinical models. To bring them to patients, the team is performing critical 'proof of concept' and mechanistic studies in influenza and RSV models, with a view to developing a new class of safe but potent anti-viral drugs.

Morningside Ventures

Hudson Institute's leadership in inflammation research was reconfirmed with the appointment of Associate Professor Ashley Mansell to global firm Morningside BioPharma Advisory, a subsidiary of Morningside Ventures.

A/Prof Mansell, an inflammation scientist, accepted the role of Senior Director of Research and Development with the company, a technology and life science venture investment firm with offices in Boston, London and Shanghai.

The appointment brings mutual benefits, as A/Prof Mansell continues independent inflammation research at Hudson Institute while also performing his new role as Morningside's research leader developing anti-inflammatory therapies within their existing companies. A/Prof Mansell will interact with the company's local investments and identify new research with commercial potential.

"The arrangement enables the incubation and translation of research from the laboratory to patients, while also investing in the development of students and staff," he says.

The appointment builds on a relationship between Morningside and Hudson Institute formed in early 2017.

People

Celebrating diversity in STEM

Rainbow art and a special seminar helped the Hudson Ally Network promote a supportive environment for members of our LGBTQIA+ community. The network nurtures diversity and active allyship among colleagues and is led by Dr Beth Allison and Dr Erin McGillick, as part of the Equity and Diversity Committee.

To celebrate LGBT+STEM Day, a chalk event saw Hudson Institute's driveway transformed into a rainbow, and a Hudson Ally LGBT+ STEM Day seminar and discussion panel focused on the importance of inclusion and shared experiences.

"We're proud of the active allyship generated by the Hudson Ally Network. There was wonderful support shown by staff and students who incorporated positive messages for LGBTIQA+ colleagues as part of our chalk art," says Dr McGillick.

L-R: Professor Elizabeth Hartland, Dr Erin McGillick, Dr Beth Allison

QueersInScience Award

Dr McGillick was "incredibly honoured" to receive the national QueersInScience Scott Johnson Memorial Award for her institutional and international LGBTIQA+ advocacy in STEM. The award recognises work towards improving lives and making workplaces safer and more inclusive for LGBTIQA+ people in STEM.

"I am grateful to the allies who have worked with me to develop these initiatives and I look forward to continuing to create environments where nobody has to choose between who they are and doing the job they love," she says.

First for families

Hudson Institute has become Australia's first medical research institute to be officially recognised by Family Friendly Workplaces™.

Led by UNICEF Australia and Parents at Work, Family Inclusive Workplace™ certification encompasses policies and practices around flexible work, parental leave, family care and family wellbeing — all actions that Hudson Institute takes extremely seriously.

It recognises a commitment to implementing, measuring, managing and sustaining a family-friendly workplace culture. This includes understanding that many people have parenting and caring responsibilities outside work that often intertwine with work hours.

Certification also notes an awareness of and actions around creating a culture where equality, integrity and respect are core values.

All this was underlined by COVID-19, which changed where, when, and how we work. In light of this, the People and Culture team developed an Action Plan to further embed family-friendly measures and deliver this to national standards.

OUR RESEARCH LEADERS

Dr Wilson Wong

Remarkable science

Some of the biggest breakthroughs in medical science have come from understanding the workings of the body's tiniest systems.

It's the search for those understandings that drives Dr Wilson Wong, who joined the Institute in 2021, leading the Structural Biology of Inflammation and Cancer Research Group.

With a remarkable scientific record behind him and Australia's largest grouping of inflammation researchers around him,

"I am inspired by making fundamental discoveries that have far-reaching influences on science and the potential to positively impact on the treatment of disease."

Dr Wilson Wong

Dr Wilson Wong is excited by what the future holds.

He is working on understanding how inflammation is activated in cells and how malfunction could lead to the multitude of diseases.

"My research focus is revealing the molecular mechanisms of protein-nucleic acid complexes and the critical role they play in inflammation and chromosome ends protection. Particularly where their malfunction could result in susceptibility to cancer, auto-inflammatory disease, infections and premature cellular ageing," Dr Wong says.

"My ultimate goal is to use the knowledge we uncover to develop treatments for auto-inflammatory diseases, cancer and conditions associated with genome instability," he says.

Award-winning research

Dr Wong's research is twofold. In addition to inflammation and cancer, he is also a leading expert in malaria and how it invades human red blood cells. He has previously been awarded the highest scientific honour from WEHI, the Burnet Prize, for his work identifying the structure of invasion ligands and ribosome of the human malaria parasite.

"Malaria is an infectious disease that kills over 400,000 people each year. I was able to solve the structure of a key malaria vaccine candidate, providing a blueprint for a malaria vaccine," he says.

Dr Wilson Wong

OUR RESEARCH LEADERS

Each of Hudson Institute's 43 Research Groups is led by a Research Group Head — scientists who have demonstrated significant achievements in their field of research.

In 2021, four scientists were promoted to Research Group Heads in recognition of their outstanding scientific discovery and leadership. As Research Group Heads, they will lead their team's scientific investigation, mentor students and contribute to Institute leadership.

Dr Miranda Davies-Tuck

A quest for stillbirth prevention

Dr Miranda Davies-Tuck's focus is on preventing stillbirth. This includes improving maternity care and pregnancy, and birth outcomes for women and babies.

She has an outstanding record of achievement, including her role as a Chief Investigator on the NHMRC Stillbirth Centre for Research Excellence (Stillbirth CRE), and participation in landmark studies that have changed clinical practice, leading to a reduction in stillbirth rates.

In 2021, Dr Davies-Tuck was awarded a grant from Stillbirth Foundation Australia to undertake a world-first study on the causes of preterm stillbirth.

"Preventing preterm stillbirth, when most stillbirths occur, is a major challenge. While most research focuses on the placenta, this ignores the critical steps at conception and before the placenta has formed. Scientists have been in the dark about these events and the potential they hold for preventing the loss of infants before birth," says Dr Davies-Tuck.

"This will be the first study to describe the endometrial conditions in women who experience stillbirth. This new knowledge will uncover the early drivers of stillbirth and potential treatments to optimise implantation or support fetal development."

Dr Shayanti Mukherjee

POP innovation recognised

Pelvic Organ Prolapse (POP) is a hidden and often debilitating disease with no reliable treatment. It develops when tissues, pelvic floor muscles and ligaments that support the pelvic organs become damaged, usually in childbirth, causing organs to shift or 'drop' into or outside the vagina.

With a background in biomedical engineering, Dr Shayanti Mukherjee is developing a world-first safe POP treatment combining stem cells from a woman's own uterus with biodegradable materials, using 3D printing and nanotechnology.

In 2021, her groundbreaking bioengineering work won her the prestigious international Women in STEM2D Scholar Award — from more than 650 global applications. The award supports women at critical points in their careers, fuelling a talent pipeline of female STEM leaders.

"Millions of women worldwide suffer from POP with very limited treatment options," says Dr Mukherjee. "We are working to make mothers' lives better as they age — exciting work that could bring enormous benefits to many."

Dr Beth Allison and her daughter Penny

Dr Beth Allison

Understanding the seeds of cardiovascular disease

Being born small or with fetal growth restriction (FGR) increases the risk of future cardiovascular disease. Dr Beth Allison investigates how the health of the pregnancy impacts fetal development, particularly how hypoxia affects fetal heart and blood vessel development.

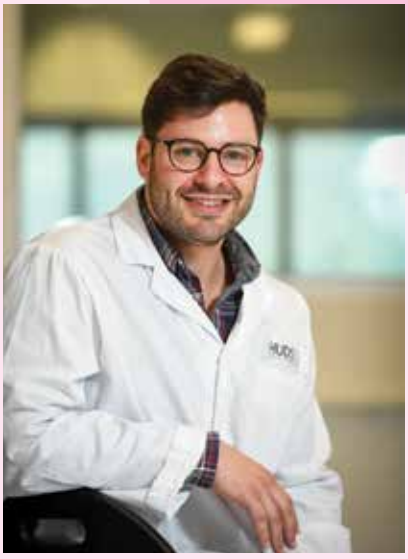
Dr Allison's interest in this field of research deepened after she gave birth to a daughter with FGR. "My experience has inspired me to understand how FGR will impact my daughter's health at all ages," she says.

"FGR babies have distinct medical needs that may require different and personalised medical attention. My aim is to give them the best start in life by finding new personalised treatments for FGR infants and those requiring cardiovascular support."

Dr Allison has already identified current treatments that are not suitable for babies born with FGR.

"Success for me would mean that FGR infants grow up with better cardiovascular health outcomes," she says.

Dr Allison also leads the Hudson Ally Network, which creates a supportive and welcoming environment for the LGBTQIA+ community.



Dr Robert Galinsky

Anti-inflammatory cure for cerebral palsy

Exposure to inflammation at or around the time of birth is a key contributor to impaired newborn brain development and the development of cerebral palsy, a disability that affects one in 500 Australians and more than 17 million people worldwide. Sadly, there is no effective treatment for cerebral palsy.

Dr Robert Galinsky's focus is on the developmental period around birth, and changes in newborns' brains that can have a negative impact on healthy brain function. His aim is to find a treatment for cerebral palsy.

In a study published in *Neuroinflammation*, Dr Galinsky identified key cellular and physiological pathways that underpin how inflammation impairs brain cell development, and an existing anti-inflammatory drug, anakinra, that could help.

"By better controlling a key inflammatory pathway in the brain that is overactivated in infants that develop cerebral palsy, we hope to promote healthy brain development and function," Dr Galinsky says.

"Improving the lives of infants at greatest risk of disability and their families is what gets me out of bed in the morning."

AWARDS

International honours

When our research attracts the highest international honours, the descriptions 'world-leading' and 'groundbreaking' are apt.

2021 saw Professor Caroline Gargett recognised as a key member of a team awarded the $US1 million Magee Prize for their research proposal to identify vaginal stem cells.

Prof Gargett was the only member of the team from outside the USA working on the project *Vaginal Stem Cells: the missing link in vaginal reconstruction.*

Prof Gargett is world-renowned for discovering stem/progenitor cells in human endometrium, the highly regenerative lining of the uterus, thereby establishing a new field of research in reproductive biology. She is now applying that knowledge and expertise to discover stem cells in the human vagina, aiming to develop new treatments for women with compromised vaginal structure and function.

"This important research is for women without a vagina or who have lost much of it via life-saving surgery — it is to give them their lives back," Prof Gargett says.

Beating lung disease

Silicosis, a deadly and incurable lung disease afflicting Australian tradies, could be successfully treated following a multi-million-dollar federal funding boost.

The Medical Research Future Fund (MRFF) has backed collaborative projects investigating ways to prevent and treat the potentially fatal lung disease caused by inhaling respirable crystalline silica fibres while cutting artificial stone benchtops. An estimated 20 per cent of Australian stonemasons exposed to the fibres are at risk of lung conditions like silicosis.

Associate Professors Michelle Tate and Ashley Mansell will undertake the research with our partners Monash Health, Alfred Health and Monash University and industry partner Bacainn Therapeutics (USA). The teams aim to identify inflammatory markers and disease biomarkers that can be used to predict the silicosis development and severity, and investigate drugs that could dampen the inflammatory response.

"Identifying biomarkers could improve silicosis diagnosis and prognosis, and the effectiveness of potential treatments" — Associate Professor Michelle Tate

Preventing stomach cancer

Two significant research grants awarded to Professor Richard Ferrero will improve understanding of stomach cancer and possibly lead to a vaccine against a common bacterial infection.

Helicobacter pylori (H. pylori) is a bacterium that infects half the world's stomachs, causing inflammation and disease. It can also lead to stomach cancer, which has a survival rate of less than 30 per cent. The body fights *H. pylori* by mobilising white blood cells to the stomach, but this same process can lead to lymphoma. Prof Ferrero has found that a host protein, NLRC5, can help generate immune responses to protect against lymphoma.

Prof Ferrero was awarded an NHMRC Ideas Grant to investigate how NLRC5 offers this protection against stomach lymphoma. He has also received funding from the US Department of Defense for a three-year study to develop a vaccine against *H. pylori* infection to which veterans and their families are frequently exposed.

Supporting preterm babies

Research on helping at-risk preterm infants begin breathing and reduce injury has attracted an NHMRC Ideas Grant of more than $1 million.

Preterm birth is the single greatest cause of death and disability in children. Professor Stuart Hooper AM and his team are looking for ways to improve success providing gentle respiratory support at birth for the 92 per cent of very preterm babies who need it.

While providing respiratory support with a face mask is the gentlest approach, it often fails because a baby's vocal cords automatically close if they stop breathing, preventing air from entering their lungs.

This significant grant will help Prof Hooper continue his valuable work.

Tackling bone cancer survival

Dr Vijesh Vaghjiani has been awarded one of two grants by the Australia and New Zealand Sarcoma Association (ANZSA) to help children and young adults with osteosarcoma, a highly aggressive bone tumour. Osteosarcoma survival rates have not improved since chemotherapy was introduced 40 years ago.

Using cutting edge technologies, Dr Vaghjiani will investigate the underlying causes of recurrent osteosarcoma due to a poor chemotherapy response. The answers will provide a path for improved treatments.

"This project has enormous potential to greatly improve the clinical care and outcomes of young osteosarcoma patients," says Dr Vaghjiani.

Unlocking the microbiome

The human microbiome contains trillions of microorganisms that govern human health. Understanding how they interact has become increasingly important to science and medicine.

The Australian Research Council has awarded Dr Vanessa Rossetto Marcelino a Discovery Early Career Researcher Award (DECRA) to investigate the complex nutritional relationships between microorganisms in the gut microbiome.

Dr Marcelino will build computational models of how microbes interact under a range of conditions. In addition, she will help establish a 'gut-on-a-chip' — an artificial but realistic environment to see how microorganisms interact with each other, their host, and potential drugs. The research will inform strategies to manipulate microbial communities and eventually guide new treatments.

Improving babies' breathing

Dr Doug Blank's research into how newborns start breathing and the difficulties some of them encounter has received a prestigious NHMRC Emerging Leadership Investigator Grant.

Failing to breathe at birth kills more than one baby every minute, while more than five per cent of all babies worldwide need help breathing after birth. This new study, *Improving Neonatal Resuscitation*, will investigate a simple technique that may make birth safer for babies, including delaying umbilical cord clamping to maintain placental circulation.

"By translating scientific advances into clinical realities globally, we can save and protect thousands of newborns," Dr Blank says.

Fertile ground for future leaders

A key focus at Hudson Institute is to mentor the next generation of medical researchers. In 2021, more than 176 Honours, Masters and PhD students were supervised by our senior scientists, giving them the knowledge, skills and confidence to forge a successful medical research or clinical career.

PhD candidate Penny Whiley and her supervisors, internationally recognised reproductive health experts Professor Kate Loveland and Associate Professor Robin Hobbs, are working to answer what causes male infertility.

Penny Whiley
PhD student

What are you researching?

In Australia, one in 20 men is infertile and for many the underlying cause is unknown. I study the spermatogonial stem cells (SSCs) that are essential for lifelong production of sperm in the testis. My research has identified that too much activin A in the developing testis disrupts SSC establishment, potentially leading to infertility and testicular tumours later in life. The answers we uncover will help scientists develop new treatments.

What is your typical day?

Research is all about discovery and learning. I love trying to understand how our bodies work and discovering something new. My days are spent in the laboratory, doing experiments and analysing results. The rest of the time, I'm reading up on new discoveries or attending meetings where I present my data and learn about others' amazing research.

What's important for people to know about science?

Good science takes time. Your body is amazingly complex, and everything is interlinked, so understanding how one gene/protein/RNA works within an organ requires a logical and thorough approach.

Why did you choose your supervisors/group?

Collaboration and a supportive environment are vital to succeeding in science. I worked at Hudson Institute before embarking on a PhD, so I knew my supervisors were encouraging and supportive. The community of students, medical researchers and on-site clinicians also offers plenty of opportunity for collaboration.

What was your 2021 highlight?

Winning both the School and Faculty level 3 Minute Thesis (3MT) competitions. This event provides a unique challenge for PhD students to communicate their research to the public in just three minutes. I think it's more important than ever for scientists to practise sharing their work and its impact in an uncomplicated and engaging manner.

L-R: Professor Kate Loveland, Penny Whiley, Associate Professor Robin Hobbs

Professor Kate Loveland
Supervisor

Why is a supervisor important in science?

My role is to instil critical thinking that prepares students for a lifetime of exploration and finding answers. Every student learns differently, so the aim is to provide an environment for each student to excel. That requires setting realistic and clear goals, and providing a place where people feel safe to share, collaborate and expand their knowledge.

Associate Professor Robin Hobbs
Supervisor

Why are resilience and curiosity important in science?

Scientific curiosity is essential — it motivates and drives progress. Resilience is vital because the trial-and-error nature of science means that most experiments don't work as planned. Success in science often follows the lessons learnt from many failures. While negative results are disheartening, they can ultimately point the way towards the most insightful discoveries.

Our graduates

Congratulations to our Postgraduate and Honours students who graduated in 2021

Doctor of Philosophy

Dr Benjamin Amberg (MD PhD)

The physiological effects of amniotic CO2 insufflation

Dr Kelly Crossley, Dr Philip Dekoninck, A/Prof Ryan Hodges, Prof Stuart Hooper AM

Dr Sarah Catford

Health status and fertility in ICSI-conceived children

Prof Rob McLachlan, Prof Moira O'Bryan, Prof Jane Halliday

Dr Wai Chin Chong

Investigation of panobinostat differentiation therapy in SWI/SNF-deficient solid tumours

Dr Jason Cain, A/Prof Elizabeth Algar

Dr Jennifer Hutchison

Studies in obesity-associated advanced glycation end products and female fertility

Prof Lois Salamonsen, Prof David Gardner, Prof Guiying Nie, Dr Jemma Evans

Dr Nazanin Karimnia

Development of diabetic complications by the Set7 methyltransferase enzyme

Dr Andrew Stephens, Prof Magdalena Plebanski, Dr Maree Bilandzic

Dr Manijeh Khanmohammadi

Multi-modal biomaterial boosted cell therapy for Pelvic Organ Prolapse

Prof Caroline Gargett, Dr Fiona Cousins, Dr Shayanti Mukherjee

Dr Hue Mai La

Roles of mTORC1 signalling in spermatogonial stem cell maintenance and regeneration

A/Prof Robin Hobbs, Dr Jan Kaslin

Dr Emma Lamanna

Characterising airway and vascular changes in a mouse model of bronchopulmonary dysplasia (BPD)

A/Prof Jane Bourke, A/Prof Claudia Nold

Dr Paul Leong

Pulmonary artery pulsatility in chronic obstructive pulmonary disease

Prof Philip Bardin, Dr Paul King, A/Prof Brian Ko, Dr Martin MacDonald

Dr Joanne Lundy

Advancing precision medicine in pancreatic cancer using endoscopic ultrasound guided biopsy

Dr Daniel Croagh, Prof Brendan Jenkins

Dr Laura Moffitt

The role of Dipeptidyl Peptidase 4 in ovarian tumours

Prof Magdalena Plebanski, Dr Andrew Stephens

Dr Anna Maria Muccini

Creatine as a prenatal treatment to protect multiple fetal organs from the effects of acute hypoxia

Dr Stacey Ellery, Prof David Walker, Dr Matthew McKenzie

Dr Kallyanashis Paul

Nanotechnology for gynecology: bioengineering nanostructured drug-releasing meshes for pelvic organ

Prof Caroline Gargett , Dr Shayanti Mukherjee, Prof Laurence Meager

Dr Tayla Penny

The use of stem cells to treat perinatal brain injury

Dr Courtney McDonald, A/Prof Suzie Miller

Dr Manjeet Kaur Sandhu

The role of IL-38 in inflammatory bowel disease

Prof Marcel Nold, A/Prof Claudia Nold, Dr Ina Rudloff, Dr Gregory Moore

Dr Beatrix Stadler

Role of oxytocin in the contractility of the male reproductive tract: implications for the treatment of benign prostatic hyperplasia

Dr Betty Exintaris, Prof Kate Loveland, Prof Ralf Middendorp, Dr Michael Whittaker

Dr Rachelia Raissa Wibawa

Role of Dot/Icm effector proteins in Legionella pneumophila replication in macrophages

Prof Elizabeth Hartland, Dr Shivani Pasricha

Master of Philosophy

Ms Nayla Leon Carlos

Understanding PML nuclear bodies in health and disease

Prof Vincent Harley, A/Prof Lee Wong

176 Enrolled students (PhD, Masters, Honours)

126 PhD, Masters

50 Honours

26 Students with medical training

68 Graduates

L-R: (back row) Penny Whiley, Michael Luu, L-R: (front row) Dr Sarah Moody, Dr Diana Micati

Bachelor of Biomedical Science (Honours)

Ms Siti Zahrah Azman
Ms Elizabeth Bakaniozos
Ms Jessica Bean
Ms Yoveena Brian
Ms Eilidh Cameron
Ms Jasmine Chuah
Ms Jennie Do
Ms Johanna Farley
Ms Amber Irving
Mr Filip Jeftic
Mr Eeshan Jhingran
Mr Rachid Kamareddine
Ms Navneet Kaur
Ms Gabrielle Malabanan
Ms Hoang Thy Nguyen
Mr Matthew Parker
Ms Emma Pearson
Ms Chiara Piazzese
Ms Joanna Picerni
Ms Jacqueline Piskopos
Ms Bruna Rossi Herling
Ms Ainsley Somers
Ms Monica Suehiro
Ms Melanie Tripp
Ms Neluni Yapa Udawela

Bachelor of Medical Science (Honours)

Miss Ashleigh Carolan
Mr Shaveen Kariyawasam
Mr Keeth Mayakaduwage
Mr Matthew Oyang
Ms Wentong Mary Xu
Mr Henry Shen

Bachelor of Science (Honours)

Mr Blake Ashley
Ms Senay Bayer
Ms Ebony Cannata
Mr Steven Garrick
Mr Liam Gubbels
Ms Jamia Hemphill
Ms Kayla Kockaya
Mr Joseph Lam
Ms Natalie Mercuri
Ms Lucy Monk
Ms Orlen Mulia
Ms Briana Peterson
Ms Paige Riddington
Ms Aishah Segumohamed
Mr Dominic Silvestrini
Mr Tasman Sutherland
Ms Darcy Tantanis
Mr Maxwell Whitty
Ms Mariam Zobair

Board of directors

The directors of Hudson Institute of Medical Research Board, 31 December 2021

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BEcon (Hons), PhD (Ohio State), FAICD

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MBA, CPA

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Organisation structure

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- Career Development Committee
- Culture and Engagement Committee
- Early Career Researcher Committee
- Education and Training Committee
- Equity and Diversity Committee
- Ethics Committee
- Hudson Institute Student Society
- OHSE Committee
- Research Committee
- Seminar Committee

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- Investment Committee
- Intellectual Property and Commercialisation Committee

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Professor Elizabeth Hartland

CENTRE HEADS

Centre for Cancer Research
Associate Professor
Ron Firestein

Centre for Endocrinology and Metabolism
Professor Peter Fuller

Centre for Innate Immunity and Infectious Diseases
Professor Brendan Jenkins

Centre for Reproductive Health
Professor Kate Loveland

The Ritchie Centre
Professor Stuart Hooper

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Professor Paul Hertzog

Chief Financial Officer
Chief Commercialisation Officer
Company Secretary
Mr Rob Merriel

Senior Operations Manager
Dr Joseph Pereira

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Mr Garry Tanner

Executive Officer
Ms Ann Scott

SCIENTIFIC SUPPORT GROUP

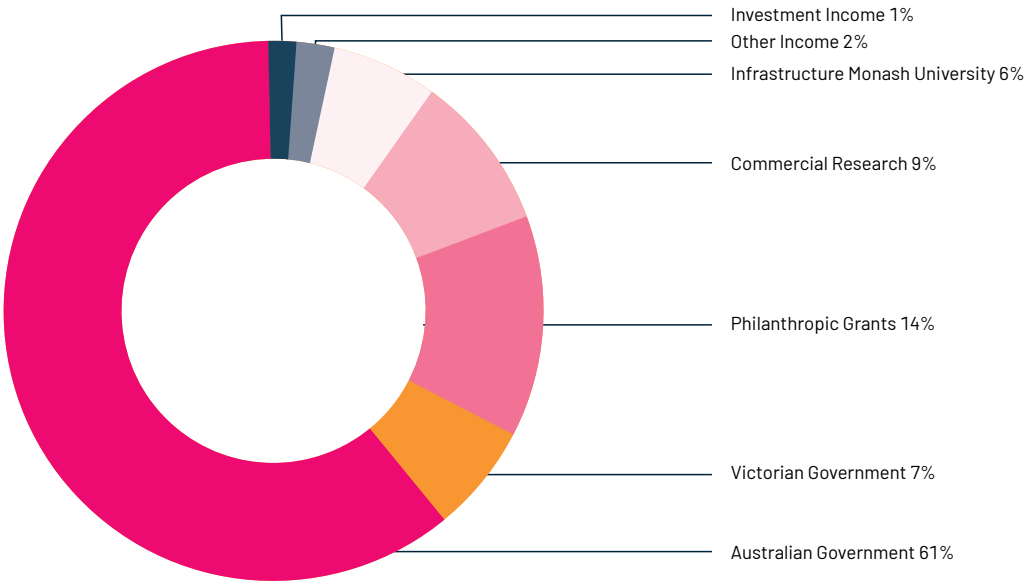
- Finance
- Commercialisation and IP
- Research Office
- Research Integrity
- People and Culture

- OHSE
- Logistics and Technical Services (LATs)
- Platforms
- Bioresources
- Purchasing

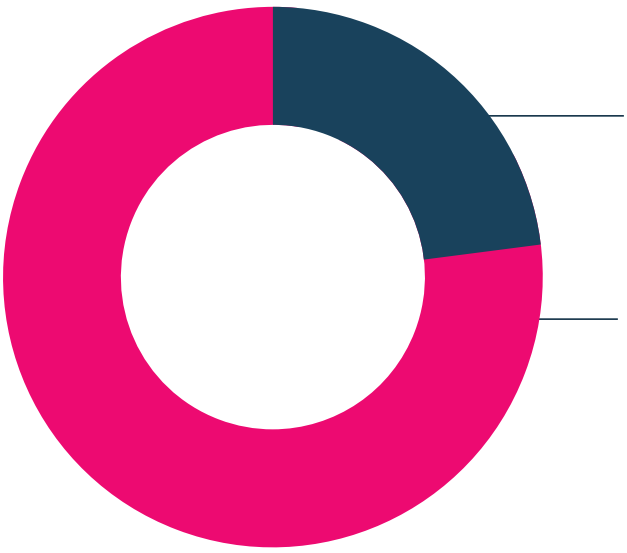
- Fundraising
- Communications

- Strategic Committees

Financial snapshot



Revenue	2021 ($)	2020 ($)	2019 ($)
Australian Government	35,831,133	33,717,571	28,408,235
Philanthropic Grants	7,975,494	7,672,830	8,168,395
Commercial Research	5,539,265	5,374,502	3,984,044
Victorian Government	3,844,981	2,419,514	3,172,168
Infrastructure Monash University	3,702,044	3,207,348	3,616,999
Other Income	1,283,901	1,084,855	1,485,615
Investment Income	701,942	400,587	586,932
Total	**58,878,760**	**53,877,208**	**49,432,388**



Expenditure	2021 ($)	2020 ($)	2019 ($)
Scientific and Laboratory	46,558,691	42,911,471	40,238,073
Administration Expenses*	11,465,389	9,952,501	9,058,817
Total	**58,024,079**	**52,863,972**	**49,296,890**

*Administration Expenses include: special projects; salaries of administrative and scientific support staff; fundraising; communications; rent, utilities and buildings; information systems; professional services; legal patents and commercialisation; finance; and insurances.

2021 Publications

Book Chapters

1 Jenkins BJ (2021) Research and Clinical Applications of Targeting Gastric Neoplasms. ed. Melbourne, Victoria, Australia: Academic Press. pp 352.

2 Lundy J, Jenkins BJ, Saad MI (2021) A Method for the Establishment of Human Lung Adenocarcinoma Patient-Derived Xenografts in Mice. *Methods Mol Biol*. 2279:165-173.

Journal Articles

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2 Aldahhan RA, Stanton PG (2021) Heat stress response of somatic cells in the testis. *Mol Cell Endocrinol*. 527:111216.

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6 Amberg B, DeKoninck P, Kashyap A, Rodgers K, Zahra V, Hooper S, Crossley K, Hodges R (2021) The effects of cold, dry and heated, humidified amniotic insufflation on sheep fetal membranes. *Placenta*. 114:1-7

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8 Angus LM, Yang J, Cheung AS (2021) Persistent hypoaldosteronism post-adrenalectomy for primary aldosteronism – a role for pre-operative spironolactone? *Endocrinol Diabetes Metab Case Rep*. 2021:21-0137.

9 Aridas JD, Yawno T, Sutherland AE, Nitsos I, Wong FY, Hunt RW, Ditchfield M, Fahey MC, Malhotra A, Wallace EM, Gunn AJ, Jenkin G, Miller SL (2021) Melatonin augments the neuroprotective effects of hypothermia in lambs following perinatal asphyxia. *J Pineal Res*. 71:12744.

10 Baburamani AA, Tran NT, Castillo-Melendez M, Yawno T, Walker DW (2021) Brief hypoxia in late gestation sheep causes prolonged disruption of fetal electrographic, breathing behaviours and can result in early labour. *J Physiol*. 599:3221-3236.

11 Badurdeen S, Santomartino GA, Thio M, Heng A, Woodward A, Polglase GR, Hooper SB, Blank DA, Davis PG (2021) Respiratory support after delayed cord clamping: a prospective cohort study of at-risk births at ≥35(+0) weeks gestation. *Arch Dis Child Fetal Neonatal Ed*. 106:627-634.

12 Badurdeen S, Kamlin COF, Rogerson SR, Kane SC, Polglase GR, Hooper SB, Davis PG, Blank DA (2021) Lung ultrasound during newborn resuscitation predicts the need for surfactant therapy in very and extremely preterm infants. *Resuscitation*. 162:227-235.

13 Baker EK, Wallace EM, Davis PG, Malhotra A, Jacobs SE, Hooper SB, Lim R (2021) A protocol for cell therapy infusion in neonates. *Stem Cells Transl Med*. 10:773-780.

14 Baroni L, Sundaresan L, Heled A, Coltin H, Pajtler KW, Lin T, Merchant TE, McLendon R, Faria C, Buntine M, White CL, Pfister SM, Gilbert MR, Armstrong TS, Bouffet E, Kumar S, Taylor MD, Aldape KD, Ellison DW, Gottardo NG, Kool M, Korshunov A, Hansford JR, Ramaswamy V (2021) Ultra high-risk PFA ependymoma is characterized by loss of chromosome 6q. *Neuro Oncol*. 23:1360-1370.

15 Bassam A, Thacker J, Walter LM, Davey MJ, Nixon GM, Horne RS (2021) Nocturnal dipping of heart rate is impaired in children with Down syndrome and sleep disordered breathing. *Sleep Med*. 81:466-473.

16 Bawazeer A, Rosli S, Harpur CM, Docherty CA, Mansell A, Tate MD (2021) IL-1β exacerbates disease and is a potential therapeutic target to reduce pulmonary inflammation during severe influenza A virus infection. *Immunol Cell Biol*. 99:737-748.

17 Bellofiore N, George E, Vollenhoven B, Temple-Smith P (2021) Reproductive aging and menopause-like transition in the menstruating spiny mouse (Acomys cahirinus). *Hum Reprod*. 36:3083-3094.

18 Brouwer E, Knol R, Hahurij ND, Hooper SB, Te Pas AB, Roest AAW (2021) Ductal Flow Ratio as Measure of Transition in Preterm Infants After Birth: A Pilot Study. *Front Pediatr*. 9:668744.

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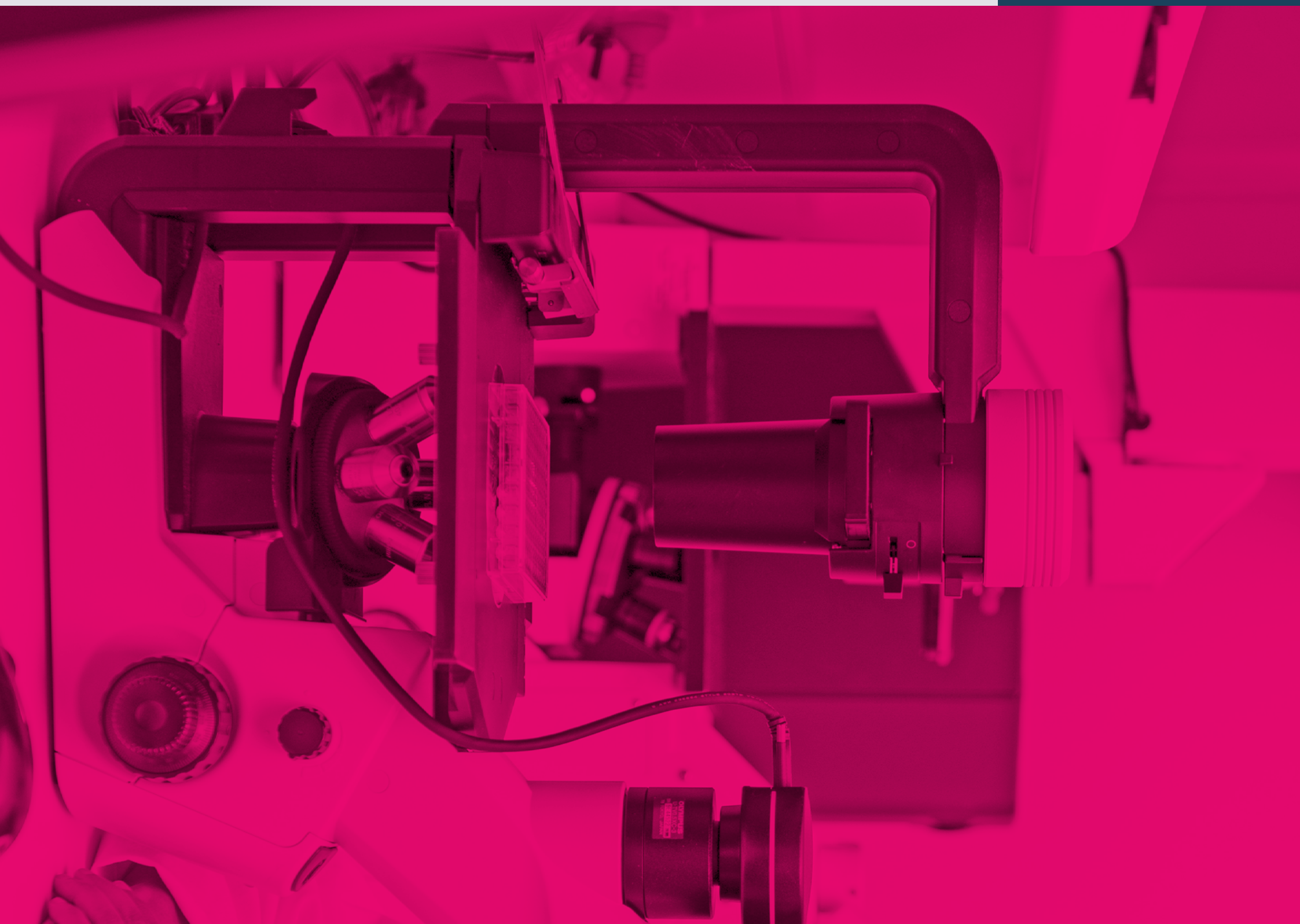

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