Our Impact

HUDSON
INSTITUTE OF MEDICAL RESEARCH

Annual Report 2017

Our precinct

Monash Health Translation Precinct
Delivering cutting edge research to patients

About Hudson Institute

As a leading Australian biomedical research institute, Hudson Institute is recognised internationally for delivering better health through translational research into inflammation, cancer and reproduction and development.

We are home to 470 world-class scientists and students who push the boundaries of scientific knowledge to answer complex questions about human disease.

Our scientists study human health and disease from a molecular and cellular level through to clinical application to develop new diagnostics, treatments and cures that change and save lives. Through this translational pipeline, our breakthroughs directly benefit our community.

Working alongside clinicians in Melbourne hospitals for more than 50 years, our scientists' pioneering discoveries include the differentiation of embryonic stem cells into new human cell types, a foundation of modern stem cell treatments; changes in practice that have helped to prevent Sudden Infant Death Syndrome (SIDS) and the discovery of Inhibin, leading to diagnostic tests for Down syndrome and some ovarian cancers.

Our themes

CANCER

Using the latest approaches including immunotherapies and precision medicine, our cancer researchers tackle the most pressing challenges in the diagnosis and treatment of adult and childhood cancers. They undertake basic and translational research into the molecular mechanisms underlying the development, growth and metastasis of tumours, as well as the relationship between the immune system and how it might be used to treat or even prevent cancer. By explaining the fundamental mechanisms of tumour biology, our discoveries pave the way for new biomarkers (indicators) of cancer and the development of novel cancer therapies.

INFLAMMATION

Inflammation and the body's innate immune responses are central to almost all disease conditions, from infectious diseases to cancer and infertility. Scientists studying inflammation focus on the molecules and cells that comprise our innate immune system and how these interact in complex networks. Our work is centred around understanding how the innate immune system helps fight infection but also how unrestrained inflammation can lead to chronic disease. Our goal is to find ways to reverse or prevent tissue damage due to dysregulated inflammation by defining the role of the innate immune system in infection, inflammatory diseases, autoimmune diseases and cancer.

REPRODUCTION AND DEVELOPMENT

Lifelong health is often determined by events that occur prior to birth. Using discovery and translational research, our scientists seek to answer crucial questions about sperm and egg development, early embryo development, implantation of the embryo into the womb, formation of the placenta, health of the developing fetus and the transition from the womb to life after birth. We have major programs focusing on the health of preterm infants and the development of novel interventions to prevent permanent harm in babies born prematurely. Through unique collaborations with clinicians, our researchers seek solutions to the most important problems facing infertile couples, pregnant mothers and newborn babies.

At a glance

290
STAFF

188
STUDENTS

55
RESEARCH GROUPS

309
RESEARCH PUBLICATIONS

Director's report

It is my pleasure to share our 2017 Annual Report with you, my first since joining Hudson Institute.

Thanks to incredible advances in technology and medical research, healthcare as we know it is being rapidly transformed in ways that were previously unheard of. The sequencing of the human genome in 2003 cost around $3 billion and took more than thirteen years. Today, the entire human genome can be sequenced in just a day at a cost of around US$1000. This kind of technology has created a paradigm shift in the way we approach and understand disease, allowing us to define the unique biology of individuals and develop the most effective treatments and cures.

Hudson Institute is at the forefront of this revolutionary new approach termed 'precision medicine'. In 2017, we established a new paediatric cancer precision medicine program, where we are growing three dimensional organoids, or 'mini organs', from tumours to fast-track treatments for childhood brain and solid tumours. I am extremely grateful to the Children's Cancer Foundation for funding this potentially life-saving program.

Our advances in precision medicine and stem cells (which you can read about on pages 14-19) depend on access to state-of-the-art technologies. We thank Gandel Philanthropy for its vision and foresight in establishing the Gandel Genomics Centre in 2017. This centre will provide us with expertise to help translate the wealth of human genomic data into patient treatments.

I was drawn to Hudson Institute because it is in a unique position to close the gap between scientific discoveries and clinical care. We are an agile, independent medical research institute, co-located with Monash University, Australia's largest University, and Monash Health, Victoria's largest healthcare provider. Together we have created the $87.5 million Monash Health Translation Precinct (MHTP) Translational Research Facility to create clear pathways for clinical translation. Our strong foundation in molecular science provides the ideal environment for driving better health outcomes, jobs and new industries for Victoria – benefits that ultimately reverberate across Australia.

A strong endorsement of the quality and importance of our research was our success in the 2017 round of national competitive grant funding. Our scientists were awarded $15.3 million for 20 peer-reviewed grants by the National Health and Medical Research Council (NHMRC), a 31 per cent success rate, nearly double the national funded rate of 16 per cent. This is strong recognition of our innovative, world-class research programs and we are indebted to the NHMRC for its support.

Our research output in 2017 was substantial. Hudson Institute scientists published more than 309 medical research publications and reviews, laying the groundwork for clinical trials and major advances in health. Our scientists established several significant partnerships with industry to accelerate the translation of our discoveries into clinical practice.

The Victorian Government's announcement of $26 million in infrastructure support to medical research institutes is extremely positive for the state's medical research sector and will ensure we stay competitive, grow local jobs, advance technologies and develop translation pathways, resulting in better health outcomes for Victorians. I acknowledge and thank the Victorian Government for their support.

We know that women face significant barriers to achieving their full potential in science. While we acknowledge there is always more work to be done in elevating female scientists to positions of leadership, I am proud to report that almost 40 per cent of our research leaders are now female, a significant step towards gender equity at Hudson Institute. As well as this, many of our female scientists received academic promotions and accolades during 2017, which you can read about on pages 26-29.

In addition, our previous Directors and Distinguished Scientists of the Institute were recognised for their contribution to medical science. Professor Evan Simpson AM was made a Member of the Order of Australia (AM) for his significant service in the field of breast cancer, Professor Henry Burger AO was awarded a Doctor of Medical Science honoris causa at the University of Melbourne and Professor Jock Findlay AO received the Society for the Study of Reproduction's Distinguished Service Award.

Finally, I wish to extend my gratitude to our community for your steadfast support, which has enabled Hudson Institute to reach even higher in striving towards life-saving discoveries. Without our many long-term supporters, such as the Fielding Family Foundation, Robert Connor Dawes Foundation, Andrea Evans and Richard Harbig our work wouldn't be possible.

I also wish to thank our team of outstanding researchers, students and support staff who make Hudson Institute a dynamic, focused and outcome-driven research institute. Our success is due to their passionate and unwavering pursuit of scientific discovery. I hope you enjoy reading about our outstanding achievements in 2017.

Professor Elizabeth Hartland
Director and CEO
Hudson Institute of Medical Research

Launchpad for innovation

Game-changing collaborations between world-leading scientists and clinicians are inspired in purpose-built facilities equipped with state-of-the-art technologies

Hudson Institute is a foundation member of the Monash Health Translation Precinct (MHTP), a major medical and scientific research hub based at the Monash Medical Centre in Melbourne's south-eastern corridor.

With our precinct partners, Monash Health and Monash University, we bring together world-leading scientists, clinicians and educators in a culture of collaboration and innovation that delivers research advances to benefit human health.

This unique, end-to-end translational environment is supported by state-of-the-art laboratories, world leading technology platforms and a clinical trials centre in our $87.5 million MHTP Translational Research Facility.

Coupled with Hudson Institute's expertise in precision medicine and stem cell therapies, MHTP scientists and clinicians have a unique advantage in taking pioneering scientific discoveries from the laboratory into the clinic.

Hudson Institute and the precinct also benefit from the close proximity of key research, industry and academic institutions including Monash University's Clayton Campus, the Australian Synchrotron, CSIRO's largest research and development site and the Melbourne Centre of Nanofabrication.

A bridge links Monash Health with our state-of-the-art Translational Research Facility, serving as a crucial connection between patients and new potential therapies. The facility houses an eight-bed, 21-chair clinical trials centre and nine world-leading technology platforms supporting the transition of discoveries from initial Phase I testing right through to Phase IV primary health trials.

Hudson Institute's medical research spans discovery and translational research. What does this mean?

DISCOVERY SCIENCE

Today's treatments and tomorrow's advances depend upon fundamental discovery science.

Discovery science is the foundation for understanding the human body, where researchers delve deep into the molecular function of cells to understand how biological systems work, what goes wrong in diseases like cancer and how diseases can be prevented or treated to create a healthier future.

TRANSLATIONAL RESEARCH

Translational research requires the combined skills of scientists and clinicians to take laboratory discoveries through to clinical application, harnessing both scientific and clinical expertise to produce new drugs, devices or treatments that will improve the lives of patients.

Hudson Institute is a leader in translational research. As a partner of the Monash Health Translation Precinct (MHTP), we are co-located with Victoria's largest hospital, Monash Health, and work alongside clinicians on issues directly affecting patient health. Access to a dedicated clinical trials centre and our partnerships within the MHTP mean that our scientific discoveries benefit patients sooner.

Translational Research Facility

Sharing scientific and clinical expertise - saving lives

A new Monash Health clinic led by Hudson Institute clinician-researchers is making phenomenal progress in the prevention of heart attacks and strokes through research that could inform new screening guidelines for high blood pressure, also known as hypertension.

Dr Jun Yang, a Hudson Institute researcher and consultant endocrinologist at Monash Health, set up the Endocrine Hypertension clinic at Monash Health in 2016 to help patients who have primary aldosteronism (PA), a disorder that leads to high blood pressure caused by the over-production of the hormone aldosterone.

PA is often misdiagnosed as essential hypertension of unknown causes. While it is thought to affect one in ten hypertensive patients, currently less than one in a hundred are actually diagnosed. Crucially, the treatment for PA and essential hypertension are completely different. This leaves misdiagnosed PA patients on medication that doesn't benefit them and puts them at greater risk of stroke and heart attack.

As a result of Dr Yang's new Monash Health PA guidelines, in 2017 more than 60 people were diagnosed and successfully treated for PA compared to just three in 2012. With these new guidelines in place, the clinic is capturing and treating a previously undiagnosed portion of hypertensive patients.

In recognition of their growing impact, the team has been awarded philanthropic funding in 2017 from the Heart Foundation, Collier Charitable Fund, CASS Foundation and Foundation for High Blood Pressure Research to start Australia's largest PA study. With the objective of preventing heart attack and stroke, the study will aim to confirm exactly how common PA is in the community by asking GPs to screen hypertensive patients for PA using a simple blood test.

"Patients will be identified at an early stage and given targeted treatment to effectively manage the condition and prevent further cardiovascular damage," says Dr Yang.

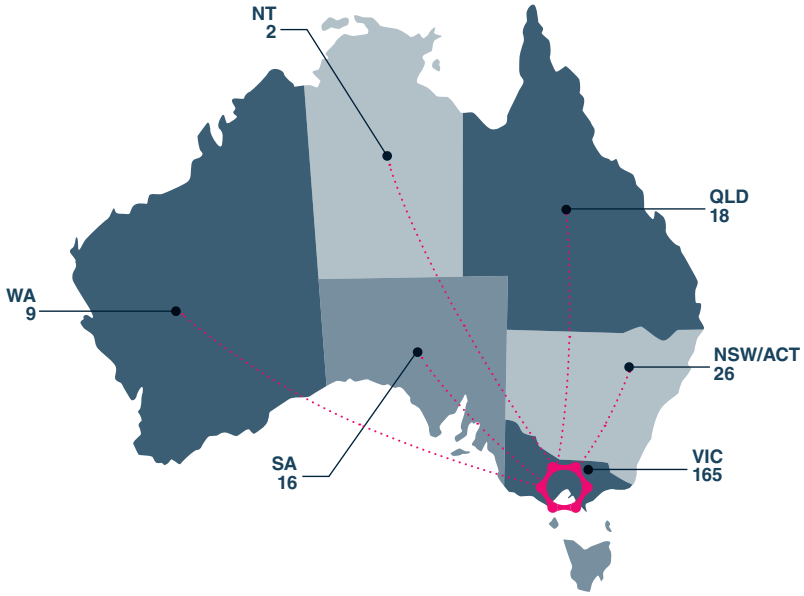
The team is hopeful that the project will lead to new hypertension management guidelines in GP clinics across Australia, so that more patients can benefit from early detection and treatment.

Our collaborators

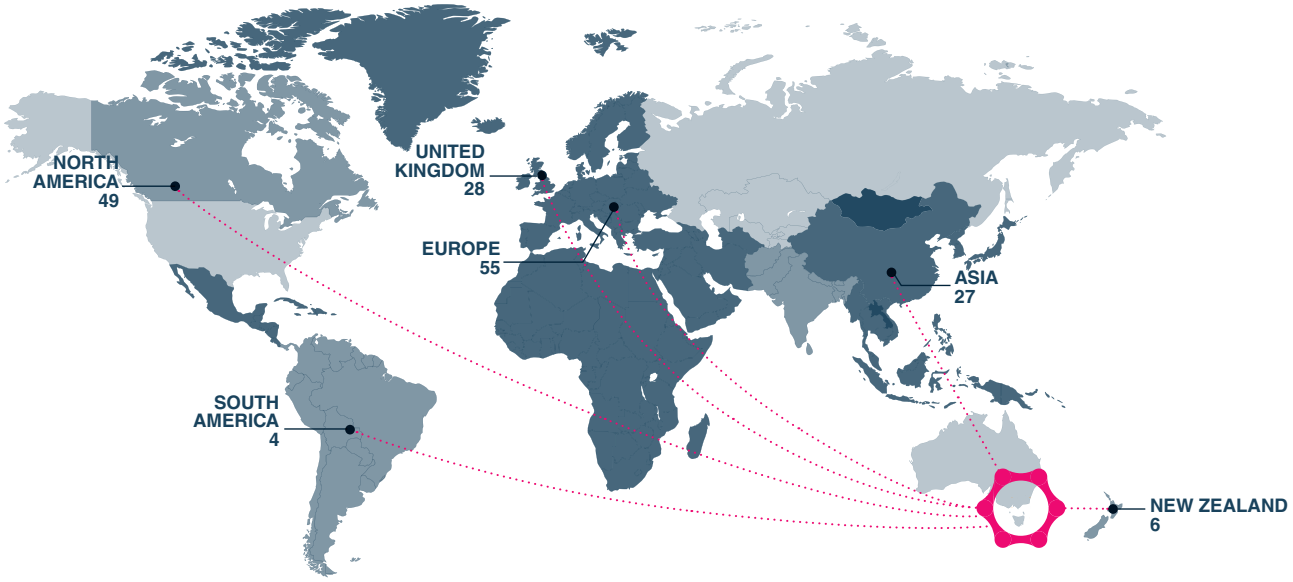
Collaboration and innovation are fundamental to translating medical research and ground-breaking results into better health.

Our researchers work with leading scientific minds at home and around the world, sharing expert knowledge and resources. These collaborative partnerships ensure our discoveries are driven forward by cutting-edge science and technological advances.

Australia



World



Our history

LONSDALE ST

Queen Victoria Hospital

1978

Monash University's Centre for Early Human Development is established at Queen Victoria Hospital, Lonsdale Street, Melbourne focusing on research into neonatal and paediatric health. Professor John Maloney is appointed Director.

Professor John Maloney

Professor Henry Burger AO

Professor Henry Burger is appointed Director of Prince Henry's Hospital Medical Research Centre.

1969

1960

Prince Henry's Hospital Medical Research Centre is established on St Kilda Road, Melbourne. Professor Bryan Hudson, renowned endocrinologist and inaugural Chair of the Department of Medicine at Monash University, is appointed Director of the new Centre.

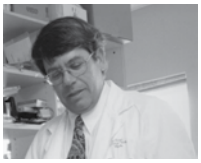
Prince Henry's Hospital

ST KILDA RD

Professor Bryan Hudson AO

1988

Prince Henry's Hospital Medical Research Centre is incorporated as an independent medical research institute, Prince Henry's Institute of Medical Research, with strengths in endocrinology, cancer and reproduction.



Professor Alan Trounson

Renowned IVF pioneer, Professor Alan Trounson is appointed Director of the Centre for Early Human Development.

1986

CLAYTON RD

Professor David de Kretser AC

Centre for Early Human Development and the male reproductive health group from Monash University's Department of Anatomy merge to form the Monash Institute of Reproduction and Development. Led by Professor David de Kretser, the Institute's strengths encompass reproduction and development, and fetal, newborn and paediatric research.

1991

Queen Victoria Hospital and Prince Henry's Hospital are relocated to the new Monash Medical Centre, Clayton. The Centre for Early Human Development and Prince Henry's Institute relocate with the hospitals.

1987-91

Associate Professor Blair Ritchie

The Ritchie Centre is established within the Monash Institute of Reproduction and Development following an endowment by Associate Professor Blair Ritchie, a long serving clinician-scientist. The Centre focuses on fetal, newborn and paediatric research.

1998

Professor Evan Simpson AO

Internationally renowned breast cancer researcher, Professor Evan Simpson, is appointed Director of Prince Henry's Institute of Medical Research.

1998

The Institute is renamed Monash Institute of Medical Research, acknowledging its expansion to encompass inflammation, immunity and cancer research.

2005

Professor Bryan Williams

World renowned innate immunity and cancer researcher, Professor Bryan Williams is appointed Director of the Monash Institute of Medical Research.

Professor David de Kretser becomes the Governor of Victoria.

2006

Professor Matthew Gillespie

Professor Matthew Gillespie, respected bone cell biologist and cancer researcher is appointed Director of Prince Henry's Institute of Medical Research.

2008

2014

Hudson Institute of Medical Research is formed through the merger of Prince Henry's Institute and Monash Institute of Medical Research. The merged Institute is named after Professor Bryan Hudson, the founding Director of Prince Henry's Hospital Medical Research Centre, and mentor to the Director's of both merged Institutes.

Professor Bryan Williams is appointed as inaugural Director and CEO.

L-R: Professor David de Kretser AC, Professor Bryan Hudson AO, Professor Henry Burger AO

Translational Research Facility, Monash Health Translation Precinct, Clayton

Translational Research Facility opens.

2016

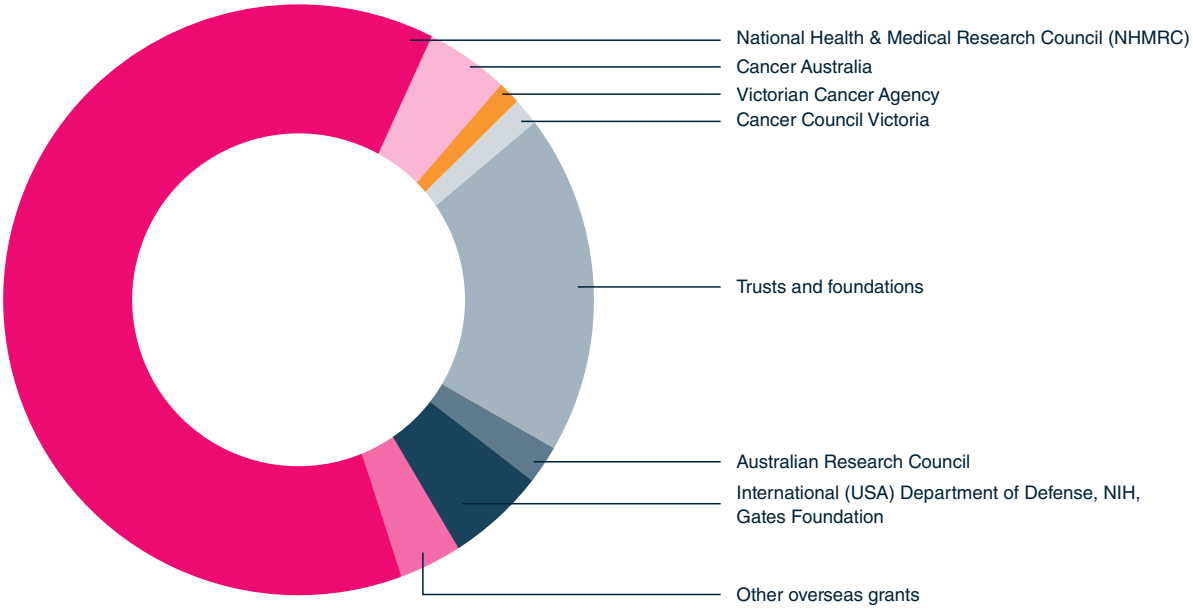
Aug 2017

Professor Elizabeth Hartland

Internationally renowned infection and immunity scientist, Professor Elizabeth Hartland, is appointed Director and CEO of Hudson Institute. The Institute's renewed focus is on translational research into inflammation, cancer and reproduction and development.

Research outputs

Grant funding received in 2017



FUNDING BODIES ($)

National Health & Medical Research Council (NHMRC)	11 745 707
Australian Research Council	334 074
Cancer Australia	880 000
Victorian Cancer Agency	225 000
Cancer Council Victoria	274 692
Trusts and foundations	
Ovarian Cancer Research Foundation	671 249
Gandel Philanthropy	500 000
Children's Cancer Foundation	484 492
Cerebral Palsy Alliance	327 101
Science and Industry Endowment Fund	197 000
Australian Communities Foundation	136 864
Robert Connor Dawes Foundation	125 000
Monash IVF	114 244
Other trusts and foundations	1 113 599
TOTAL	**3 669 548**
International (USA) Department of Defense, NIH, Gates Foundation	1 017 401
Other overseas grants	674 330
TOTAL	**18 820 753**

PUBLICATIONS

In 2017, Hudson Institute's researchers published in a number of international peer-reviewed journals.

Publication type	2015	2016	2017
Original research articles	209	234	273
Reviews	51	28	36
Editorials and commentaries	7	11	20
Books and book chapters	17	19	10

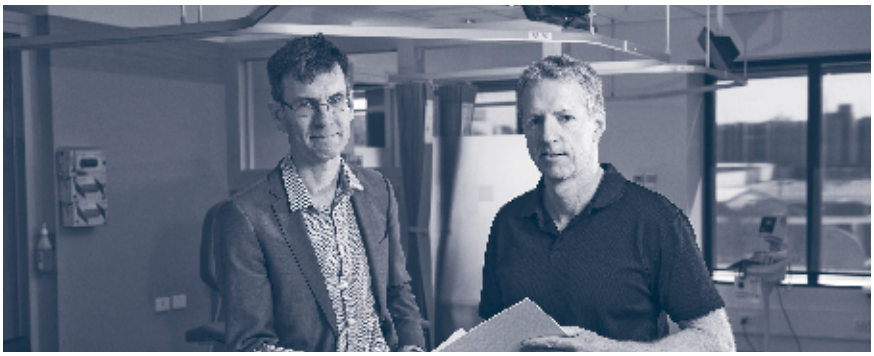
Research impact

Precision medicine

No two people respond to a disease or treatment in the same way. This is often due to genetic variability, the fundamental DNA building blocks that make us unique.

Precision medicine is an emerging approach that takes into account differences in genes, environment and lifestyle to target treatment to each individual patient.

This intersection between science and the clinic is arming medical researchers with a wealth of genomic data and knowledge. A one-size-fits-all approach to disease treatment may soon become a thing of the past.



L-R: Dr Daniel Croagh (Monash Health), Professor Brendan Jenkins

Precision medicine targets pancreatic cancer

Pancreatic cancer has a five-year survival rate of just five to seven per cent, making every day spent with loved ones extremely valuable. Sadly, these statistics have not changed significantly in 40 years.

A study by Professor Brendan Jenkins, PhD student Mr William Berry and Dr Daniel Croagh, a hepatobiliary surgeon from Monash Health, has laid the groundwork for a clinical trial that is aiming to improve survival rates with a drug currently used to treat colon cancer.

“We are taking the guesswork out of treatment for pancreatic cancer,” Prof Jenkins says.

“Instead of a one-size-fits-all approach, the drug is selected for the patient based on the genetic make-up of their tumour and how likely it is an individual will respond to the treatment – an approach known as precision medicine.”

Published in the *International Journal of Cancer*, the study showed that around 10 per cent of patients with a specific genetic tumour profile could benefit from a particular type of drug, called an epidermal growth factor receptor inhibitor.

In the study, the team also refined an endoscopic technique used to extract biopsies of tumours, so that genetic material can be extracted from virtually any patient’s tumour for screening with the drug.

The Victoria-wide Monash Health clinical trial, led by Dr Croagh, will see between 150 and 200 patients screened for suitability to benefit from this drug.

“If successful, this clinical trial will be one of the first applications of precision medicine, targeting cancer treatment to the genetic profile of the tumour, in pancreatic cancer anywhere in the world.”

Dr Andrew Stephens

Associate Professor Sefi Rosenbluh

Hope for ovarian cancer treatments

Precision medicine is providing new hope for patients with ovarian cancer, the most common cause of death from gynaecological cancers.

Only 3 out of every 10 women diagnosed with advanced stage ovarian cancer will survive after five years. These statistics haven't improved in 30 years, but new precision medicine approaches are opening up new possibilities.

While most ovarian cancer patients initially respond well to chemotherapy, 90 per cent will relapse with tumours that are resistant to treatment. New treatments and approaches are vital to improving survival rates.

The Ovarian Cancer Research Foundation (OCRF) tissue bank at Hudson Institute is a vital resource for tackling ovarian cancer. Funded by OCRF since 2006, it is one of the largest Australian repositories of ovarian cancer tumour samples for use in research and houses more than 2200 ovarian tissue samples.

In a new collaborative project focused on advancing treatment options, Dr Andrew Stephens, Head of the Ovarian Cancer Biomarkers laboratory and Associate Professor Ron Firestein, Head of the Cancer Genetics and Functional Genomics laboratory, are screening tumour samples from patients to identify how they respond to different drugs. Samples collected by the OCRF tissue bank will be screened for compatibility with drug compounds.

The results will provide oncologists with individual therapies to guide treatment based on individual tumour biology, specifically suited for each patient's clinical history.

"This represents a new era in clinical practice – oncologists will no longer be restricted to a one-size-fits-all approach. By personalising treatment options, we are identifying the best therapy for each patient and providing better treatment choices. This is particularly important for ovarian cancer patients who develop resistance to standard chemotherapy," said Dr Stephens.

Centre for Functional Genomics

CRISPR is a powerful gene-editing technique that enables scientists to pinpoint the gene underlying a disease and snip or 'edit' it.

Functional genomics, including CRISPR screening, is enabling scientists to alter DNA sequences to uncover the role of specific genes in diseases, such as identifying mutations driving resistance to treatment in cancer patients.

It is widely considered to be the next frontier in precision or personalised medicine, giving scientists the ability to reconfigure the fundamental DNA 'building blocks' of disease.

A new Centre for Functional Genomics is the centrepiece of Hudson Institute's expertise in precision medicine, supporting our scientists and clinicians in this burgeoning area.

"Precision medicine provides a more efficient way of treating cancer than traditional therapies. Functional genomics allows us to find specific genetic mutations that cause cancer and apply new treatment approaches that are targeted to the patient," explains Centre for Functional Genomics Head, Associate Professor Joseph (Sefi) Rosenbluh.

"This gives us a clearer picture of the role these genes are playing in inflammation and diseases such as cancer or those inherited from our parents or grandparents.

"If a sequenced genome is a library, CRISPR screening provides researchers with the tools to find any book, open it up to a specific page and edit the text," A/Prof Rosenbluh said.

L-R: Associate Professor Ron Firestein, Dr Jason Cain, Dr Peter Downie (Monash Health)

Our paediatric cancer team

Hudson Monash Precision Medicine Program

The Hudson Monash Pediatric Precision Medicine Program aims to significantly improve treatment for childhood cancer patients with the greatest unmet clinical need; those diagnosed with brain cancers and solid tumours.

Established with a $1.3 million investment from the Children's Cancer Foundation, this program will take advantage of major advances already being made in adult solid tumours.

Our scientists will establish a living biobank of paediatric brain tumours and solid cancers, including living organoids or lab-grown 'mini-tumours' to trial and develop new targeted treatments and improve survival rates for childhood cancer.

The living biobank will be established using tumour biopsies taken when children are surgically diagnosed at Monash Children's Hospital and The Royal Children's Hospital.

"Every child's tumour is genetically unique and responds to cancer treatment in a different way," lead researcher, Associate Professor Ron Firestein, Research Group Head, Cancer Genetics and Functional Genomics says. "Knowledge of the genetic variability of paediatric tumours is building at a fast pace and this program is translating this information into treatment."

Scientists will use the three-dimensional lab-grown organoids to run specialised genetic tests, called CRISPR screens, that will identify key genetic mutations in tumours for targeting with specific drugs.

"Current treatment options, such as chemotherapy and radiation, can have devastating long-term health effects for childhood cancer survivors. Our aim is to develop effective, targeted treatment options with fewer side effects for these young patients and improve long-term survival," A/Prof Firestein says.

We are indebted to the Children's Cancer Foundation for their support of this program.

Pooling paediatric cancer expertise

Hudson Institute was announced as the first Australian member of the US-based Children's Brain Tumor Tissue Consortium (CBTTC). CBTTC is a collaborative, multi-institutional research program dedicated to the study and treatment of childhood brain tumours.

This important enterprise enables researchers to share expertise with 16 leading international institutions including Weill Cornell Medicine, Stanford University and the Children's Hospital of Pittsburgh to improve treatments for children and adolescents with brain cancer.

Associate Professor Ron Firestein says the consortium enables leading scientists from across the world to pool data from high-quality brain tumour biopsy specimens that will help them find cures for childhood brain cancers.

"Hudson Institute's expertise lies in developing clinically-relevant, laboratory-based organoid models of patients' tumours for screening compatibility with new drugs in partnership with Monash Children's Hospital," A/Prof Firestein said.

"Our ultimate aim is to improve treatment outcomes for paediatric brain cancer patients and their families."

Protecting preterm babies

The transition at birth, from the womb to the outside world, presents the greatest challenge of our lives. Preterm babies, those born prior to 37 weeks of gestation, are the most vulnerable to this transition.

We are investigating how key events in pregnancy and labour lead to preterm birth. Though our research and collaborations with clinicians, we are developing new ways to protect the fragile preterm brain, lungs, intestines and heart from injury and better treat ongoing complications, giving all babies born early the best chance of a long, healthy life.

Associate Professor Graeme Polglase

Life-saving treatment at no cost

Thousands of preterm babies' lives could be saved by waiting 60 seconds before clamping the umbilical cord after birth, according to an international study including research from Hudson Institute.

Published in the *American Journal of Obstetrics and Gynecology*, the review assessed morbidity and mortality outcomes from 18 trials, comparing delayed versus immediate cord clamping in nearly 3000 babies born before 37 weeks' gestation.

Led by University of Sydney researchers, it found clear evidence that delayed clamping reduced mortality in hospitals by a third and is safe for mothers and preterm infants.

Hudson Institute researcher, Associate Professor Graeme Polglase (whose work helped uncover the benefits of delayed clamping) says 1 in 5 babies born in Australia will need help to take their first breath outside of the womb.

"This study shows that simply giving the baby more time to breathe before removing it from the life support of its mother has amazing immediate and long-term benefits for the newborn," A/Prof Polglase says.

Our researchers are now developing teaching resources to share expertise on delayed cord clamping with midwives and doctors to help improve care in Victorian hospitals.

L-R: Dr Miranda Davies-Tuck, baby Arjun and Neelim Kota

Reducing stillbirth

Stillbirth is a devastatingly common outcome to a pregnancy. In Australia, 1 in 135 births will result in a stillbirth, but there is hope on the horizon.

Research led by Dr Miranda Davies-Tuck, published in the journal *PLOS One*, is changing the way women are cared for in the final weeks of their pregnancy which may help reduce the rates of stillbirth.

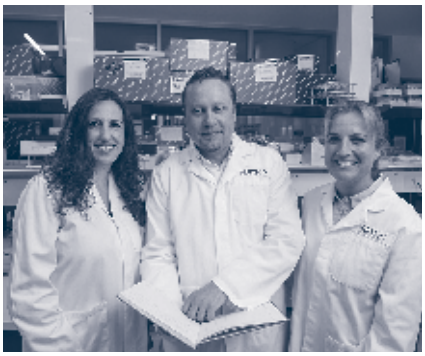
The study shows the length of a pregnancy may differ based on the mother's ethnic background or country of origin.

By analysing almost 700 000 births and stillbirths in Victoria, Dr Davies-Tuck research team found that women born in South Asian countries such as India, Sri Lanka or Afghanistan, were at an increased risk of having a stillbirth in late-term pregnancy.

Their average natural onset of labour occurred at around 39 weeks, suggesting the time at which a placenta can no longer sustain a fetus may vary across ethnic groups.

"These findings could change the definition of 'term' and 'post-term' birth in clinical care as current guidelines suggest all women should undergo fetal surveillance or have the option of having their labours induced at 41 weeks' gestation to prevent stillbirth," Dr Davies-Tuck explains.

"However for women born in South Asia and Africa, 41 weeks may be too late and we may need to set their guidelines earlier, for example at 39 weeks of gestation."



L-R: Dr Ina Rudloff, Professor Marcel Nold, Associate Professor Claudia Nold

Stopping lung inflammation in preterm babies

A combination of anti-inflammatory drugs could be given to high-risk premature babies in the hours after birth to prevent development of inflammatory lung disease.

Bronchopulmonary dysplasia (BPD) is a chronic lung disease affecting up to 60 per cent of all preterm babies. It's incurable, and there is currently no safe and effective treatment. Sadly, babies that survive BPD often suffer severe and lifelong complications including impaired neurodevelopment, and they are susceptible to airway infections that require ongoing medical care.

Professor Marcel Nold and Associate Professor Claudia Nold, working with senior scientist Dr Ina Rudloff, showed that a natural anti-inflammatory protein called interleukin 1 receptor antagonist (IL-1Ra) was effective in preventing BPD.

In a preclinical study published in the *Journal of Cellular and Molecular Medicine*, they showed that the drug was most effective against BPD when given in moderate doses and when administered early, ideally within 24 hours of delivery.

The team also investigated protein C, a drug used to prevent blood clotting, and found it has potential when combined with IL-1Ra to further ameliorate BPD.

"Our findings pave the way for a preventive treatment that could be given to premature babies during their highest risk of developing BPD," A/Prof Claudia Nold says.

Dr Beth Allison

Link between preterm birth and long-term heart health

With an ever-increasing number of babies surviving preterm birth, understanding how events in the womb and at birth affect a person's long-term development are vital to preventing chronic health problems in adults.

New research by Dr Beth Allison has found that babies born at 35 weeks could be at a higher risk of cardiovascular disease in adult life than those born at full term.

The study, published in the journal Experimental Physiology, found links between late preterm birth (35–36 weeks' gestation) and a decrease in regulation by the parts of the nervous system that work together to keep the heart rate under subconscious control; a key marker of heart disease.

"We show that even a late preterm birth leads to adult cardiovascular dysfunction. These early signs of cardiovascular dysfunction might underpin the later hypertension and increased risk of heart disease observed in adults born preterm." says Dr Allison.

Dr Tamara Yawno

Protecting the preterm brain

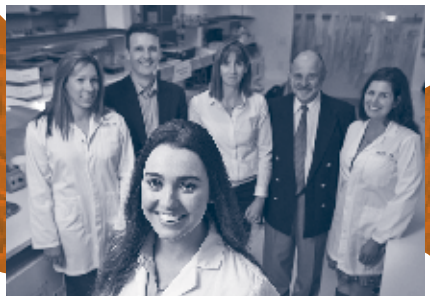
The placenta is a rich source of life for unborn babies, supplying oxygen and sustaining nutrition to the fetus via the umbilical cord.

A new study led by Dr Tamara Yawno has shown that placental stem cells could give preterm babies the best chance at a healthy life by preventing serious brain injury caused by exposure to infection in the womb; a condition known as chorioamnionitis.

Chorioamnionitis is an intrauterine bacterial infection and a leading cause of preterm birth that can result in brain injury and cerebral palsy in newborn babies.

Published in the journal, *Cell Transplantation*, the preclinical study showed that amnion epithelial cells (derived from the amniotic membrane, the innermost layer of the placenta) helped to protect fetuses against white matter brain injury that would normally have occurred as a result of this infection.

Dr Yawno and the team are hopeful that amnion epithelial cells could one day be given to preterm babies as a treatment shortly after delivery to protect their brains against the risk of serious injury.



Ms Madison Paton and supervisors (L-R) Dr Courtney McDonald, Associate Professor Michael Fahey, Associate Professor Suzie Miller, Professor Graham Jenkin, Dr Beth Allison

Dr Rebecca Lim

Rescuing the preterm brain

PhD student, Madison Paton, was awarded the Kahli Sargent Research Studentship for her research investigating the use of umbilical cord blood stem cells in the prevention of preterm brain injury.

The studentship was generously established by the family of Kahli Sargent, a teenage girl whose short life was affected by cerebral palsy. Kahli was starved of vital oxygen at birth, resulting in brain damage.

Madison's studies are examining how stem cells derived from the placenta could help to protect the immature brain from the long-term effects of exposure to infection during critical periods of development in the womb.

These stem cells are providing a promising treatment for preterm brain injury.

"We are extremely hopeful that umbilical cord blood stem cells could be a treatment option, not only for preterm babies exposed to infection, but also for those starved of oxygen at birth, like Kahli," Madison says.

"If we can show that these cells can protect the preterm brain after injury, we can start to understand how stem cells may be used to prevent cerebral palsy."

The future of stem cell therapies

What if the regenerative properties of stem cells – their ability to repair tissue – could be explained by nanoparticles containing potent biological 'cargo' released by these cells?

Dr Rebecca Lim, head of the Amnion Cell Biology Group, is at the forefront of the next generation of cell-free regenerative medicine.

What are exosomes?

Exosomes, or cell-derived vesicles, are naturally occurring particles approximately 1/1000th the size of a fine grain of sand. They are present in many bodily fluids. Many cells, including amnion epithelial cells (stem cells found in the innermost layer of the placenta), release exosomes, which contain important proteins and other genetic material that can be transferred to other cells where they can affect function and physiology.

Exosome therapeutics are a new alternative to traditional stem cell therapies and Dr Lim is taking a pioneering approach using amnion epithelial stem cells.

Dr Lim is a lead investigator on multiple clinical trials using these cells to repair scarred and damaged cells in chronic, premature lung disease and end-stage liver fibrosis – diseases at opposite ends of the human lifespan.

While promising, there are challenges posed by current stem cell therapy approaches that limit their use, including high production costs and the need for specialised equipment to store, transport and prepare these treatments.

Based on her team's research, Dr Lim is developing a low-cost, cell-free regenerative treatment using exosomes extracted from amnion epithelial stem cells.

In December, Dr Lim was awarded a prestigious NHMRC project grant to investigate amniotic exosomes as a potential off-the-shelf treatment for bronchopulmonary dysplasia (BPD).

"BPD is a chronic lung disease that occurs in babies born too early. It's expensive to treat and complications from treatment can lead to lifelong health problems," Dr Lim says.

"Our vision is to develop a treatment that could be administered easily and cost-effectively to preterm babies with BPD – even by parents after babies are discharged from hospital."

Focus on women's health

Women face unique health challenges. Pregnancy and child-bearing affect many women, and some face cancers of the uterus and ovaries, fertility issues and reproductive health disorders during their lifetime.

Our scientists are working to detect female cancers earlier, improve fertility and better diagnose and treat hidden conditions like endometriosis and pelvic organ prolapse. Our research aims to improve women's participation in all aspects of life through better health.

L-R: Professor Caroline Gargett, Dr James Deane

Miracle tissue provides hope

A new discovery is accelerating solutions for women's reproductive health disorders such as endometriosis and adenomyosis.

Professor Caroline Gargett's Endometrial Stem Cell Biology Group has found an identifying marker, or unique signature, that can be used to identify and isolate rare stem cells in the uterus.

"We can now examine when these cells are behaving normally, such as in menstruation, and when they exhibit uncontrolled growth, such as in endometrial cancer or endometriosis, to assist in finding new treatment solutions for women."

The research, a culmination of eight years of work, was published in the journal *Human Reproduction.* The marker, N-cadherin, is a protein expressed by adult stem cells called endometrial epithelial progenitor cells.

"The endometrium is incredibly regenerative. It regrows each month when an embryo does not implant, approximately 400 times in a woman's reproductive life. We believe these adult stem cells could play an important role in this process and in menstrual disorders," Prof Gargett says.

Prof Gargett's team believes these cells may be responsible for regenerating glands that regrow the womb lining each menstrual cycle, which also sustains an implanted embryo until the placenta is fully formed.

Professor Eva Dimitriadis

Intercepting pregnancy signals

For a woman to fall pregnant, a fertilised egg or embryo must implant or 'stick' to the lining of the womb. Failure of the embryo to implant is a frustrating outcome for many women and couples undergoing IVF and the cause is often unknown.

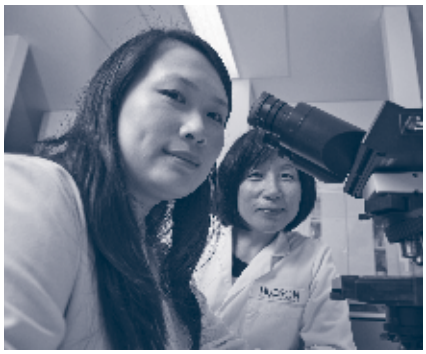
What if a key 'message' sent to the womb by an embryo could be intercepted to determine whether or not the embryo will successfully implant?

Research by Professor Eva Dimitriadis, Head of the Embryo Implantation Laboratory, is helping more women to fall pregnant through IVF by understanding this message.

A study published in the journal *Reproduction, Fertility and Development* has identified that human embryos release a small molecule (microRNA-661) or message that is sent to the woman's body in a pattern. The pattern of this message has been shown to reflect whether or not that embryo will successfully implant in the womb during IVF.

"Based on this discovery, it may now be possible to manipulate specific factors in the uterine cavity prior to IVF, to assist more women to achieve a successful pregnancy," Prof Dimitriadis says.

Dr Shayanti Mukherjee



L-R: Dr Sophea Heng and Professor Guiying Nie

Solutions for pelvic organ prolapse

Pelvic organ prolapse is a potentially debilitating condition, predominantly caused by the impact of childbirth. Symptoms including poor bladder or bowel control and pain during sex may profoundly affect a woman's quality of life.

Prolapse develops when pelvic floor muscles, tissues and ligaments become damaged, causing the bladder, bowel or uterus to shift or drop into the vagina or outside the body.

Professor Caroline Gargett's team (including Dr Shayanti Mukherjee, pictured) is creating an innovative solution to a hidden problem by combining stem cells from the lining of a woman's uterus with nanotechnology to develop safer and more effective treatments.

In preclinical studies, endometrial stem cells were shown to produce factors that trick the body or modify the immune response to one of healing, rather than scarring, to repair damage.

The team is now using electrospun nanofibres to 'anchor' endometrial stem cells to sites of injury to help regrow the tissues and ligaments that support pelvic organs.

The multi-disciplinary project includes collaborators from CSIRO, Flinders University, Monash Institute of Medical Engineering and Monash Health.

Detecting endometrial cancer earlier

There is no early detection test for endometrial cancer, yet it remains one of the most common gynaecological cancers diagnosed in Australian women.

Pre-menopausal women with endometrial cancer have no obvious symptoms, while post-menopausal women with the disease often present with vaginal bleeding, a sign the cancer has spread.

New research by Professor Guiying Nie and first author Dr Sophea Heng, is paving the way for a world-first early detection test for endometrial cancer.

In a study published in the journal *Oncotarget*, the team identified that a key protein called dystroglycan changes during early stage endometrial cancer in post-menopausal women. When dystroglycan, which normally helps to bind cells together in the uterus, is not present, the tight junctions of the cells are reduced, a key indicator of early stage endometrial cancer.

"Dystroglycan is shed from the cell surface during early endometrial cancer development and is released into the uterine cavity where it 'floats' and could potentially be detected for early diagnosis," Prof Nie, Head of the Implantation and Placental Development Research Group, says.

"This discovery could help us to develop a non-invasive early screening test, which would greatly reduce the morbidity and mortality associated with endometrial cancer."

Dr Jemma Evans

Raising awareness for endometriosis research

A debilitating 'hidden' women's health condition, affecting an estimated 1 in 10 women, was the focus of Hudson Institute researcher Dr Jemma Evans' presentation at a high tea event hosted by Endometriosis Australia for EndoMarch.

Dr Evans spoke about her work towards an early test that could help reduce the delay in diagnosing endometriosis, which often takes up to 10 years.

EndoMarch is a worldwide campaign raising awareness about the impact of endometriosis on women, families and our economy.

L-R: Event speakers - Dee Ryall (Member for Ringwood), Sarah Maree Cameron (Nova), Dr Jemma Evans and Dr Emma Readman (Specialist Gynaecologist)

Endometriosis public forum

Sharing knowledge on endometriosis

Giving back to the community by sharing the benefits of scientific discovery with the general public is an important part of Hudson Institute's role.

In early October, more than 100 women with endometriosis, their partners and family members attended a free public forum titled *Endometriosis – Moving towards a pain-free future* at the Melbourne Museum Theatre.

A panel of world-renowned women's health researchers and clinicians, moderated by Dr Bernie Hobbs (ABC Science), helped to shed light on endometriosis, a condition affecting around 1 in 10 women, through an engaging discussion and by explaining how medical research can help.

The forum addressed key issues, including why it can take up to 10 years for the diagnosis of endometriosis, what causes symptoms, treatments and future research in key priority areas.

L-R: Donna Ciccia (Endometriosis Australia), Professor Caroline Gargett, Nicolle Flint (Member for Boothby) and Gai Brodtmann (Member for Canberra)

Health Minister announces national action plan

In early December the Australian Minister for Health, Greg Hunt, announced a national action plan for endometriosis, including a targeted call for funding for research into the disease.

Professor Caroline Gargett represented Hudson Institute alongside parliamentarians, support groups, clinicians and scientists at a highly successful event at Parliament House in Canberra.

"Importantly, medical research will be critical to uncovering new options for diagnosis, treatment, care and understanding of endometriosis," Minister Hunt said in a statement.

The action plan will be developed in collaboration with the Australian Coalition for Endometriosis and the Parliamentary Friends for Endometriosis Awareness and will seek to improve the treatment, understanding and awareness of endometriosis.

Endometriosis - not just about period pain

Doctors told Bianca that she had the worst case of endometriosis they had seen. Yet, she had no pelvic pain and was only diagnosed after experiencing infertility. She now wants to spread awareness so that other women don't suffer.

As a teenager, Bianca felt a "heavy pulling, like a brick in her uterus" during her menstrual cycle. When she started taking the oral contraceptive pill, her symptoms disappeared for 10 years.

It wasn't until she began trying to fall pregnant in her mid-twenties that Bianca began to question why she and her husband were having trouble with becoming pregnant.

A fertility specialist suspected that Bianca might have endometriosis, which causes infertility in around one third of women. A diagnostic laparoscopy confirmed the presence of stage IV (severe) deep infiltrating endometriosis.

Endometriosis had completely changed the anatomy of Bianca's pelvic organs. Lesions and cysts had become stuck to her bowel, bladder and ovaries.

"I was told by doctors that it was the worst case of endometriosis they had ever seen," Bianca says.

Bianca was shocked. She had no pelvic pain and infertility was the only symptom since her teenage years. Bianca had surgery to remove the endometriosis lesions, but soon after she began experiencing paralysing pain in her neck and shoulder that strangely corresponded with her cycle.

While endometriosis usually affects the pelvic organs, in rare cases, it can be found in other parts of the body. Keyhole surgery confirmed Bianca had diaphragmatic endometriosis that had spread across her torso. It was aggravating a nerve, triggering the pain in her neck and shoulder.

One of Bianca's ovaries required removal as it was no longer functioning due to the severity of the disease. Endometrial cells had also infiltrated her ureter, blocking the passage between the bladder and one kidney. She had to undergo a ureteric reconstruction to restore normal function to her kidney.

"People associate endometriosis with period pain or pelvic pain, but it's so much more than stomach cramps. I nearly lost a kidney and was close to requiring a bowel resection due to endometriosis. This is not just about period pain. It's just horrific," Bianca says.

Since the operation, Bianca's pain and life have improved. She believes women should have access to an early diagnostic test for endometriosis and a range of effective treatment options.

"Early diagnosis is critical," Bianca said. "We need treatments other than surgery. Every woman's experience is different. There's an urgent need to create progress for endometriosis through medical research."

Out of the box discoveries

Professor Vincent Harley

Boys, girls and intersex conditions

In a world-first, Hudson Institute researchers are closer to understanding the fundamental processes that make embryos develop as male, helping 1 in 5000 babies that are born intersex.

Scientists had already established that the protein, SOX9, is a crucial regulator of male sex development, directing the testes to form in a developing embryo; but how SOX9 did this remained a mystery.

The collaborative study, led by Hudson Institute's Professor Vincent Harley and published in *Nucleic Acids Research* has solved the puzzle, opening up the potential to help people born intersex with diagnosis and treatments.

In preclinical models, the team identified that SOX9 works with two other proteins turning hundreds of genes on or off to form the testes. In addition, they made a completely unexpected finding that SOX9 can cut messenger RNA, effectively creating a different message in males and females. This phenomenon, sex-specific RNA splicing, had previously only been described in vinegar flies.

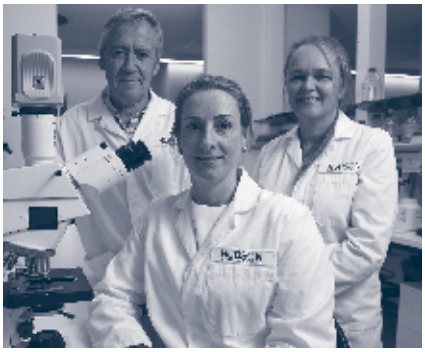
"SOX9 'turns on' male genes, like a switch turning on a light bulb, to determine the sex of an embryo. Before we made this discovery, we did not understand which light bulbs these were, or how many SOX9 need to switch on to be male," said Prof Harley.

"This research provides the first insights into how SOX9 controls testes formation through its unique control of genes. It also improves our understating of what genetic pathways are activated," said Prof Harley. In babies born intersex, these pathways go awry.

With this knowledge, scientists will be able to identify genes involved in male sex determination and examine their role to improve diagnosis and treatments for genetically based sex development disorders.

The research was led by Hudson Institute (Prof Harley, Aleisha Symon and Dr Rowena Lavery) and the University of Montpellier in France with assistance from VLCSI in Melbourne, collaborative laboratories in Argentina and France.

Around 1% of babies are born each year with a disorder of sex development, or intersex, where their genetic, hormonal or physical sex characteristics (genitals, gonads and chromosome patterns) are not typically male or female.



L-R: Professor Paul Hertzog, Dr Niamh Mangan, Dr Nicole de Weerd

Body's HIV barrier revealed

Despite advances in treatment and education, HIV, or human immunodeficiency virus, remains a major global health challenge.

According to the World Health Organization, there are 36.7 million people living with HIV and over 95 per cent of infections occur in the developing world. More prevention and treatment options are needed to tackle the spread of HIV.

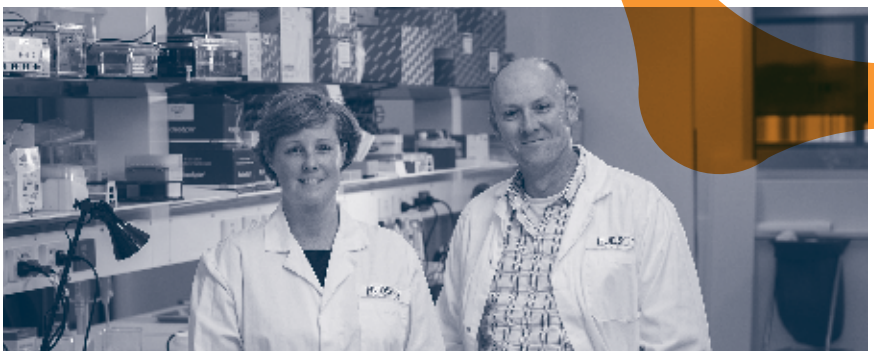
A study by Professor Paul Hertzog and Dr Niamh Mangan, published in *Immunology and Cell Biology,* has shown that a signalling protein or cytokine found in the female reproductive tract, interferon epsilon, could form a first-line defensive response to HIV.

Scientists pre-treated human cell lines with pure interferon epsilon, then infected the cells with HIV. Working with Deakin University collaborators, they showed the cytokine, first characterised by Prof Hertzog's laboratory in 2013, reduced replication of HIV and induced mechanisms known to block HIV infection.

"The wonderful thing about interferon epsilon is that it's made naturally by the body. It boosts natural immunity," Dr Mangan says.

"We know it acts quickly and effectively and it's always there in the reproductive tract of pre-menopausal women. Boosting levels of the protein could help to protect women against HIV infection."

Dr Anthony Sadler



L-R: Dr Michelle Tate, Associate Professor Ashley Mansell

New gastro–diabetes link

The exact cause of type 1 diabetes, a disease where the immune system attacks insulin-producing cells in the pancreas, remains unknown.

Dr Anthony Sadler is providing important clues as to why some children develop this autoimmune disease, which affects an estimated 130 000 Australians. The answer may lie in the immune system's overzealous response to a common childhood viral infection.

Research published in *The EMBO Journal* shows how rotavirus, a common cause of gastroenteritis, sets in motion a chain of immune system events that can culminate in type 1 diabetes in children with a specific genetic predisposition to the disease.

The study identified how variation in the gene that encodes an immune response protein called MDA5, alters the body's immune response to rotavirus and that this activity is particular to the pancreas, where diabetes starts.

"We were able to show that in trying to fight off rotavirus, MDA5 overcompensates and actually induces cell death and damaging inflammation in the pancreas in some individuals," Dr Sadler says.

Dr Sadler said understanding how type 1 diabetes starts could help to more easily identify children at risk of developing type 1 diabetes and intervene earlier.

Fighting a deadly pandemic

Why do seasonal strains of influenza make many people sick yet cause relatively few deaths, while 40 per cent of people affected by strains of avian influenza, or 'bird flu', succumb to their infection?

A discovery by Associate Professor Ashley Mansell could form a strategy to protect the world's population from a potential global outbreak of pandemic influenza.

In a paper published in *The Journal of Biological Chemistry,* A/Prof Mansell and his team have identified that a protein called PB1-F2, produced by a highly pathogenic strain of avian influenza called H7N9, is detected by the immune system of the infected person or animal.

"While inflammation is a normal response to seasonal flu infection, leading to symptoms like fever and aching joints, PB1-F2 induces an overzealous response and sets into motion a 'cytokine storm', which is often more damaging than the virus itself. The body burns up with inflammation, leading to organ failure and even death.

"When the immune system detects PB1-F2, it triggers a highly inflammatory response by an immune sensor complex called the inflammasome. It is almost like the body's alarm system for highly pathogenic viruses," A/Prof Mansell explains.

Importantly, in previous studies, the team showed that targeting this inflammasome with a new drug compound could reduce the 'cytokine storm' in those infected during a global pandemic event.

There is concern that strains of avian influenza such as H5N1 and H7N9 could become easily transmissible from person to person. Since 2003, when the strains first surfaced in humans, more than 2500 people in south-east and east Asia have died from these infections.

"As a global community, we live in the shadow of a severe or pandemic influenza outbreak that could devastate the world's population. This year marks the 100th anniversary of the Spanish Influenza outbreak which infected approximately 30 per cent of the world's population and claimed 50–100 million lives – more than both World Wars combined," A/Prof Mansell says.

"Our ability to tackle such an outbreak is limited. There are no effective drugs to treat patients who present with fully-fledged viral infection.

"Our research may lead to a world-first approach to treat people infected with avian flu, which could prove life-saving in the event of a once-in-a-generation deadly influenza pandemic."

People impact

Associate Professor Claudia Nold

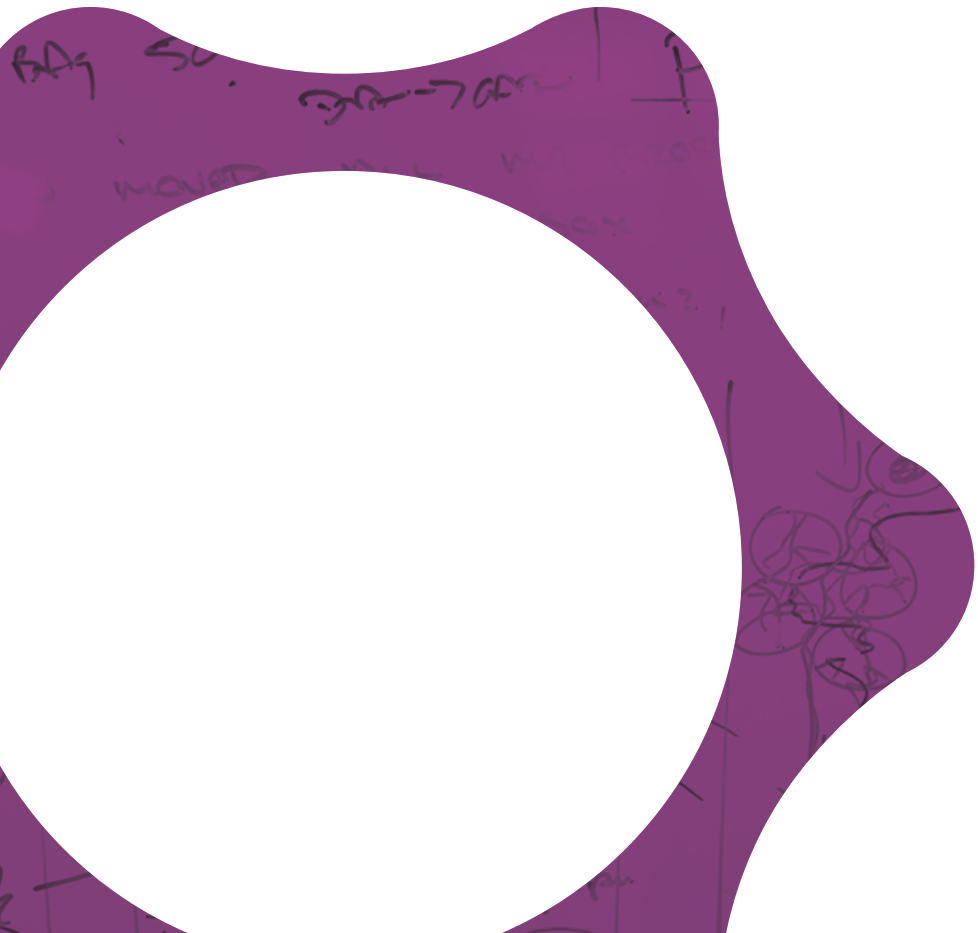
Research interests: inflammation, children's health

Immunology expert and Head of the Interventional Immunology in Neonatal Diseases research group, Claudia Nold received an academic promotion to Associate Professor in 2017.

A/Prof Nold's focus is on finding treatments for the most serious diseases affecting newborn babies. Her team is nearing completion of pre-clinical research into interleukin 1 receptor antagonist (IL-1Ra) as a treatment for bronchopulmonary dysplasia, one of the biggest challenges for clinicians in the neonatal intensive care unit.

A pharmacist by training, A/Prof Nold has broad research expertise in cytokine biology, inflammation and immunology and is a Heart Foundation Future Leader Fellow.

"As a mother myself, nothing in science would give me greater pleasure than to help other families experience the joy of healthy children."



Professor Caroline Gargett

Research interests: women's health, stem cells, endometriosis

Renowned stem cell scientist and endometriosis expert and head of the Endometrial Stem Cell Biology laboratory, Caroline Gargett received an academic promotion to Professor this year. Prof Gargett is also an NHMRC Senior Research Fellow and a board member of the National Stem Cell Foundation of Australia.

With a strong record of research excellence and discovery, Prof Gargett leads a multi-disciplinary project in collaboration with CSIRO Manufacturing, Flinders University Biomedical Engineering, Monash Institute of Medical Engineering and urogynaecologists to investigate the use of endometrial mesenchymal stem cells for a tissue engineering application in pelvic floor prolapse surgery.

"I am proud and humbled to have become a Monash Professor and encourage young women scientists so that they can make it too – just set your goals and work towards them. Everything is possible. This promotion reflects my group's contributions to our research efforts and all my lab members should be applauded as well."

Professor Eva Dimitriadis

Research interests: reproductive health, embryo implantation

Leading female reproductive health research expert, Evdokia (Eva) Dimitriadis received an academic promotion to Professor.

Prof Dimitriadis, Head of the Embryo Implantation laboratory, is a world-renowned researcher in the field of embryo implantation in healthy pregnancy, contraception and infertility. Her research looks into the underlying factors that help to make the endometrium more receptive to an implanting embryo.

"I have had the privilege to lead a great team, whose hard work and dedication has contributed to our success and recognition for grant funding. The discussions and friendships with Hudson Institute colleagues have certainly been very important in developing ideas, as well as having the facilities to do the work and getting through hard times."

Dr Jaclyn Pearson

Research interests: inflammation, host–pathogen interactions, cell death signalling

Dr Jaclyn Pearson was named as a L'Oréal-UNESCO For Women in Science 2017 Australian Fellow in October. The prestigious fellowship recognises Dr Pearson's contribution to the field of microbiology and will support her career progression.

Dr Pearson's research focuses on microorganisms of the gastrointestinal tract, specifically their role in the development of inflammatory bowel disease. She also investigates interactions between viral and bacterial infections in the gut and assesses the implications of this, particularly in young children.

"From the time I first looked down a microscope at a tiny stained bacteria during my undergraduate degree, I was amazed at how such a small organism could have such an impact on human health. I encourage aspiring female scientists to believe in their ability and to follow their research passion, you'll see just how much you can contribute to the wellbeing of others."

Professor Guiying Nie

Research interests: reproductive health, women's health

Highly respected reproductive biologist and Head of the Implantation and Placental Development laboratory, Guiying Nie, was promoted to Professor.

Failure of an embryo to implant in the womb is a major cause of infertility and unsuccessful IVF cycles. Placental disorders cause serious life-threatening pregnancy complications including pre-eclampsia. Prof Nie's research focuses on human implantation and placental development with the goal of developing diagnostics and therapies to achieve a healthy pregnancy.

Prof Nie is a Senior Research Fellow of the NHMRC and a Fellow of the Society of Reproductive Biology. Her work has been supported by NHMRC and international funding bodies, with her research resulting in over 100 peer-reviewed publications.

"This promotion represents a major career milestone and it gives me greater confidence to continue to pursue a rewarding career and an innovative area of research that I really love."

Professor Kate Loveland

Research interests: reproductive health, cellular differentiation

Reflecting her strong leadership skills and scientific accomplishments in the field of men's reproductive health, Professor Kate Loveland was appointed Head of Hudson Institute's Centre for Reproductive Health in 2017. In addition, her honorary title of Liebig Professor, Justus-Liebig University (JLU) was renewed, continuing this important international collaboration for Monash–JLU research training.

Prof Loveland holds an NHMRC Senior Research Fellowship and heads the Testis Development and Male Germ Cell Biology Research group, which aims to discover how early life events impact adult male fertility and testicular cancer risk.

Prof Loveland has published more than 150 peer-reviewed manuscripts, serves as Head of Post-Graduate Studies for the School of Clinical Sciences at Monash and is an Associate Editor for *Andrology.*

"It is a privilege to be in a profession charged with revealing the intricacies of life that are encapsulated in each cell and every biological process, as well as being responsible for passing on that knowledge."

Professor Rosemary Horne

Research interests: children's health, sleep

In 2017, Professor Rosemary Horne was awarded a Doctor of Science (DSc) from Monash University. Her thesis is a culmination of more than three decades of her research, which has shaped the understanding of sleep in children and infants.

The DSc is awarded for work that makes an original, substantial and distinguished contribution to knowledge in a particular field of research.

Prof Horne's thesis incorporates 143 research publications, from her PhD studies into Sudden Infant Death Syndrome (SIDS) in the early 1980s, to studies on sleep disorders in infants and children published up until 2015.

"I have thoroughly enjoyed my research career and fostering the careers of the students and postdoctoral fellows who all contributed to the research included in the thesis. It is very satisfying to know that my research has made a difference to improving the health of infants and children worldwide."

Professor Lois Salamonsen

Research interests: reproductive health, endometriosis

Women's reproductive health expert Professor Lois Salamonsen was 1 of 21 top Australian scientists inducted into the Australian Academy of Science for outstanding contributions to science.

Prof Salamonsen's research career in the field of endometrial biology spans more than 30 years and includes over 260 peer-reviewed publications. Her discoveries have helped to determine the mechanisms underpinning menstruation and the embryo–maternal cross-talk critical for embryo implantation.

Prof Salamonsen's findings have important implications for infertility, abnormal uterine bleeding, endometriosis and the development of new non-hormonal contraceptives for women.

"From an early age I was enthralled by science and the diversity of nature. The complexity of reproduction fascinates and drives me. I encourage those interested in a career in science to follow their passion. The excitement of discovery and the hope that one may leave the world a better place is truly rewarding."

Associate Professor Frances Milat

Research interests: osteoporosis, metabolic bone disorders, women's health

Associate Professor Frances Milat was awarded the Endocrine Society of Australia's Mid-Career Award and the Ken Wynne Memorial Postdoctoral Research Award in 2017. These awards acknowledge her contribution to metabolic bone disease, particularly in underserved populations.

A/Prof Milat heads the Metabolic Bone Disease Group and the Metabolic Bone Service at Monash Health. She is committed to improving patient care through clinical research, with interests in bone disease associated with transfusion-dependent thalassemia, chronic neurological disorders, renal failure, premature menopause and other medical conditions. She is involved in the supervision of research students and teaches medical students and postgraduates.

"It has been rewarding to develop the clinical osteoporosis service and the bone research group over recent years. Our work has improved our understanding of osteoporosis in chronic disease as well as patient care."

Dr Michelle Tate

Research interests: inflammation, influenza

As an emerging leader in viral pathogenesis and immunology, Dr Michelle Tate was appointed to lead her own research group, Viral Immunity and Immunopathology at Hudson Institute.

Dr Tate's research aims to explain the mechanisms that contribute to hyper-inflammation, or an overwhelming reaction to infection, during severe influenza A virus infection. This damaging inflammation can lead to multi-organ failure or respiratory failure.

Her research has been published in top journals such as *PLoS Pathogens, Immunity, eLife, Journal of Immunology, Journal of Virology* and *Scientific Reports.*

"Influenza virus does not discriminate, impacting the young, old and healthy. As a scientist, I feel privileged to investigate an area of research that has the potential to improve the lives of many people."

Student impact

70
POSTGRADUATE AND HONOURS STUDENTS COMPLETED

188
STUDENTS
138 PHD
3 MASTERS
47 HONOURS

33
STUDENTS WITH MEDICAL TRAINING

50
STUDENT FIRST AUTHOR PUBLICATIONS

We nurture and inspire the next generation of scientists and clinicians by educating and training more than 180 students through our academic affiliation with Monash University.

Our learning environment supports excellence, innovation and collaboration. We provide students with support and tools to develop the confidence and skills they need to succeed as professionals working in science and in alliance with health care professionals.

Our students receive one-on-one supervision from a senior scientist alongside wider support from their research group. They join in a range of development opportunities including workshops, seminars and national and international conferences.

Publication of work in scientific journals enables our students to make an early mark in their chosen field of research under the guidance of their supervisor. During 2017, our students published in prestigious scientific journals, including 50 that were student first author publications.

Developing vital communication and networking skills is also encouraged through:

THE THREE MINUTE THESIS

In just three minutes, students have to convey the significance of their research, without using scientific jargon, to ensure everyone can understand their science and be excited by its impact.

PHD STUDENT SHOWCASE

As part of Monash Health Translation Precinct (MHTP) Research Week, high-achieving students are invited to present their achievements to clinicians, scientists and staff at our precinct.

PROFESSIONAL DEVELOPMENT

A range of opportunities including open forums, expert seminars, inductions, LabArchives training and mentoring breakfasts help to broaden scientific knowledge and link students to senior scientists and clinicians.

LOCAL, NATIONAL AND INTERNATIONAL CONFERENCES

Our students attend conferences in their area of expertise alongside their supervisors and teams to present their work and update their knowledge. This provides crucial professional development opportunities that include competing for prestigious awards, and building valuable networks for scientific collaboration and future employment.

NEXT BIG IDEA

This competition provides students with support and training to develop a four-minute pitch for the commercialisation of their research. Students receive valuable feedback from an expert panel to advance their ideas.

HUDSON INSTITUTE STUDENT SOCIETY (HISS)

This group, run for and by students, provides a vital support network and study–life balance for all students. HISS hosts on- and off-site social events and student symposia.

Hudson Institute Student Society (HISS) 2017 committee

The real McCoy

PhD student Madison Paton is investigating how stem cells could protect a baby's brain from exposure to infection while still in the womb, aiding the prevention of cerebral palsy, the most common childhood disability that can lead to lifelong difficulties with movement, talking, vision and sleeping. Madison is part of Associate Professor Suzie Miller and Professor Graham Jenkin's research group, Neurodevelopment, Neuroprotection and Cell Therapies.

In Australia, a child is born with a brain injury leading to cerebral palsy every 15 hours. With no progress in treatment, this rate has remained static for decades.

As a child, Madison treasured her toy stethoscope and blood pressure monitor so much that her parents bought her "the real McCoy" for her fifth birthday. "It gave my make-believe clinics a realistic edge and set me on my path."

Madison is passionate about taking science beyond the lab, working with and for patients. "That's why I chose Hudson Institute. A busy link bridge connects our labs to Monash Health, which delivers more babies than any other Victorian health service. A large portion of my PhD involved talking to parents and attending births every day. It made my research very real."

"When we explain to parents that we need placentas for medical research to help us discover new treatments for vulnerable newborns, they are incredibly generous. There's genuine interest in the potential to help other families and babies."

"This was a new project so we needed to generate funding support. I am incredibly grateful to the Cerebral Palsy Alliance and the Sargent family for the Kahli Sargent Research Studentship. The grant was set up in memory of their granddaughter and daughter to fund research into cerebral palsy. Every day, it's a powerful reminder of why I am here."

Madison presented at her first international conference in Japan in 2017. "It was a big step and I wanted others to understand my research so it reaches its potential." Madison was awarded the Tanya Gunn prize for best PhD presentation at the conference. "I was so happy, I cried."

From one to a million

PhD student Aidan Kashyap is investigating new treatments for the 1 in 4000 families with a baby that is born with congenital diaphragmatic hernia (CDH). Around 30 per cent of babies born with CDH die soon after birth, while survivors face lifelong neurological and respiratory problems. Aidan is part of Associate Professor Ryan Hodges' Fetal Therapy Research Group.

For babies born with CDH, birth is a treacherous experience. Early in their development, a hole forms in the diaphragm, allowing the stomach to move into the chest, preventing their lungs from growing. When they are born, their small lungs are often unable to breathe enough air to sustain life.

"Imagine if, when we diagnose babies with CDH at 20 weeks, we intervened to help them develop normally in the safety of their mother's womb, so that they are born with a healthy set of lungs. That's the aim of my research, to explore in-utero surgery and a new treatment that may correct or prevent the lung damage," explains Aidan.

Aidan enjoys working alongside clinician-scientists and researchers. "The collaborative culture that exposes me to variety of projects is invaluable."

A split-second decision on the day of enrolment saw Aidan change from engineering to medicine. However, it wasn't a case of love at first lecture. Aidan was only captured by medicine when he started working with patients. "Once I was with people, I knew I was in the right place, but something was still missing. As a clinician you can make tremendous impact on individuals, but medical research has the potential to help millions. When I started my research project, it all fell into place."

Aidan's passion for helping people has led him to get involved globally. He organised a conference in Fiji for 120 medical students from the Pacific region to learn new skills, and volunteers with Global Ideas, a not-for-profit. "The best way to affect change is to empower others through education."

Graduates of 2017

Congratulations to our 70 graduates

23
PHD STUDENTS

1
MASTERS STUDENT

46
HONOURS STUDENTS

Doctor of Philosophy

Dr Dhafer Mohammed Alahmari
Develop MR sequence to characterise the structural and functional changes in animal brains and lungs
A/Prof Graeme Polglase, Prof James Pearson, A/Prof Michael Farrell

Dr Sarah Ashley
Identification of epigenetic and molecular pathways underlying food allergy and acquired tolerance in children
Prof Richard Saffery, Dr Stefan White

Dr Natalie Bitto
Transport and innate immune properties of bacterial nano-sized vesicles
A/Prof Richard Ferrero, Dr Katryn Stacey

Dr Carmela Suzan de Boer
Modelling epigenetic dysregulation in developmental disorders
Prof Jose Polo, Dr Stefan White, Dr Patrick Western

Dr Gavin Brooks
Deregulated IL-6 signalling as a key molecular bridge linking the pathogenesis of emphysema and lung cancer.
Prof Brendan Jenkins, Prof Neil Watkins, Dr Saleela Ruwanpura

Dr Steven Cho
A new armour against an old enemy: interleukin 37 for necrotising enterocolitis
A/Prof Claudia Nold, Prof Marcel Nold, Prof Wei Cheng

Dr Saeedeh Darzi
Interplay between macrophages and endometrial stem/stromal cells on mesh performance in animal models
Prof Caroline Gargett, Prof Jerome Werkmeister, Dr James Deane

Dr Shanti Gurung
Culture expansion of undifferentiated human mesenchymal stem/ stromal Cells for management of gynaecological diseases
Prof Caroline Gargett, Prof Jerome Werkmeister

Dr Seshi Gurusinghe
Identifying potential therapeutics for preeclampsia
Dr Rebecca Lim, Dr James Armitage, Prof Euan Wallace

Dr Sophea Heng
Dystroglycan in the uterus: role in embryo implantation and endometrial cancer
Prof Guiying Nie, Dr Sarah Grace Paule

Dr Britta Klein
Human testis cancer control by local factors: interrogation of hedgehog and activin signalling pathways
Prof Martin Bergmann, A/Prof Mark Hedger, Prof Kate Loveland

Dr Justin Anthony Lang
Mechanisms regulating the increase in pulmonary blood flow at birth
Prof Stuart Hooper, Prof James Pearson, A/Prof Michael Farrell

Dr Constanze Maresch
Glycation adducts in sperm and activin regulation of inflammation induced by diabetes
Prof David de Kretser, A/Prof Mark Hedger, Dr Thomas Lin

Dr Nour Raymond Nicolas
Role of activin and follistatin in chronic testicular inflammation in mice
Prof David de Kretser, A/Prof Mark Hedger, Prof Kate Loveland

Dr Tracey Ong
The effects of different methods of asphyxia and sustained inflation strategies on the cardiorespiratory system in near-term asphyxiated lambs
Prof Stuart Hooper, A/Prof Graeme Polglase

Dr Dean Popovski
Investigation into the biology of human malignant rhabdoid tumour
Prof Neil Watkins, Dr Jason Cain

Dr Lexie Prokopuk
The role of epigenetic modifiers on germ-line development and inheritance of epigenetic information
Dr Patrick Western, Dr Jessica Stringer

Dr Suzanne Sinni
Evaluation of maternity services at Casey Hospital – Casey Maternity Services ("Cas-Mat")
Prof Euan Wallace, Prof Wendy Cross

Dr Kanokwan Srirattana
Manipulating the mitochondrial genome to generate more economically viable livestock
Prof Jus St. John, Dr Matthew McKenzie

Dr Te-Sha Tsai
The effect of mitochondrial DNA on pre-implantation embryo development
Prof Jus St. John, Dr Matthew McKenzie

Dr Rukmali Wijayaranthna
The roles of activins and follistatin in infections of the epididymis
A/Prof Mark Hedger, Prof David de Kretser, Prof Andreas Meinhardt

Dr Heba Zahid
Metformin to treat and prevent oestrogen-dependent cancers
Dr Kristy Brown, Prof Susan Davis

Dr Dandan Zhu
Determining dose and time point effects of human amnion epithelial cells in the experimental treatment of BPD
Dr Rebecca Lim, Prof Euan Wallace

Master of Philosophy

Miss Jessica Rose Crawshaw

Bachelor of Biomedical Science (Honours)

Miss Nahal Atashkadeh
Miss Martha Celina Calalang
Miss Kathika Atash Das
Miss Tiasha Fernando
Miss Sarah Glenn
Mr Song Jing Khor
Miss Sharon Kiew
Miss Monica Kuy
Mr Sheraz Muhammad Majoka
Mr Timothy Simora
Miss Tessa Marie Svinos
Ms Blessy Thomas
Mr Jaynen Yong

Bachelor of Science (Honours)

Ms Indianna Ishanie Alexander
Ms Dilara Anbarci
Ms Angela Grace Ediriweera
Mr Jack Keen Emery
Miss Madeleine Foreman
Ms Meaghan Griffiths
Mr Ata UL Hadi
Ms Caitlyn Holt
Mr Struan Jansen
Miss Ellen Jarred
Ms Keerthi Kottampally
Mr Ruhan Frans Kruger
Ms Saskia-Aisha Marguccio
Ms Emily Phillips
Ms Alice Sharpe
Ms Isabelle Shearer
Mr James Tran
Miss Vivian Tran
Ms Anida Velagic
Ms Fiona Elizabeth Williams

Bachelor of Medical Science (Honours)

Mr Benjamin James Amberg
Miss Chloe Higgins
Miss Nalian Ibrahim
Ms Natasha Juchkov
Ms Calista Jayne Lambert
Miss Tuzana Nawar
Miss Suveena Ranzil
Miss Kathryn Alexandra Shearer
Dr Lindsay Sirjusingh
Miss Jessica Stark
Ms Tanya Tang
Miss Jennifer Susan Volaric
Miss Hannah Youn

International partners

The Human Variome Project

The Human Variome Project (HVP) is an international organisation working to ensure that all information on genetic variation and its effect on human health is collected, curated, interpreted and shared globally to improve clinical genetic testing services and support medical research.

The HVP is a World Health Organization and United Nations Educational, Scientific and Cultural Organization (UNESCO) affiliate organisation with 81 members.

Hudson Institute became the host of the Australian node for HVP in 2016. Its aim is to collect data on genetic variation reported by Australian diagnostic laboratories, and the interpretation of whether certain variants are associated with disease or alterations in development.

The Australian node aids international collaboration through our world-leading technology platforms and includes a secure digital data repository and a suite of tools for the collection and de-identified sharing of our country's data.

University of Toronto, Canada

A new program linking research labs at Hudson Institute with the University of Toronto's Department of Immunology aims to deepen international collaborations between cancer and inflammation researchers.

This senior undergraduate student exchange and community outreach program was set up to provide opportunities for long-term collaborations and potential joint funding.

Justus-Liebig University, Germany

A collaboration with Justus-Liebig University, which seeks to progress ground-breaking research and patient outcomes in men's reproductive health, has been renewed until 2022.

What started in 1990 with a research training stay by a German postdoctoral researcher is now a $15m multi-faceted collaborative program supporting male reproductive health researchers and students at both the Hudson Institute and the German university.

By exchanging unique skills and technologies, this collaboration provides students and scientists with training and opportunities to create new diagnoses and treatments that will reduce the health burden for men with reproductive health issues.

Professor Kate Loveland

L-R: Monash University Senior Pro Vice-Chancellor (Academic), Professor Zlatko Skrbis; Co-leader, International Research Training Group (IRTG) for Justus-Liebig and Monash Universities and Hudson Institute Centre Head, Professor Kate Loveland; Director of Development Co-operations and Supra-Regional programs at DAAD, Mr Stefan Bienefeld,; President of Justus-Liebig University and Vice-President of DAAD, Professor Joybrato Mukherjee; Monash University President and Vice-Chancellor, Professor Margaret Gardner.


20°C.

Commercialisation and business development

Hudson Institute is focused on taking research discoveries from the laboratory into clinical practice to provide the greatest benefit to patients.

Our Commercialisation and Business Development team work closely with scientists to unlock the potential impact of their research, and collaborate with academic and industry partners to turn this potential into real-world outcomes, including new drug treatments and medical devices.

Highlights

Patent portfolio

We have made significant progress towards commercial milestones in our drug development collaboration with Swiss-based healthcare company Roche (F. Hoffman-La Roche Ltd and Hoffmann-La Roche Inc.). Roche are working with our researchers, Associate Professors Claudia and Marcel Nold, in partnership with scientists from Monash University, to develop next-generation treatments for autoimmune diseases. A number of patent applications in Hudson Institute's portfolio matured in 2017, hitting national phase. Many were also licensed to commercial partners like Merck and Roche, while new provisional and PCT applications are attracting strong interest from Venture Capital.

Next Big Idea

The inaugural Next Big Idea pitch competition took place, providing students and early career researchers with support and training to develop a pitch for the commercialisation of their research. With just four minutes to pitch their idea to a panel of experts from industry, research and business development, participants received valuable feedback to advance their ideas.

Providing access to expertise and resources

Industry and research organisations can now access our world-class expertise and facilities on contract through our registration as a Research Service Provider via the Australian Government's Department of Industry, Innovation and Science.

Ximbio partnership

We partnered with Ximbio, an online global resource for antibodies, cell lines, bacterial strains and other tools used in research, to provide our scientists with a platform to share their research reagents for academic and commercial use.

Chief Commercialisation Officer, Mr Rob Merriel

Building relationships with industry

Hudson Institute extended a collaborative research agreement with Paranta Biosciences to commercialise an oncology discovery involving chemotherapy resistance in non-small cell lung cancer.

The team is investigating the use of PBO1, a recombinant form of follistatin, a human protein follistatin developed by Paranta Biosciences, as an injectable drug to block the actions of certain signalling molecules.

The aim is to increase the sensitivity of highly resistant non-small cell lung cancers to platinum-based chemotherapy drugs, thereby making treatment more effective.

Our supporters

Philanthropy and fundraising

Hudson Institute achieved significant success in its philanthropic and fundraising endeavours in 2017, thanks to the generous support of our donors.

OUR MAJOR PHILANTHROPIC AND FUNDRAISING ACTIVITIES INCLUDE

- The establishment of Hudson Institute Foundation. Comprised of leaders of corporate Australia, philanthropists and eminent scientists, its role is to advocate on behalf of our researchers and further expand our fundraising capabilities.

FUNDING FROM CHILDREN'S CANCER FOUNDATION

- An investment of $1.3 million established the Hudson Monash Paediatric Precision Medicine Program. This program aims to improve treatment for childhood cancer patients with the greatest unmet clinical need, those diagnosed with brain and solid tumours Read more about it on page 43.
- The program was also promoted through a video shown to 650 guests at the Children's Cancer Foundation Million Dollar Lunch at Crown Palladium in August.
- Supported Dr Lisa Walter to investigate the effects of light therapy on sleep, fatigue and quality of life of children with acute lymphoblastic leukaemia.
- Enabled global specialist paediatric researchers to present their work at Hudson Institute's Childhood Cancer Research Symposium.
- Australian Lions Childhood Cancer Research Foundation, via Children's Cancer Foundation, supported Dr Sara Khan to investigate new therapeutic options for two of the most prevalent and aggressive paediatric brain tumours, Medulloblastoma and Diffuse Intrinsic Pontine Glioma.

FUNDING FROM OVARIAN CANCER RESEARCH FOUNDATION

- Supported Dr Andrew Stephens' research group to work on a screening tool, called the active ratio test, which could result in an ovarian cancer early detection test and the discovery of new drugs to better treat the disease.
- Enabled Dr Simon Chu's research laboratory to work on human granulosa cell tumours and serous epithelial ovarian cancer with a class of drugs in preclinical models. It also allowed them to analyse the role of a genetic mutation found in the majority of granulosa cell tumours.

- Continued the ovarian cancer tissue bank based at Hudson Institute, where since 2006, more than 2200 samples have been stored. This repository is unique in Australia, making it a valuable resource for ovarian cancer research.

OTHER SUCCESSES

- Gandel Philanthropy provided $500 000 to establish the Gandel Genomics Centre and Gandel genomics health research program to develop genomics technologies from basic research through to diagnostics and precision medicine. It will enable more rapid diagnosis, early intervention and prevention, targeted to individual needs.
- Funding from the Gemma Howell Scholarship Fund, via the Australian Communities Foundation, supported PhD student, Ms Hannah Newnes, to conduct research into paediatric brain cancer.
- The Ron Evans AM Cancer Research Fellowship supported Dr Afsar Ahmed to investigate the regulation of myeloid cell functions by integrin-linked kinase as a novel therapeutic option for inflammatory bowel diseases and bowel cancer.
- The Kahli Sargent Research Studentship into cerebral palsy was established. Its inaugural recipient, PhD student Ms Madison Paton, conducted research into stem cell treatments for preterm brain injury leading to cerebral palsy.
- Funding from Perpetual Trustees enabled Dr Anthony Sadler to investigate why the immune system, which usually fights viral infection to prevent or cure disease, can trigger type 1 diabetes in some children with a specific genetic predisposition.
- The Angior Family Foundation supported Dr Jennifer Dowling to conduct research into sepsis, a life-threatening immune response to infection that can lead to tissue damage, multi-organ failure and death.
- Two fundraising appeals were implemented, supporting research into creatine levels in pregnant women and type 1 diabetes.
- The Fielding Foundation Fellowship, awarded to Dr Niamh Mangan, expanded research into interferon epsilon, which has strong clinical potential in the treatment of infectious and inflammatory diseases, and cancer.
- The Fielding Foundation Innovation Award, presented to Associate Professor Marcel Nold, supported a multidisciplinary team from Hudson Institute and Monash University to enter into a collaboration with global pharmaceutical company, F. Hoffmann-La Roche Ltd to develop next-generation treatments for autoimmune diseases.
- To increase awareness of the groundbreaking research that can be achieved through donations and bequests, Hudson Institute hosted tours for philanthropic, corporate and community groups. This included Australian Lions Childhood Cancer Research Foundation, Pro Bono Australia, Children's Cancer Foundation, AFL Media, National Breast Cancer Foundation, RACV Foundation, Geelong Prostate Cancer Group, My Room, Perpetual Trustees, Red Energy, Slater and Gordon Lawyers and Ovarian Cancer Research Foundation.

Thanks to support from the Ovarian Cancer Research Foundation (OCRF), Dr Andrew Stephens (right) and Dr Simon Chu are closer to developing an early detection test for ovarian cancer and better therapies to treat the disease.

Gandel Genomics Centre

L-R: Mrs Helen Gandel, Professor Bryan Williams, Mrs Lisa Thurin, Mrs Pauline Gandel, Mr Frank McGuire and Mr Andrew Thurin at the official launch ceremony of the Gandel Genomics Centre

The Gandel Genomics Centre, launched in June 2017 by Mr Frank McGuire, Parliamentary Secretary for Medical Research, will play a vital role in transforming the future of Victorian healthcare.

Established with generous support from Gandel Philanthropy, the centre will see genomic specialists and bioinformaticians translate complex medical research data into rapid diagnostic tests and treatments targeted to patients' individual needs.

"We are extremely grateful to Gandel Philanthropy and the Gandel family for supporting Hudson Institute's genomic research capabilities and genomics technologies," said Professor Elizabeth Hartland, Hudson Institute Director.

"This donation will see the Gandel Genomics Centre become the premier site for genomic health research, recognised for excellence and innovation."

The Gandel Genomics Centre is uniquely positioned within the Monash Health Translation Precinct (MHTP) Translational Research Facility, where scientists and clinicians from Hudson Institute, Monash University and Monash Health access a suite of world-leading technology platforms.

Mr John Gandel AC, Chair of Gandel Philanthropy, says he sees the life-changing potential of genomics technologies to transform healthcare.

"My wife Pauline and I have been supporting genomics work at the Monash Health Translation Precinct and the Hudson Institute for more than a decade," said Mr Gandel.

"Helping set up this centre to enable future significant research in genomics and precision medicine was a natural next step in our productive and longstanding relationship."

L-R: Dr Jason Cain, Associate Professor Ron Firestein

New hope for paediatric cancer patients

Hudson Institute scientists were awarded a $1.3 million grant from the Children's Cancer Foundation to establish the Hudson Monash Paediatric Precision Medicine Program.

The program, led by a team of researchers and clinicians from Hudson Institute, Monash Children's Hospital and Monash University, aims to significantly improve treatment for childhood cancer patients, in particular those diagnosed with brain cancers and solid tumours.

Cancer researcher, Associate Professor Ron Firestein explains that "The program will ensure children with cancer benefit from major advances already being made for adult solid tumours."

Included in the biobank are 3D organoids or laboratory-grown 'mini-tumours' that mimic each tumour's unique biology. Using the organoids, Hudson Institute scientists will identify the key genetic changes in the tumour to inform selection of the most effective drugs and therapies.

Hudson Institute appreciates the support and foresight of the Children's Cancer Foundation in enabling research that will improve treatment options and clinical outcomes for children with cancer.

Hudson Institute supporters 2017

We are grateful for the gifts received from individuals, trusts, foundations and organisations during the year.

We also acknowledge the support of the Victorian State Government through the Operational Infrastructure Support Program and the Australian Government through its funding bodies including the NHMRC. These valuable contributions assist our scientists to undertake and progress life-changing research.

FUNDING BODIES

Alliance for Lupus Research
Andrology Australia
Australian Academy of Science
Australian Chinese Medical Association of Victoria
Australian Communities Foundation
Australian Lions Childhood Cancer Research Foundation
Australian Pork Limited
Australian Research Council
Bailey's Day
Bayer Grants4Targets
Bill & Melinda Gates Foundation
Cancer Australia
Cancer Council Victoria
Cell Care Australia Pty Ltd
Cerebral Palsy Alliance
Children's Cancer Foundation
Collier Charitable Fund
CSIRO
Department of Health – Victorian Government
Deutsche Forschungsgemeinschaft
German Research Foundation
Equity Trustees
European Society of Human Reproduction and Embryology
Fielding Foundation
Foundation for High Blood Pressure Research
Gandel Philanthropy
Government of Canada
P&M Harbig (Holdings) Pty Ltd
Harold & Cora Brennen Benevolent Trust
Harold Mitchell Foundation
Heart Foundation
Inner Wheel Australia
International Cytokine & Interferon Society
International Federation of Placenta Associations
Isabella & Marcus Paediatric Brainstem Tumour Fund
Lettisier Foundation
LEW Carty Charitable Fund
Lord Mayor's Charitable Trust
Miette Skiller Scholarship Fund
Monash Comprehensive Cancer Consortium
Monash IVF Pty Ltd
Monash University
Multiple Sclerosis Research Australia
National Breast Cancer Foundation
National Health and Medical Research Council (NHMRC)
National Institutes of Health (USA)
Ovarian Cancer Research Foundation
Peninsula and Southeast Oncology
Perinatal Society of Australia & New Zealand
Perpetual Trustees
Rebecca L. Cooper Medical Research Foundation
Red Nose
Robert Connor Dawes Foundation
Rollcraft Pty Ltd
Royal Australasian College of Physicians
Royal Australasian College of Surgeons
Science and Industry Endowment Fund
Society for Reproductive Biology
Society for Reproductive Investigation
Telethon Kids Institute
The Angior Family Foundation
The Australasian Society for Stem Cell Research
The CASS Foundation Limited
The Endocrine Society of Australia
The Heart Foundation
The Ian Potter Foundation
The Japan Society for the Promotion of Science
The Phoebe Jones Trust
The Pierce Armstrong Foundation
The Winston Foundation
Department of Defense (USA)
Victorian Cancer Agency
Windermere Foundation
World Congress of Reproductive Biology
Youanmi Foundation Pty Ltd

MAJOR DONORS

Professor Arthur Clark
Mr Frank Corless
Mrs Joan Donaldson
Mrs Patricia Donges
Mrs Andrea Evans
Mr Peter Fielding
Professor Caroline Gargett
Mr Richard Harbig
Associate Professor Mark Hedger
Ms Julie Muir
Mrs Jill Ross-Perrier
Mrs Jean Thomas
Ms Denise Young
Estate of Wendel Bernard John Zwart
Family of Ms Kahli Sargent

A team of 51 staff and students and Institute supporters raised more than $30,000 for medical research by joining in Run Melbourne 2017.

Board chair's report

It is my pleasure to report on the achievements of Hudson Institute for 2017.

The perception that the benefits of medical research always take years to flow to patients is slowly, but surely, changing. A large shift is taking place.

Scientists at Hudson Institute are delivering life-changing research outcomes to the clinic, here and now. The outstanding highlight of the year for me has been the progression, in one year, from laboratory based discovery science to potentially transforming and lifesaving research, largely thanks to our scientists' close clinical partnerships with Monash Health.

Dr Miranda Davies-Tuck's research on ethnicity and pregnancy has already prompted a change in clinical guidelines at Monash Health to better prevent stillbirth (page 17). Professor Brendan Jenkins' research with Dr Daniel Croagh into pancreatic cancer led to a Victoria-wide clinical trial that is aiming to improving survival rates, shortly after it was published. (page 14).

A testament to the contribution, quality and impact of Hudson Institute's research is the substantial support received from the NHMRC in 2017, as well as from other funding bodies. Our researchers were awarded 20 NHMRC grants totalling more than $15.3 million – almost double the national funded rate - to progress basic and clinical research.

We know that every $1 invested in medical research yields $3 in health benefits. In 2015, clinical trials provided 6900 jobs Australia-wide. This investment in medical research, together with advancements in technology and infrastructure on our site, will surely pay dividends by improving the health of all Australians.

The contribution of independent medical research institutes, such as Hudson Institute, to Victoria's health provision, community and economy is immense. Increasingly, medical research is a global, highly competitive industry and our state leads the nation, we are home to eight of the 12 largest and most successful institutes in Australia.

We welcomed the Victorian Government's budget announcement to increase its contribution to the state's independent medical research institutes. This is a vital step that will ensure Victoria continues to punch above its weight in discoveries. We look forward to continuing work with the State Government to ensure Victoria continues to lead the nation in medical research.

Of course, the success of Hudson Institute research is not possible without the generosity of our philanthropic donors. I am tremendously grateful to our many wonderful contributors for their foresight in supporting life-saving medical research.

One of the Institute's highest priorities is retaining and recruiting world-leading scientists, including women. The Institute is working hard to address the well-documented challenges facing women in science, and to ensure female scientists reach their full potential by being advanced to parity in senior roles. I am proud to have welcomed a world-renowned scientist, academic leader and mentor, Professor Elizabeth Hartland, as the new Director of Hudson Institute in August. Professor Hartland has taken up the role with dedication, and on behalf of the Board and staff of the Institute I thank her for her work and leadership.

I want to express my appreciation to our inaugural and long-serving Institute Director, Professor Bryan Williams for his sterling leadership over the last four years and throughout the merger that created Hudson Institute.

Finally, I want to acknowledge Hudson Institute's Board, all of whom gave their time and expertise generously to guide the Institute's affairs with care and commitment over the past year. I warmly thank the directors who retired in 2017, Professor Pauline Nestor and Mr Graeme Wise, for their contributions – and welcome our new directors Mr David Hanna and Professor Kim Cornish.

My sincere thanks also to the dedicated scientists, students and staff at the Institute. It is an honour to work with you to help advance medical research.

We look forward to another year of achievement in 2018, as we continue to realise Hudson Institute's mission of enhancing health for all people.

Dr Bob Edgar
Board chair
Hudson Institute of Medical Research

Board of directors

The directors of Hudson Institute of Medical Research Board, 31 December 2017

Dr Robert (Bob) Edgar

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

Appointed: April 2009

Dr Edgar has extensive experience in financial services, including 25 years at ANZ Bank where he retired as Deputy Chief Executive Officer in 2009. He is also a director on the boards of Djerriwarrh Securities, Linfox Armaguard Pty Ltd and Transurban Ltd.

Special responsibilities: Board Chair

Professor Warwick Anderson AM

BS (Hons) UNE, PhD (Adelaide), DUniv (Adelaide), FAHA (Int), FRCPA (Hon), FAAHMS, DH (Newcastle)

Appointed: July 2015

Prof Anderson is Secretary-General of the International Human Frontier Science Program Organization. He was previously CEO of the NHMRC and a member of numerous international medical research bodies. Prof Anderson is a Vice-Chancellor's Professorial Fellow at Monash University and has held academic and research positions at Monash University, The Baker Heart and Diabetes Institute, The University of Sydney and Harvard Medical School.

Professor Kim Cornish

BS (Hons), PhD (London)

Appointed: September 2017

Prof Cornish is Director of the Monash Institute of Cognitive and Clinical Neurosciences and the Head of School of Psychological Sciences. Prior to joining Monash University in 2009, she was a Canada Research Chair (Tier 1) at McGill University (Montréal, Canada). In 2017, Professor Cornish was elected Fellow of the Academy of the Social Sciences in Australia. Over her 25-year career, Professor Cornish has received over $9 million in competitive grant and fellowship funding for her work in delineating cognitive profiles and trajectories in typically developing children and in neurodevelopmental disorders. Professor Cornish is the co-inventor of TALI Train™ – a novel, interactive technology platform for detecting and training attention deficits in early childhood.

Mr Nigel Garrard

BEcomm, AICD, CA FAMI

Appointed: March 2016

Mr Garrard has been the Managing Director and CEO of Orora Limited since 2013 when it was listed on the Australian Securities Exchange. Mr Garrard has held a number of senior executive positions including Managing Director of SPC Ardmona, Coca Cola Amatil's food and service division, Chiquita Brands South Pacific Ltd and Amcor Australasia. He is a former Chair of the Australian Government's National Food Industry Strategy Ltd and has been a director of a number of industry and not-for-profit organisations.

Special responsibilities: Chair, Hudson Foundation; Investment Committee member

Mr David Hanna

BEcomm, BAsian Studies, GAICD

Appointed: March 2017

Mr Hanna joined Monash University in 2012 as Director, Business Strategy. For 15 years prior to this, David held a variety of senior management positions in the Victorian Government in economic development policy, international policy and operations and innovation policy. Earlier, Mr Hanna spent 15 years in the Australian Government, including three years on the personal staff of then Prime Minister, Bob Hawke.

Mr Andrew Leyden

BComm

Appointed: March 2016

Mr Leyden has been Managing Director of Lazard Corporate Advisory and its predecessors since 2003. He previously worked in investment banking at Credit Suisse for 10 years.

Special responsibilities: Chair, Investment Committee; Hudson Foundation member

Professor Christina Mitchell

MBBS, PhD, FRACP

Appointed: September 2011

Prof Mitchell is the Academic Vice-President and Dean of the Faculty of Medicine, Nursing and Health Sciences at Monash University. Prof Mitchell is a physician-scientist, specialising in clinical haematology. In 2011, she was the first woman appointed Dean of Medicine among the group of eight universities in Australia. In 2015, Prof Mitchell was inducted into the Victorian Honour Roll of Women for her leadership as the Dean and also received the Lemberg Medal which is awarded annually to a distinguished Australian biochemist. In 2015, Prof Mitchell became a member of the Australian Academy of Health and Medical Sciences.

Ms Zita Peach

BSc, GAICD, FAMI

Appointed: May 2016

Ms Peach is a non-executive director on ASX listed, government and not-for-profit boards. She has also worked in senior leadership roles as Executive Vice-President and Managing Director of Fresenius Kabi, Vice-President of Business Development at CSL Limited and Commercial Director at Merck Sharp Dohme. Ms Peach has extensive experience in commercialising technologies, licensing, mergers and acquisitions. She is a graduate of the Australian Institute of Company Directors and a Fellow of the Australian Marketing Institute. She is a non-executive director of Starpharma Holdings Limited, AirXpanders Inc, Monash IVF Group Limited, Visioneering Technologies Inc, Pacific Smiles Group Ltd and Mt Buller, Mt Stirling Alpine Resorts Management Board.

Special responsibilities: Chair, Intellectual Property and Commercialisation Committee

Ms Maria Trinci

BA/BComm, CA

Appointed: March 2015

Ms Trinci is a partner with KPMG, and has been specialising in financial services since 2000. In 2012, she was admitted to the partnership and is the head of Capital Markets for KPMG Australia as well as the Head of Digital for the Audit, Assurance and Risk Consulting Business. Ms Trinci has worked in London, Edinburgh, Glasgow and New York. She is Chair of the Cancer Council Victoria board.

Special responsibilities: Chair, Finance and Audit Committee; Investment Committee member

THE FOLLOWING DIRECTORS OF THE HUDSON INSTITUTE OF MEDICAL RESEARCH BOARD RETIRED DURING 2017

Professor Pauline Nestor

BA(Hons), MPhil, DPhil

Appointed: November 2013
Retired: March 2017

Mr Graeme Wise

B.Ec (Monash), FAICD

Appointed: November 2013
Retired: May 2017

COMPANY SECRETARY

Mr Rob Merriel

BA, Grad Dip (Psych), Grad Dip (Accounting), CPA

Appointed: May 2014

Mr Merriel is a Certified Practicing Accountant with more than 35 years working in medical research (Baker IDI and Hudson Institute), healthcare (Melbourne Health and Monash Health) and commercial organisations (Pacific Dunlop and Deloitte Consulting). The current Chief Financial Officer and Chief Commercialisation Officer of Hudson Institute, Mr Merriel is a Director of MHRP Pty Ltd and was previously the director and company secretary of several biotechnology-focused companies including BioGrid Australia, Biocomm, the Australian Technology Fund and Evivar.

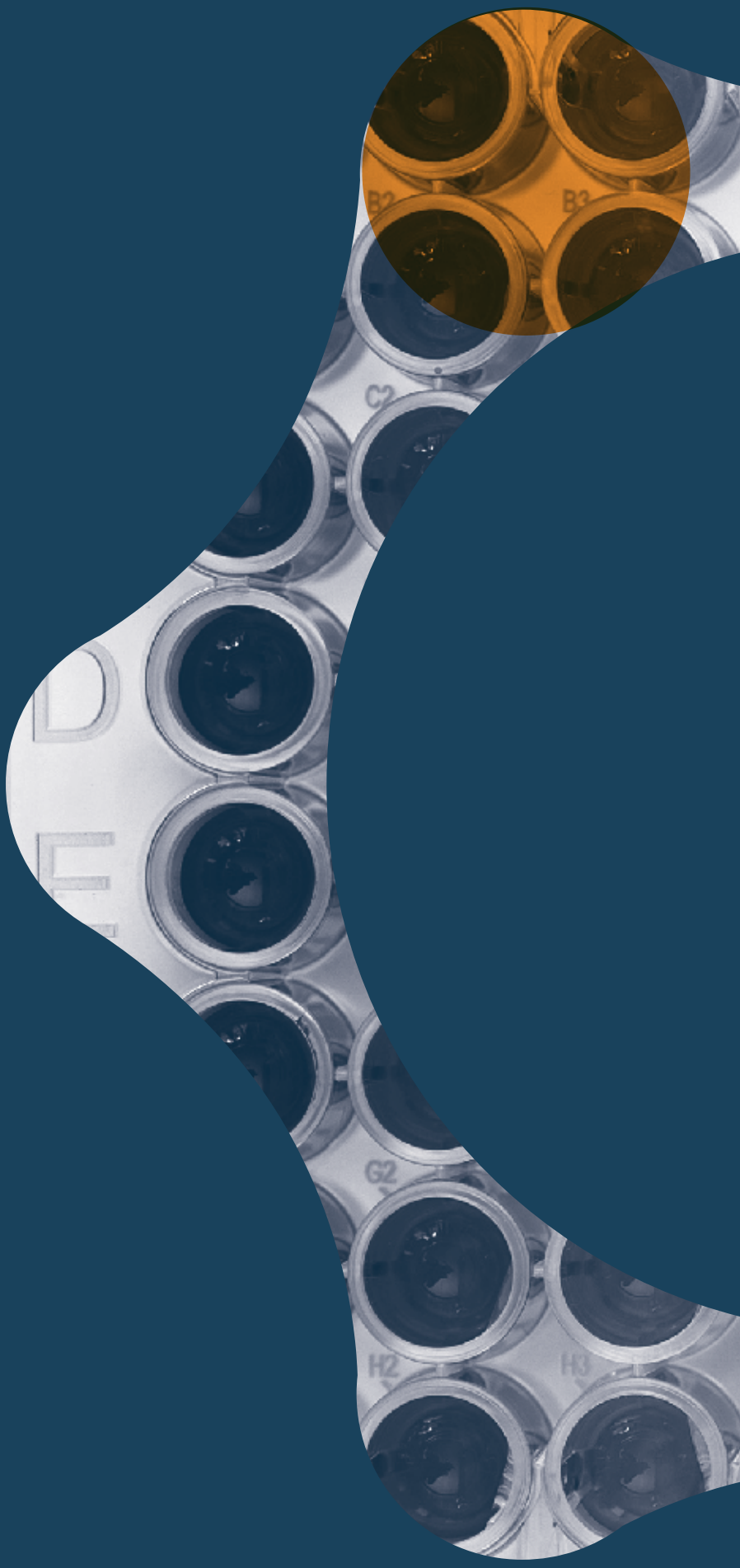
BOARD OBSERVER

Professor Erwin Loh

MBBS, LLB (Hons), MBA, MHSM, PhD, FAIM, FCMI, FAICD, FACLM, FCHSM, FRACMA

Appointed: May 2016

Prof Loh is Chief Medical Officer and Executive Director of Innovation, Patient Safety and Experience at Monash Health, Victoria's largest health service. He has qualifications in medicine, law and management, and is a practising doctor and lawyer. He is fellow of the Royal Australasian College of Medical Administrators, Australasian College of Health Service Management, Australian Institute of Company Directors and Australasian College of Legal Medicine. He is also on the board of the Monash Health Research Precinct, Australasian College of Legal Medicine and Royal Australasian College of Medical Administrators. He is an adjunct Clinical Professor at Monash University where he teaches clinical leadership and health law. He has spoken at local and international conferences, supervises doctoral students, and has published articles, books and book chapters.



Organisation structure

BOARD OF DIRECTORS

DIRECTOR
Professor Elizabeth Hartland

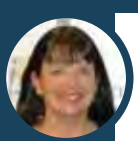
EXECUTIVE

CHIEF OPERATING OFFICER
Mr Rod Wealands

CHIEF FINANCIAL OFFICER
CHIEF COMMERCIALISATION OFFICER
Mr Rob Merriel

EXECUTIVE OFFICER
Ms Ann Scott

ASSOCIATE DIRECTOR
Professor Paul Hertzog



HEAD OF PHILANTHROPY AND FUNDRAISING
Ms Kay Blandthorn

SCIENTIFIC SUPPORT GROUP

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 Paul Hertzog

CENTRE FOR REPRODUCTIVE HEALTH
Professor Kate Loveland

THE RITCHIE CENTRE
Professor Stuart Hooper

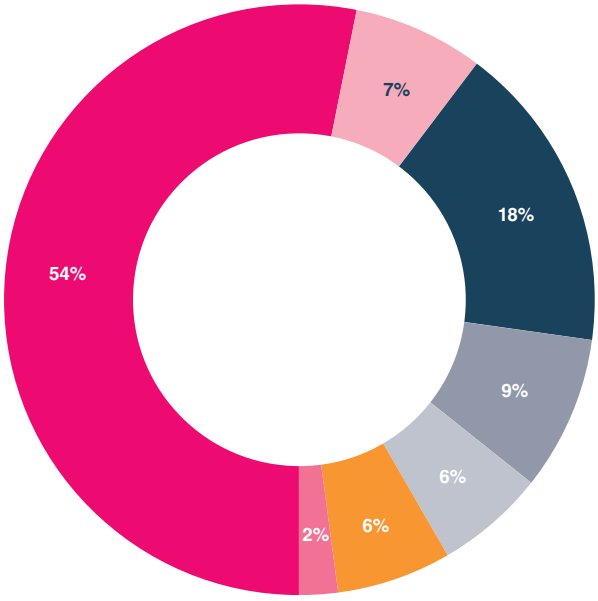
TECHNOLOGY PLATFORMS AND CAPABILITIES

MHTP PLATFORM STRATEGIC INITIATIVES MANAGER
Ms Vivien Vasic

Bioinformatics
Cell Therapies
Flow Cytometry
Functional Genomics
Histology
Mass Spectrometry
Medical Genomics
Micro Imaging
Monash Biobank

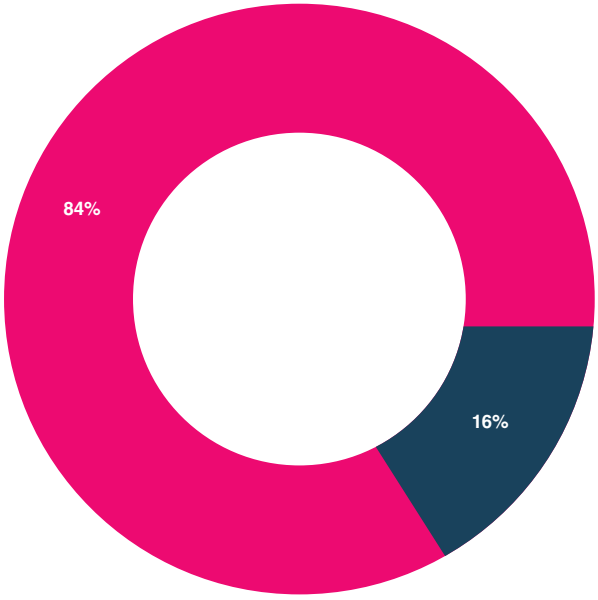
Financial snapshot

Revenue



Revenue	2017 ($)	2016 ($)
Australian Government	22 899 072	22 389 405
Victorian Government	3 089 225	2 672 867
Philanthropic grants	7 520 853	8 225 532
Commercial research	3 649 352	2 819 941
Infrastructure Monash University	2 474 291	3 131 004
Other income	2 493 126	1 610 163
Investment income	672 315	1 625 163
Total	**42 798 233**	**42 474 076**

Expenditure



Expenditure	2017 ($)	2016 ($)
Scientific and laboratory	36 061 186	36 076 745
Administration expenses	6 971 045	7 077 068
Total	**43 032 232**	**43 153 813**

2017 PUBLICATIONS

Book Chapters

1. Davies-Tuck M, Davey M, Fernandez JA, Reddy M, Caulfield M and Wallace E (2017) Ethnicity, obesity, and pregnancy outcomes on fetal programming. In *Diet, Nutrition, and Fetal Programming*. Eds: Rajendram R, Preedy VR and Patel VB. Humana Press, USA, pp 185-198.
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3. Gurung S, Werkmeister JA and Gargett C (2017) Endometrial mesenchymal stromal cell and tissue engineering for pelvic organ prolapse repair, 601. In *The Biology and Therapeutic Application of Mesenchymal Cells*. Ed: Atkinson K. Wiley-Blackwell, New Jersey, USA. Vol 1&2, pp 599-615.
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6. McDonald C, Castillo-Melendez M, Penny TR, Jenkin G and Miller SL (2017) Umbilical cord blood cells for perinatal brain injury: The right cells at the right time? In *Umbilical Cord Blood Banking for Clinical Application and Regenerative Medicine*. Ed: Mauricio AC. InTech, United Kingdom, pp 101-131.
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Journal Articles

1. Abell SK, Boyle JA, de Courten B, Soldatos G, Wallace EM, Zoungas S and Teede HJ (2017) Impact of type 2 diabetes, obesity and glycaemic control on pregnancy outcomes. *Aust & N Z J Obstet Gynaecol* 57:308-314.
2. Abell SK, Suen M, Pease A, Boyle JA, Soldatos G, Regan J, Wallace EM and Teede HJ (2017) Pregnancy outcomes and insulin requirements in women with type 1 diabetes treated with continuous subcutaneous insulin infusion and multiple daily injections: cohort study. *Diabetes Technol Ther* 19:280-287.
3. Ahmed AU, Yim HCH, Alorro M, Ernst M and Williams BRG (2017) Integrin-linked kinase expression in myeloid cells promotes inflammatory signaling during experimental colitis. *J Immunol* 199:2128-2139.
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5. Alahmari DM, Chan KYY, Stojanovska V, LaRosa D, Barton SK, Nitsos I, Zahra V, Barbuto J, Farrell M, Yamaoka S, Pearson JT and Polglase GR (2017) Diffusion tensor imaging detects ventilation-induced brain injury in preterm lambs. *PLoS One* 12: e0188737.
6. Alahmari DM, Skiold B, Barton SK, Nitsos I, McDonald C, Miller SL, Zahra VA, Galinsky R, Wu Q, Farrell MJ, Moss TJ, Hooper SB, Pearson JT and Polglase GR (2017) Diffusion tensor imaging colour mapping threshold for identification of ventilation-induced brain injury after intrauterine inflammation in preterm lambs. *Front Pediatr* 5:70.
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18. Au CC, Furness JB and Brown KA (2017) Ghrelin and breast cancer: emerging roles in obesity, estrogen regulation, and cancer. *Front Oncol* 6:265.
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