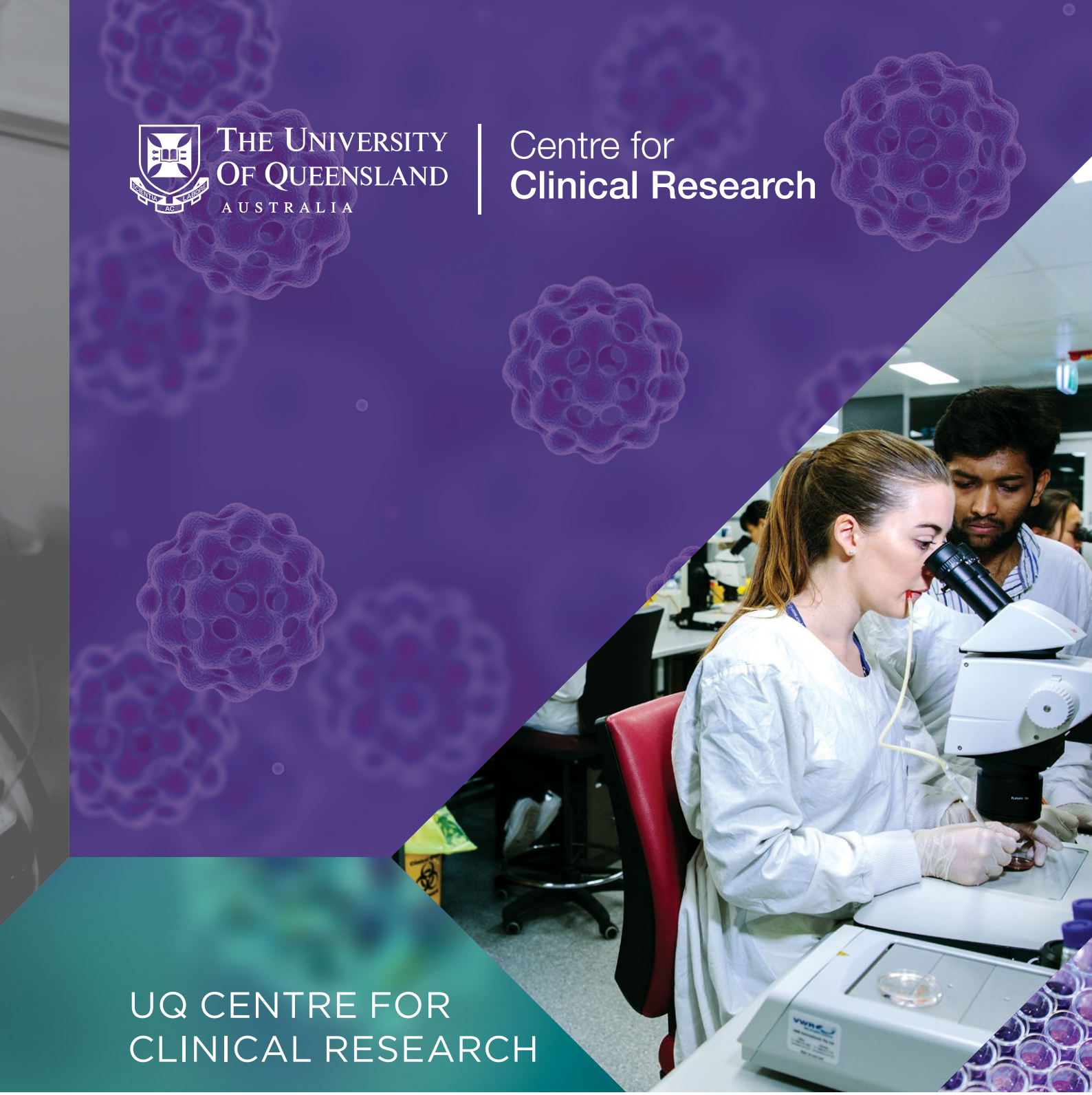
THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Centre for
Clinical Research



UQ CENTRE FOR
CLINICAL RESEARCH

# 10 Year Report

2008–2018

# Contents



# UQ Centre for Clinical Research

In 2008, The University of Queensland, in partnership with the Queensland Government and major US Philanthropic organisation Atlantic Philanthropies, developed the $70 million UQ Centre for Clinical Research (CCR) at the Royal Brisbane and Women's Hospital (RBWH).

Focused on improving people's lives through patient-orientated research, UQCCR offers state-of-the-art facilities and brings together leading health professionals, clinicians and scientists from around the globe.

The 'patient-orientated research' ensures that research is conducted in response to questions that arise at the bedside. This allows us to provide better treatment and results for patients, as well as adding to the body of knowledge about particular diseases or problems.

## THE CCR MISSION

To improve health through excellence in research, clinical partnerships, mentorship and service.

## THE CCR VISION

- Be a world leader in innovative and multidisciplinary collaborative clinical research.
- Provide excellent mentorship and training in research.
- Engage partners in the community, health sector and industry to develop and deliver effective healthcare interventions.
- Deliver health education and scientific awareness to the community.
- Shape health and funding policy through evidence informed advocacy.

$85M IN RESEARCH INCOME

100 HDR STUDENTS ASSOCIATED WITH UQCCR IN 2017

38 HIGHLY CITED PUBLICATIONS

MESSAGE FROM
THE DIRECTOR:

# Professor David Paterson

The University of Queensland has had a strong presence at the Herston campus for over 50 years. Specifically at Royal Brisbane and Women's Hospital (RBWH) there has been a presence of notable clinical researchers such as John Tyrer, Lawrie Powell and many others. Through the work of Lawrie Powell, and the administration of both RBWH and the University of Queensland, plans for a clinical research centre at the Herston campus were developed. The financial support of Atlantic Philanthropies (founded by Chuck Feeney) was instrumental in bringing these plans to fruition. In late 2017 the University of Queensland Centre for clinical research was opened by Sir Llew Edwards but it was not until 2008 that the first researchers entered the building.

Shortly thereafter, Judith Greer performed the first laboratory experiments at UQCCR and Frank Gardiner reviewed the first patients on level 3. Much has changed over the last decade at UQCCR, and I would like to take this opportunity to reflect on the past and look forward to the future.

UQCCR'S first director, **Professor Nicholas Fisk,** led the development of the initial research themes at UQCCR. These included molecular and cellular pathology, tissue inflammation and injury repair, clinical neuroscience and clinical outcomes/clinical trials. The stem cell biology work performed by Prof Fisk's group was world renowned and attracted a number of national and international researchers to UQCCR. Prof Fisk then went on to become Executive Dean of the faculty.

UQCCR's second Director, **Professor Murray Mitchell,** complete his service with UQ on 31 March, 2018. Under Prof Mitchell's directorship, four strong research themes were established, leading the way to an era of successful competitive funding for the centre. These themes were brain and mental health, mothers babies and lifelong health, infection and immunity, and cancer.

UQCCR's Acting Director, prior to my arrival, **Professor Gregory Rice,** established many of the quality systems that have served UQCCR researchers well. Notable amongst Prof Rice's achievements was the NATA accreditation for laboratories on level 7 of the UQCCR building. While Prof Rice continues as Honorary Professor at UQCCR, he is currently in Detroit working with the Perinatology Research Branch of the NICHD/NIH helping to develop their next NIH Intramural Research Program. I would like to thank Greg for his efforts in directing UQCCR through a period of change within the Faculty of Medicine.

Moving forward UQCCR has enormous opportunities to conduct clinical research relevant to patients at RBWH, throughout Queensland and Australia and indeed throughout the world. Researchers here have had an enviable record in obtaining NHMRC grant funding and already have started to receive funding through the newly established Medical Research Future Fund (MRFF) scheme. Industry relationships have been particularly strong and philanthropic support for UQCCR research is notable.

Above all, the greatest contribution of UQCCR so far has been in advancing care of patients so that their lives are longer or of greater quality. Early diagnosis and disease prevention have been prominent achievements in many fields. With the help of their mentors and UQCCR's professional staff, our many students have pushed the boundaries of research in their fields. I look forward to many future groundbreaking clinical research developments coming from them at UQCCR, as I am sure you are too.

**UQCCR DIRECTOR**
**PROFESSOR DAVID PATERSON**

CLOSE CLINICAL TIES WITH ROYAL BRISBANE AND WOMEN'S HOSPITAL

# Executive Director Dr Amanda Dines

Royal Brisbane and Women's Hospital has enjoyed a rich history with the University of Queensland, and more recently the University of Queensland Centre for Clinical Research. RBWH has been working with UQCCR, supporting and collaborating with stream researchers, for the past 10 years.

The past decade has strengthened RBWH's reputation as a research and education hub, and I am proud of the relationship we have built.

Examples of our successes include Professor Jeffrey Lipman and Professor Jason Roberts within the Infectious Diseases theme, and our world-leading RBWH neurologists who work very closely with the neuroscience researchers.

A number of RBWH researchers also work with the researchers from the pathology stream, with great results.

Professor Paul Colditz is the Director of the Perinatal Research Centre at RBWH/UQ Paul's research focuses on perinatal health problems and how it translates to clinical practice. He is a major player in the clinical care of babies in our Grantley Stable Neonatal Intensive Care Unit.

Successful research ultimately spells outcomes, and in healthcare that is so critically important.

RBWH looks forward to furthering our collaborative research efforts with UQCCR and I congratulate everyone on a very rewarding and productive 10 years.

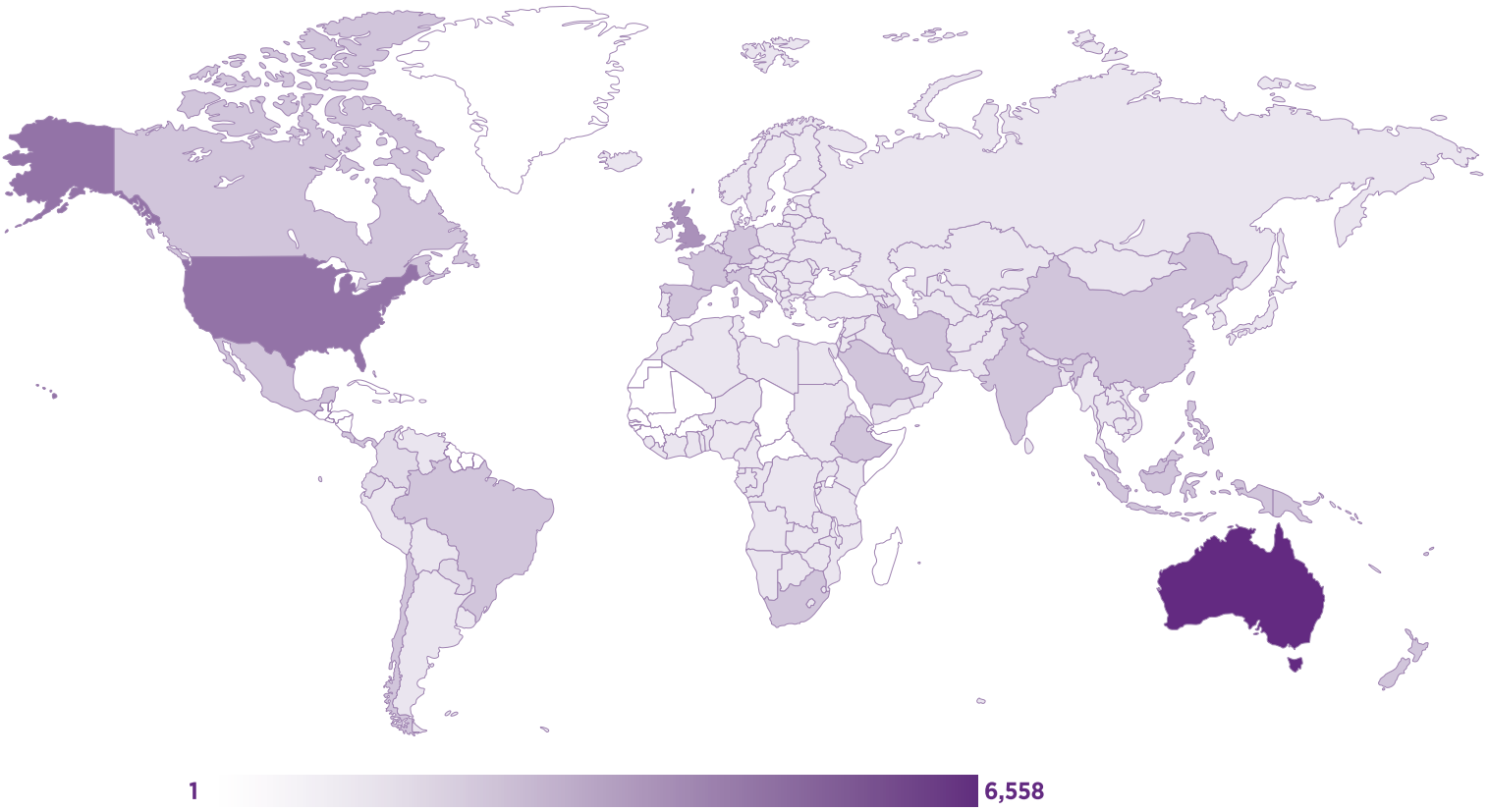
**RBWH EXECUTIVE DIRECTOR**
**DR AMANDA DINES**

WORLD

# Maps

## COLLABORATIVE PUBLICATIONS

Collaborations – The map depicts collaborations based on papers included in the UQ eSpace and Scopus for years 2008-2018 which are affiliated to UQCCR staff members and affiliations having a country code attached.



## HIGHER RESEARCH DEGREE STUDENTS BY COUNTRY

International distribution of Higher Research Degree (HDR) students with a Principal Supervisor as UQCCR staff member.

10 YEAR INSIGHT:

# Professor Paul Colditz

The multidisciplinary research team at the Perinatal Research Centre, directed by Professor Paul Colditz, is committed to improving health for mothers and babies through discovery and translation of research advances into clinical practice.

“Sick unborn and newborn babies have benefited from research advances in the past that have resulted in higher survival rates, but a new research frontier is rolling back the scourge of brain injury in the survivors,” Professor Colditz explains.

The Perinatal Research Centre have achieved much in our bench to bedside quest at UQCCR in the past 10 years.

“In a southern hemisphere first, we purchased a $1M MRI compatible incubator in 2008 to safely image preterm and term babies’ brains at RBWH,” Professor Colditz says.

“From this we have described several key aspects of brain development in the preterm baby and have become international leaders in the preterm brain and connectomics.

“We have recently added dense array source localised EEG to understand how the connectome of brain wiring supports development of normal brain wave activity.

“We now have a powerful tool to determine early whether new treatments to prevent brain injury are effective or not.”

In 2008 the Group first described neuroinflammation as a key mechanism of brain injury in the newborn and this has spawned many studies to improve outcomes through targeting deleterious aspects of brain inflammation.

Professor Colditz explains their most recent NHMRC project explores the use of stem cells to modulate inflammation and improve brain outcomes.

“Seizures can cause brain injury and current treatments are relatively ineffective,” says Professor Colditz. “We have brought sophisticated EEG analysis to the difficult task of detecting seizures in babies.

“In our current NHMRC project we are testing a novel seizure treatment.

Over the last 10 years the Perinatal Research Centre have been awarded over $30 million research funding in 29 NHMRC grants and 5 international competitive grants. They have published more than 100 peer reviewed journal articles from basic neuroscience to the results of randomised controlled trials that define standard practice.

“These research advances are based on an excellent research team and a modern supportive environment that UQCCR provides,” says Professor Colditz.

10 YEAR INSIGHT:

# Professor Sunil Lakhani

The development of UQCCR on the Royal Brisbane and Women's Hospital (RBWH) Campus, and the subsequent addition of the Herston Imaging Research Facility (HIRF), immediately adjacent to Pathology has been a massive boost to the Molecular Breast Pathology Lakhani Group and research on the campus.

"As a clinical and molecular pathology team working on breast cancer, the interactions between UQCCR, QIMR Berghofer Medical Research Institute, Pathology Queensland and the clinical units in the hospital has been fundamental to our success," Professor Lakhani explains.

"We have established a translational research program that has made an impact in classification of preinvasive disease and hence the reporting and management of early proliferative changes seen in women undergoing breast screening.

"Our program of work on the morphology and genomic analysis of familial and triple negative breast cancer has contributed to the understanding of the extraordinary inter and intra patient heterogeneity - and hence appreciating that every cancer is unique.

"The link with international collaborators, in particular the Sanger Institute, as part of the International Cancer Genome Consortium (ICGC), has been important in our success," Professor Lakhani says.

More recently, the Molecular Breast Pathology Lakhani Group have established some of the mechanisms that lead to the development of brain metastases in patients with high grade breast cancer and are developing new tools based on a 'theranostic' approach (combining diagnostic imaging and therapy) to manage this complication.

"All of our work has been underpinned by a high-quality biobank established with the Breast and Neurosurgical Unit at the RBWH," Professor Lakhani says.

"Our long-term plan is to establish a centre for metastatic disease that is driven by a multidisciplinary ethos – with teams including pathology, oncology, nanomedine & bioengineering, imaging and public health."

10 YEAR INSIGHT:

# Neuroimmunology at UQCCR

The Neuroimmunology group (with Professor Pam McCombe and Associate Professor Judith Greer as Group Leaders) were the first group to move into UQCCR — it was only a short move, from the old rat-infested Clinical Sciences Building (where we were the last group left), which was then immediately gutted and re-vamped into the Health Sciences Building..... Maybe we should take up the motto of the Royal Engineers, "First in, last out" (although hopefully UQCCR will go on long after we are gone!)

During the time we've been at UQCCR, there have been many changes in directors and support staff, but there's also been growth in our research as a result of interactions with others in UQCCR. The main themes of our work when we came to UQCCR were in autoimmune reactivity in multiple sclerosis (MS) and stroke, but the proximity of other researchers working on various topics within the Clinical Neuroscience space has seen us develop collaborations and expand to the areas of glial cell biology, motor neuron disease and psychosis. The opening of the Herston Imaging Research Facility right next door to UQCCR has also enabled new research collaborations and opportunities for us.

One of the main sources of new collaborations has been via UQCCR's Level 3 interaction area. The Neuroimmunology group has hosted several lunches, morning teas and fundraising events over the years, and discussions at these events have led to several productive collaborations with others in the building. It's amazing what benefits a few comfy chairs and some tasty food can have! The four UQCCR retreats held in the early days of the Centre were also a fun way to get to know other UQCCR staff and learn about their work.

Being in a nice new facility has been motivating in many ways, and has encouraged us to think and act more globally. In 2010, Professor McCombe and Associate Professor Greer initiated a new national society, Neuroimmunology Australia. The first 4 annual meetings of Neuroimmunology Australia were hosted at UQCCR, and the society has now expanded nationwide, and was also selected to host the 14th International Congress of Neuroimmunology at the end of August 2018 (the first time this congress has ever been held in the Southern Hemisphere!), with Associate Professor Greer as the convenor for the Congress. Professor McCombe has also recently been elected as the incoming President for the Australian and New Zealand Association of Neurologists (ANZAN).

The past 10 years have been a fairly productive times for our group, with 15 Higher Degree by Research students (12 PhDs and 1 MPhil awarded so far), numerous Honour's students and visiting researchers, 3 marriages and 8 babies. Our research during this time has been funded through over 50 grants, including 6 from NHMRC and 1 from ARC. Highlights have included several high impact publications as part of international MS consortia, a publication from the Greer group being named as one of the top 5 publications on MS by the National MS Society in the USA, invitations to take tea at Government House for our MS team, and (most importantly) having such a cheerful and helpful group of colleagues and students working with us over the last 10 years.



***Opposite page – bottom image:***
*Making friends at the first UQCCR retreat on Stradbroke Island (2009): L-R (standing) Nancy Moxey, Hayley Inglis, Amanda Jones, Zoe Ackerman, Vicki Allen, Leif Sauer and Pam McCombe. (Kneeling): Shannon Beasley*

***This page – top image:***
*Jumping for joy at working at UQCCR: Neuroimmunology group members Aakanksha Dixit, Shannon Beasley, Hayley Inglis, Jun Yan and Peter Csurhes.*

***Middle image:***
*Another "Kiss goodbye to MS" fundraiser, held in the UQCCR auditorium. L to R Leif Sauer, Kaye Hooper, Judith Greer, Nancy Moxey, Peter Csurhes and Hayley Inglis.*

***Bottom image:***
*Neuroimmunology group graduates, Amanda Jones, Diane Muller and Fusun Baumann (2012)*

NEWS

# Highlights

## 2008

In February 2008 the $66M facility designed to bridge the increasing gap in translational medicine between clinical service and basic research was opened. This unique Australian facility was established to house clinicians and clinical scientists, basic scientists applying molecular techniques to clinical problems, and clinical trial coordinators and participants.

Professor Frank Gardiner secured a $1.25M grant from the Cancer Council Queensland, to conduct the world's first randomised controlled trial into the new procedure of robotic laparoscopic surgery for radical prostatectomy.

## 2009

Professor David Paterson and Dr Peter Simpson were successful in securing $2.725m in highly competitive fellowships. Professor Paterson received a Queensland Senior Clinical Research Fellowship to stem the invasion of organisms, which are resistant to all antibiotics and current treatments. Dr Peter Simpson received a National Breast Cancer Foundation Fellowship.

## 2010

A new $1 million MRI compatible incubator designed for babies was purchased in 2010 which allowed researchers to develop earlier and more effective treatments for newborns with brain impairment. The MRI Neonatal Incubator was located at the Royal Brisbane & Women's Hospital and the Royal Children's Hospital. The incubator slides into a standard MRI unit and enables babies to lie undisturbed in a safe and warm environment while a non-invasive image of the brain is recorded. The new equipment would be used by doctors for early diagnosis of impairment and enable research into prevention, as well as earlier and improved rehabilitation treatments. Professor Paul Colditz's group was the first in Australia able to conduct imaging of preterm babies. This opportunity has the potential to break down the current boundaries of brain impairment treatment and produce huge gains for babies and their families.

## 2011

Associate Professor Kiarash Khosrotehrani's breakthrough research on regenerating skin wounds won him national recognition. In November 2011, he received an NHMRC Achievement Award. The wound-healing process is both complex and delicate. Diabetes, old age, infection and other diseases can obstruct the healing process – leaving many individuals and health care professionals burdened with the management of chronic wounds. Associate Professor Khosrotehrani's research discovered that cells from a fetus form new blood vessels in the mother after pregnancy. This discovery could be the key to successful healing of chronic wounds in the future. Although skin stem cells have been used routinely for the treatment of wounds, they cannot reconstitute a fully functional skin given the complexity and the many cell types usually involved in wound healing. The aim is to facilitate the healing of chronic wounds by isolating different populations of stem cells from the placenta – a tissue that is currently discarded after each pregnancy. Placental stem cell populations can be used to formulate new blood vessels, which are essential for quick and effective tissue repair and often absent in chronic wounds.

## 2012

A Queensland Node of the Therapeutic Innovation Australia (TIA – QLD Node) was established to aid researchers to translate their discoveries into commercial products faster. UQCCR is one of five leading Translational Research Centre's based in South East Queensland who are members of the TIA – QLD Node. This state-based model of the future national TIA entity will provide a testing model to accelerate the movement of inventions by Australian researchers from the laboratory, through preclinical trials, clinical development and produce 'reduced risked technologies' that will be highly attractive for investors to commercialise into therapeutic products.

Sufferers of Parkinson's disease and other serious brain disorders were given new hope in 2012 with the opening of a multi-million dollar Asia-Pacific Centre for Neuromodulation (APCN) – a joint initiative of UQ and St Andrew's War Memorial Hospital – with funding commitments of approximately $10m over five years. The Centre builds on two decades of groundbreaking clinical research in the application of Deep Brain Stimulation (DBS) and is poised to become a world leader in research to revolutionise the diagnosis and treatment of neurological disease.

## 2013

The Centre for Clinical Diagnostics (CCD) received formal accreditation from the National Association of Testing Authorities (NATA) in 2013. The outcome was a culmination of two years' work by a dedicated team at UQCCR and entered CCD onto a very short list of accredited research facilities in Australia. The CCD is the only 100 percent pure research facility accredited in Australia, and gives researchers the assurance that their technical processes meet world recognised standards.

Professor Peter Silburn was appointed a Member of the Order of Australia (AM) in the 2013 Australia Day Honours. The world-leading neurologist was honoured for his substantial service to medicine, particularly in the treatment of neurodegenerative disease.

## 2014

In 2014, then PhD student, Dr Hosam Zowawi was one of five Young Laureates from around the globe to receive the prestigious Rolex Award for Enterprise. Under the guidance of international infectious diseases expert Professor David Paterson, Mr Zowawi created a diagnostic tool that could rapidly identify superbugs. His fast diagnostic tool called 'Rapid Superbug' can detect resistant bacteria within three to four hours, rather than 48-72 hours like current diagnostic tests. The Rolex Laureate Award for Enterprise recipients are recognised for pioneering work in areas of science and health, applied technology, exploration and discovery, environment, and cultural heritage. Mr Zowawi underwent a stringent selection process to receive the award, with an international jury of independent experts; including prominent scientists, environmentalists and entrepreneurs; selecting him from a pool of more than 1,800 applicants from around the world. TIME magazine also identified Mr Zowawi as one of the world's Next Generation Leaders. He was also been named a Queensland Science and Innovation Champion for his work around developing 'Rapid Superbug'.

## 2015

For the last forty years, the Australasian Division of the International Academy of Pathology has organised annual scientific meetings for trainee and consultant pathologists, researchers and scientists. The 2015 Annual Meeting, held in Brisbane, assembled pathology leaders from around the world to share their knowledge and expertise, and to highlight the latest advances in this challenging field. The jewel in the crown of the meeting was the award of the highest honour in surgical pathology in Australasia, the 'Distinguished Pathologist' medal. Professor Sunil Lakhani received this medal for his outstanding contribution to diagnostic and academic pathology. Professor Lakhani trained in Medicine, Pathology and Molecular Pathology in London, UK and was Professor of Pathology at The Institute of Cancer Research and The Royal Marsden Hospital, London, UK prior to his move to Brisbane in October 2004. He is currently the Head of the Discipline of Molecular and Cellular Pathology in the School of Medicine, University of Queensland, Head of the Breast Group at The UQ Centre for Clinical Research and Queensland State Director for Anatomical Pathology, Pathology Queensland.

## 2016

Associate Professor James Scott was recognised for his work in improving the mental health of Australian youth in the Promoting Healthy Minds and Bodies category at the Metro North Research Excellence Awards. Mental Illness is the leading cause of morbidity in Australian youth. Rates of youth mental illness remain stubbornly high and the outcomes for young Australians with severe disorders such as schizophrenia are not good. Associate Professor Scott's research aims to prevent the onset of mental disorders, identify the underlying causes of schizophrenia and conduct clinical trials of low risk interventions for young people with early psychosis. His clinical trial investigating schizophrenia has potential to make meaningful improvements to the lives of those living with the condition. His work has been nationally and international recognised as having the potential to improve the mental health of young people across the world.

## 2017

UQCCR researchers Associate Professor John O'Sullivan and Dr Richard Gordon were awarded a $1.5 million grant for their research into drug repurposing. The Queensland Drug Repurposing Initiative (QDRI) would establish a platform to fast-track multiple new treatments for Parkinson's disease using an innovative approach to repurpose drugs already being used to treat other conditions.

Professor David Paterson received the Practitioner Fellowship award, given to the highest ranked applicant in the NHMRC scheme.

His research focuses on the molecular and clinical epidemiology of infections with antibiotic resistant organisms.

BENCH TO BEDSIDE:

# Aussie invention with 'bite'

It seems particularly fitting that an Australian research centre would come up with a potentially life-saving use for the venom of one of Australia's most deadly inhabitants.

Melbourne-based biotech company Q-Sera uses the blood clotting properties of proteins derived from Coastal Taipan snake venom to develop blood collection tubes that rapidly produce high quality serum.

The concept grew out of the venom research program at UQCCR funded by NHMRC and ACR grants in the early 2000s, and led by Emeritus Professor Martin Lavin.

"We were investigating the venom of various Australian snakes to identify and analyse the proteins found in it," Dr Lavin recalls.

"Our original intention was to come up with therapeutic uses for specific proteins.

"We thought the blood clotting properties of these proteins could help people who had suffered heart attacks or those with insufficient clotting factors in their blood.

"But after discussing possible applications with industry experts and partners, the team came up with the idea of putting the protein into a blood collection tube.

"The reasoning was that under some circumstances the quality of serum produced in these tubes, which is then used for biochemical analysis of the blood, isn't good.

"If patients are taking anti-coagulants or blood thinners, current activators can be unable to make the blood in these samples clot.

"By replacing the activators with venom-derived proteins, even blood from patients taking these medications was able to be clotted successfully."

Dr Lavin says the team selected three of the most venomous snakes in the world as possible commercial sources of these blood clotting proteins.

"The Coastal Taipan, Inland Taipan and Eastern Brown Snake are all closely related, but we chose the Coastal Taipan because it produced a larger volume of venom."

At first, the proteins were sourced directly from venom harvested at a special facility in South Australia. But concerns over supply chain volumes and reliability led the team to synthesise a simpler recombinant form of the protein, dubbed RAPClot, to overcome these issues.

Dr Lavin says the team are currently working to optimise the use of RAPClot while Q-Sera engages with multinational tube manufacturing companies to bring this innovative technology to the multi-billion unit blood collection tube market

"Our goal was to develop a product that could potentially be put into every blood collection tube in the world – a product that would stand up to key requirements like stability, sterility, and volume of production," says Dr Lavin.

"We have now achieved this and are looking forward to the commercial chapter of our research."

As of 2018, Q-Sera has been granted patents in China, the EU, Japan and Australia, laying the foundations for an international commercial roll out of this unique product.

BENCH TO BEDSIDE:

# Translational Neuroscience and Drug Repurposing

The focus of the Gordon Research Group is the discovery and validation of new treatments and biomarkers for debilitating neurodegenerative disorders such as Parkinson's disease (PD).

"There are over 30 new cases of Parkinson's disease diagnosed every day in Australia," Dr Richard Gordon says. "However, there are currently no effective treatments that can slow the progression of the disease or biomarkers that can accurately diagnose disease onset.

"Due to a rapidly ageing population, the prevalence of Parkinson's is predicted to increase significantly over the coming decades. Therefore there is an urgent need to develop effective treatments and diagnostic methods."

As a translational neuroscience research group their aim is to translate ideas and discoveries from the lab into treatments that have the potential to halt or slow disease progression and to enable more effective clinical diagnosis of Parkinson's and related disorders.

"We utilise a multidisciplinary approach, which includes discovering new biomarkers and targets for diagnosis and treatment, as well as the repurposing of drugs approved to treat other diseases," Dr Gordon explains.

With Queensland Government funding Richard has recently established the Queensland Drug Repurposing Initiative (QDRI), a clinical trials platform to fast-track new treatments for Parkinson's disease using an innovative drug repurposing approach.

"In collaboration with industry partners, we also apply cutting edge technologies such as artificial intelligence and machine learning to discover new drugs, drug target and therapeutic approaches.

"It is our hope that this research will lead to more effective treatments and clinical biomarkers for Parkinson's and other related diseases in the future."

Richard's research projects have been funded by the Michael J Fox Foundation, Shake It Up Australia, Wesley Medical Research (WMR) and the Queensland Government's Advance Queensland program.

BENCH TO BEDSIDE:

# Understanding the causes of familial breast cancer with genome sequencing

It has been known for many years that an inherited mutation (error) in the breast cancer genes BRCA1 or BRCA2 can cause familial breast cancer.

However, Dr Peter Simpson explains that there are other genes which, when faulty, can also cause the disease to be inherited, but in many of cases the cause of the inherited disease is unknown.

Researchers at UQCCR and at the QIMR Berghofer Institute for Medical Research have been investigating the causes of familial breast cancer.

The teams have studied 80 cases of familial breast cancer tissue that were donated to The Kathleen Cuningham Foundation Consortium for research into Familial Breast cancer (kConFab), the Australian Breast Cancer Tissue Bank (ABCTB) and the Brisbane Breast Bank (BBB, based within UQCCR).

"We studied the samples using a method known as whole genome sequencing," Dr Simpson explains. "This method enables scientists to read all the letters in the DNA sequence from an individual, just like reading a book.

"When studying a cancer tissue sample one can read the sequence of letters and identify all the errors (mutations) in the sequence that have accumulated as the cancer tissue has grown – cancer tissues can have 10s to 1000s of errors in their DNA sequence.

"A careful investigation of these errors begins to tell us a story of the history of the cancer – what factors have gone wrong in order for it to grow.

"This information is useful in the clinic because it may provide a clue as to how to best treat the patient.

"In the context of familial breast cancer, it can also tell us about the possible causes of the disease. Information which is important to help families minimise their risk of developing the disease."

**This type of research is only made possible through the generosity of breast cancer patients who donate their tissue for research purposes and through the dedication of biobanks who are able to collect and store the samples for projects that may arise in the future.**

BENCH TO BEDSIDE:

# Microbial diagnostics and Characterisation Group

In collaboration with Pathology Queensland, commercial and other partners, Associate Professor David Whiley is developing novel molecular assays to detect antibiotic resistance.

“The methods are being developed for use within clinical laboratories as well as at the point of patient care (eg. in clinics) to ensure that patients receive both the right diagnosis and the right treatment,” says Associate Professor Whiley.

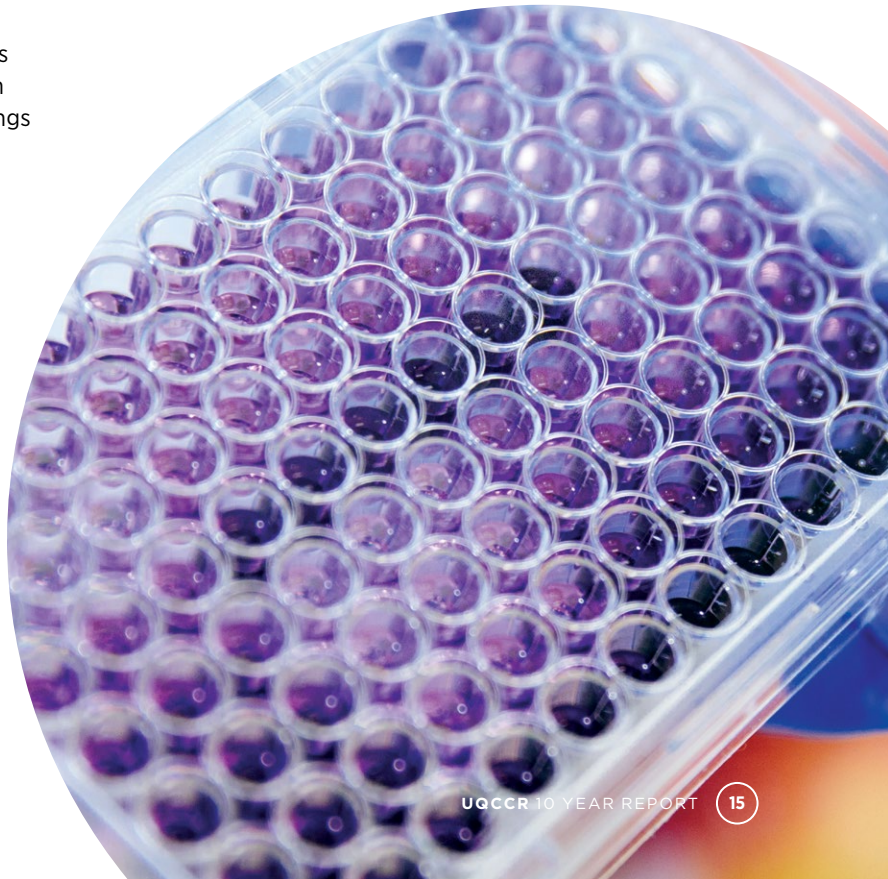
“In conducting this work, we are ensuring we focus on real-world diagnostic solutions i.e. the development of assays that are simple and cheap and can be readily implemented into routine use to make real differences to patient care.”

For example, in recent years Associate Whiley has been leading the NHMRC-funded Gonorrhoea Resistance Assessment via Nucleic Acid Detection (GRAND) studies, which are large national multi-centre collaborations.

“The first phase of this work has led to the development and implementation of novel assays that in a world-first are now being used to inform gonorrhoea treatment guidelines in remote settings of Australia.

“In the second phase of this work, we have commenced a clinical study whereby we are now using these molecular assays to detect antibiotic susceptibility at the individual patient level so as to optimise antibiotic treatment of patients infected with gonorrhoea.”

The model which was successfully utilised for gonorrhoea is now being applied to a broad range of other antibiotic-resistant pathogens, including Mycobacterium species affecting children with cystic fibrosis (funded by the Sasakawa Memorial Fund of the Children’s Hospital Foundation), carbapenemase-producing organisms, and other sexually transmissible infections such as Mycoplasma genitalium that are very quickly becoming untreatable.



STUDENT STORIES

# From communications systems to baby brainwaves

The world of research captured Dr John O'Toole's focus right at the last minute. In fact, it was the only part of his undergraduate electric engineering degree at the University College of Dublin (UCD) that he actually liked. But after four years working in microwave engineering research and completing his research masters, the real-world applications of his research began to change John's focus.

"While microwave engineering is very challenging and technically interesting, I found the applications of the technology, which tend to focus on military or commercial communication systems, less interesting," Dr O'Toole recalls. "For me, the application of the work is an important component of the job."

Dr O'Toole's desire for change ballooned from wanting to change fields, to putting his PhD on hold and setting off on a year-long round-the-world-trip. He only made it half-way through that plan before a stint as an engineer in Maleny extended his time in Australia and set him on the path to undertaking a PhD in the field of biomedical engineering at UQ.

"I had a few friends working in biomedical research at UCD and I thought their work looked far more interesting than what I was doing in microwave engineering. The methods they used were new, cutting edge, but more importantly I was intrigued by the fact that this work had the real potential to make a positive impact on people's lives."

In the second year of his PhD Dr O'Toole became part of the team at Professor Colditz's Perinatal Research Centre in the newly built UQCCR building. His PhD focused on developing new methods and theory around automated detection of seizures in newborns by measuring the baby's brainwaves through an electroencephalogram (EEG).

"For newborns with brain injuries, seizures are common and require prompt treatment. But identification of the seizures is difficult, as only about one third of newborns will show physical symptoms of seizure.

"The best way to detect these seizures is to use an EEG, but often there is lack of expertise to interpret this data. Developing a computer algorithm to automatically detect the seizures could help to ensure the right infants get the right treatment when needed."

Now a senior researcher based in southwest Ireland at the Irish Centre for Fetal and Neonatal Translational Research (INFANT), Cork University Hospital, John is continuing to develop computer-based methods for brain monitoring for preterm infants.

"It's difficult to imagine a more perfect place than UQCCR to complete my PhD for my current role. The training, support, and guidance from both Professor Colditz and Professor Boashash throughout my PhD was absolutely instrumental in gaining the skills that I now use every day at INFANT.

"Back then I didn't have the background or skills for this new area, so I was (and still am) really grateful to both Professors Boashash and Colditz for having some faith that I could transition into the field of biomedical engineering."

STUDENT STORIES

# Tackling superbugs through rapid diagnostics

As a clinical microbiologist, Dr Hosam Zowawi recognised the urgent need to revolutionise the fight on superbugs by developing rapid diagnostic tools to aid direct implementation of targeted medical managements and to monitor antimicrobial resistance (AMR).

"My research is harnessing the existing innovation in biotechnology and engineering to tailor affordable molecular, proteomic and genomic tests that can rapidly diagnose AMR and at a point-of-care and low-resourced settings" Dr Zowawi says.

"My vision is to make these tests widely accessible, affordable and on a platform to share results. My mission is to advance local capacities in routine clinical diagnoses," Dr Zowawi explains. "I am envisioning these tests will empower critical care intensivists, public health as well as field personnel in rural areas by helping to expedite diagnoses of infections and contain outbreaks."

Dr Zowawi arrived at UQCCR as a PhD student under Professor David Paterson and now he heads up his own research group.

"UQCCR is a well-equipped centre and offers a multidisciplinary environment and opportunity to collaborate with experts in the infectious diseases field," Dr Zowawi explains. "I have access to renowned investigators for mentorship and guidance such as Professor David Paterson, Professor Jason Roberts, Professor Jeffery Lipman, and Associate Professor David Whiely."

"I am so grateful for the endless support that I have received from my supervisor and mentors not only for my research, but also for extracurricular activities."

Dr Zowawi established a solid foundation in community engagement and health advocacy about AMR, which resulted in the publicity in major international press including TIME Magazine, National Geographic, The Guardian and local Australian media.

"I was empowered to become an emerging leader in my field in a short period of time," Dr Zowawi says.

"My mentor at UQCCR and the broader UQ community have provided the needed support to embrace my scientific and leadership capacity, which have resulted in attracting esteeming national and international awards, recognitions, competitive, industry and philanthropic funding. This includes the esteeming Rolex Awards for Enterprise, Marchant Foundation Research Fellowship, research funding from SpeeDx LTD and many others."

"UQCCR is a well-equipped centre and offers a multidisciplinary environment and opportunity to collaborate with experts in the infectious diseases field," Dr Zowawi explains

DATA

# Top 50 publications

Kote-Jarai, Z., **Gardiner, R. A.,** et al. (2011). Seven prostate cancer susceptibility loci identified by a multi-stage genome-wide association study. *Nat Genet, 43*(8), 785-791. doi:10.1038/ng.882

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# NHMRC Centres of Research Excellence

| Dates | Title | Researchers |
|---|---|---|
| 2009-2015 | CCRE in Aphasia Rehabilitation | Worall, Linda E; Togher, L.; Ferguson, A.; **Copland, David A;** Nickels, L. & Douglas, J. |
| 2016-2021 | Australian Cerebral Palsy Clinical Trials Network (AusCP-CTN): optimising interventions and effective services for children with cerebral palsy | Boyd, Roslyn N; Novak, I.; Wallace, E.; Badawi, N.; Fahey, M.; **Rose, S.; Colditz, Paul B;** Ziviani, Jenny M & others |
| 2015-2020 | Centre for REdefining antibiotic use to reDUce resistanCE and prolong the lives of antibiotics (REDUCE) | **Roberts, Jason A; Lipman, Jeffrey;** Peake, S.; Turnidge, J.; Slavin, M.; Hopkins, Peter M A; Bulitta, J.; Paul, Sanjoy K & others |
| 2014-2019 | Centre for Research Excellence in Advanced Cardio-respiratory Therapies Improving OrgaN Support (ACTIONS) | Fraser, John; McGIffin, David; Lovell, Nigel; Bannon, Paul; Tansley, Geoff; Pellegrino, Vincent; **Roberts, Jason;** Barnett, Adrian; Gregory, Shaun |
| 2012-2018 | Centre for Research Excellence in Evidence-based Mental Health Planning: Translating Evidence into Policy and Services | *Whiteford, Harvey; Degenhardt, L.; Pirkis, J.; Mihalopoulos, C.; Eagar, K.; Andrews, G.; HEAD, Brian W; Gunn, J.; **HALL, Wayne;** Patton, G. |
| 2011-2016 | Centre for Research Excellence in Reducing Healthcare Associated Infection | Graves, N.; **Paterson, D.** |
| 2016-2020 | NHMRC CRE: Centre for Research Excellence in Prostate Cancer Survivorship | Chambers, S.K.; Newton, R.; Scuffham, P.; Baade, P.; Galvão, D.; Dunn, J.; Smith, D.; Wittert. G.; Davis, I.; **Gardiner, R.A.** |

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