The University Of Queensland
AUSTRALIA

Queensland Brain Institute

2023/2024 RESEARCH IMPACT

A shared vision to improve brain health

Professor Thomas Burne and Ben Carman

"Your support has been a catalyst for a major milestone in my career, and the knowledge and experience I have gained are invaluable."

A Letter to my Donors

Dear Donors,

I am writing to express my deepest gratitude for your generous support through the QBI Summer Research Scholarship. This opportunity has been instrumental in my academic and professional development. I am thrilled to share that it has culminated in an offer to join the Cognitive Neuroscience lab as a research assistant, which I have accepted with great enthusiasm.

This summer, I engaged in a compelling research project that explored the predictive role of neural oscillations in perception. Our results were promising, and the project's success has led to my continued involvement as a research assistant. The implications of this research are profound, because this method of analysing neural oscillations is ground-breaking. We anticipate this approach will validate our current hypotheses and pave the way for research avenues previously unattainable.

I am incredibly grateful for the trust you placed in me by funding this scholarship.

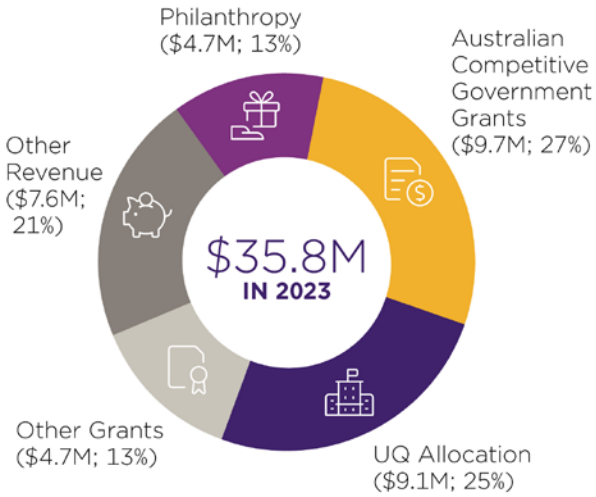
Thank you once again for your kindness and for fostering an environment where young researchers like myself can thrive and contribute to advancing neuroscience.

Warm regards,

Ben

Funding Snapshot

Philanthropy plays a key role in progressing research. Thirteen per cent of the research at QBI is funded through the support we receive from our community.



31
lab groups

250+
researchers

110+
HDR students

"There's so much about the brain we don't know, and we hope our involvement with QBI increases our understanding of what really is the most complex organ in the universe."

— Garry and Gaye Waugh,
QBI Supporters

A Message from Jeff Maclean, Chairman, QBI Advisory Board and Donor

My father, Ross Maclean, passed away with Motor Neurone Disease (MND) in 2005 so I have experienced the impact of this devastating and cruel disease firsthand and seen how it takes away a person's independence—quietly and relentlessly.

Even though Ross knew the research wouldn't benefit him, it was a priority for him to support it at QBI so that steps could be made for a future without MND. Our family (pictured) has partnered with QBI for many years to continue Dad's legacy but we also understand the importance of philanthropy in creating a sustainable platform which is vital for ensuring QBI's continued scientific success.

Ross has a special place in the hearts of an enormous number of people and I know that I share this journey with many who have lost or cared for loved ones with a neurological disease. You may not be aware but many researchers spend approximately 30% of their time writing government grants in the hope of being awarded research funding. Your donations help break this cycle and allow scientists to focus on solving the big global health challenges of today.

I encourage every one of you to continue to bring out the best of what my father always saw in humanity by supporting this worthwhile cause.

With my very best wishes,

Donors provide support for early detection test for autism

Ben and Werona Armstrong

QBI supporter, Ben Armstrong, intimately grasps the significance of medical research in advancing treatments for individuals living with disabilities.

Born deaf—which was undiagnosed until he was three years old—Ben experienced firsthand the consequences of late detection, including delayed speech development that necessitated years of therapy to overcome.

When his eldest son was born, medical advancements meant he received a day-one hearing test, confirming his hearing was fine. To Ben, the test highlighted how research had advanced healthcare since he was born.

Later, the diagnosis of autism in their son solidified Ben and his wife Werona's conviction in the critical importance of early diagnosis, empowered by medical research.

Dr Nathalie Dehorter's work has identified a molecule crucial in autism development. By studying its mechanisms in animal and human-derived stem cells, we are deepening our understanding of the disorder's physiology and the possibility of the early detection at birth or even *in utero*.

Throughout 2023/2024, QBI researchers have continued to make significant headway in discovering new treatments for neurological disorders and diseases.

Dementia

Therapeutic Ultrasound for Dementia

The clinical safety trial 'Neuromodulation using scanning ultrasound in Alzheimer's disease', which commenced in 2022, is approaching completion and is the culmination of a decade of ongoing research led by Professor Jürgen Götz, following discoveries about its potential use to improve memory function.

In August 2023, the Queensland Government committed funding of $5 million over three years to expand the rollout of clinical trials into regional Australia, that will support further evaluation of ultrasound in non-urban settings. Link to media release: https://statements.qld.gov.au/statements/98479.

Ultrasound therapy shows promise as a treatment for Alzheimer's disease

Dr Gerhard Leinenga (pictured above, left) and Professor Jürgen Götz (pictured above, right) found that targeting amyloid plaque in the brain is not essential for ultrasound to deliver cognitive improvement in neurodegenerative disorders, with ultrasound on its own inducing long-lasting cognitive changes in the brain. These changes correlate with memory improvement, increased plasticity, improved brain networks and resilience of the brain to toxic plaques which form in Alzheimer's disease.

Cell protein discovery points to healthier ageing

Associate Professor Steven Zuryn and Dr Michael Dai discovered that a protein called ATSF-1 controls a fine balance between the creation of new mitochondria and the repair of damaged mitochondria. Mitochondria produce energy within cells, but their toxic by-products contribute to cellular ageing and are involved in neurodegenerative diseases. This research aims to develop treatments that protect neurons against neurodegeneration and combat dementia.

Platelets can replicate the benefits of exercise in the brain

Dr Odette Leiter and Dr Tara Walker discovered platelets, the tiny blood cells critical for blood clotting, secrete a protein that rejuvenates neurons in aged animal models in a similar way to physical exercise, which results in regenerative and cognitive improvements. This research will lead to development of drug interventions as an alternative to physical exercise which will help those living with health conditions, mobility issues or advanced age.

Tau-ting the importance of protein mapping

Dr Ramón Martínez-Mármol and PhD student Shanley Longfield used super-resolution microscopy to visualise individual tau proteins in motion while neurons are "talking" to each other. Understanding the mechanism by which tau acts in healthy nerve cells helps identify the molecular behaviours that precede the formation of toxic tau protein aggregates in Alzheimer's disease.

Fatty acids hold clue to creating memories

Dr Isaac Akefe and Professor Frederic Meunier identified alterations in the brain's fatty acid landscape when the neurons encode a memory. Identifying these critical markers of cognitive fitness and cognitive decline will enable early treatment of declining cognition in ageing and neurodegenerative diseases.

COVID-19 can cause brain cells to 'fuse'

Dr Ramón Martínez-Mármol and Professor Massimo Hilliard discovered that viruses such as SARS-CoV-2 (that leads to COVID-19) can infect and irreversibly fuse neurons in the brain, altering their functionality. This discovery identifies the causes behind the long-term consequences of viral brain infections, such as long COVID, contributing to the development of efficient treatments for this condition.

QBI Brain Research Endowment Fund

The QBI Brain Research Endowment Fund delivers a reliable, perpetual income stream to support ongoing research. One of the initiatives supported by the Fund is the University of Zurich (UZH)/UQ Neuroscience Strategic Partnership Scheme, which enables QBI scientists to collaborate with other world-class researchers leveraging multi-disciplinary approaches to solve complex neurological problems and secure international funding. In 2023, three unique projects were selected that highlight the diversity of our research.

Novel circRNAs in neural plasticity, learning, and memory, Professor Timothy Bredy (QBI) and Professor Gerhard Schratt (UZH).

Characterising neural and cognitive mechanisms of risk perception and risky choice in humans, Professor Jason Mattingley (pictured, QBI) and Professor Christian Ruff (UZH).

Extracellular vesicle-mediated delivery of platelet-derived factors to ameliorate the progression of Alzheimer's disease, Dr Tara Walker (QBI) and Professor Christian Tackenberg (UZH).

Mental Health

Half the population to have a mental health disorder by 75

A global study co-led by researchers Professor John McGrath (pictured) from QBI and Professor Ronald Kessler from Harvard Medical School, has found one in two people will develop a mental health disorder in their lifetime. Data analysed from more than 150,000 adults across 29 countries between 2001 and 2022 demonstrated the high prevalence of mental health disorders, with 50 per cent of the population developing at least one disorder by the age of 75.

Novel treatment for depression

A novel immunomodulatory treatment for depression was discovered and a companion biomarker panel was validated by Associate Professor Susannah Tye. This discovery brings us one step closer to personalised therapeutic interventions for psychiatry which could revolutionise the treatment landscape for depression by enabling targeted, individual interventions to improve brain health, reduce healthcare burden, and enhance patient well-being and quality of life.

Dr James Kesby has shown that the neurobiology that underlies psychosis in schizophrenia also impacts cognition. They aim to include prognostic tests in routine clinical care to identify patients early in disease progression enabling development of better treatments.

Does schizophrenia shift the gut-brain axis?

Svetlina Vasileva, a PhD student in the Eyles laboratory, led a study looking at gut microbiome and schizophrenia. She found there are differences in the gut microbiome of people with schizophrenia and control individuals. There was also a strong difference between people with schizophrenia who are treatment resistant who are taking clozapine and those who are responding well to other antipsychotic medications.

Motor Neurone Disease (MND)

Mapping potential pathways to MND treatment

Dr Rebecca San Gil developed a longitudinal map of the proteins activated in the MND brain which are involved in MND across the trajectory of the disease. This has shown new biochemical pathways that could be specifically targeted for people living with MND and other neurodegenerative diseases, using either drugs or gene therapies.

Motor neurone disease treatments a step closer

Dr Adam Walker, Dr Rebecca San Gil, Dr Wei Luan and PhD student Sean Keating have identified biochemical changes in a protein that is affected by MND which could eventually help develop viable treatments—and ultimately a cure—for MND.

Trial for potential treatment

The first clinical study of an EphA4 fusion protein (Fc) therapy in patients with MND has been completed by Professor Perry Bartlett and his team. In this first-in-human study, intravenous infusion was administered in healthy volunteers alongside patients with MND. This treatment has shown positive results and will move to a Phase II clinical trial to determine if this delays or prevents the progression of MND in a larger cohort of patients.

Parkinson's disease

Through complex analysis of Parkinson's disease patient data, Dr Nathalie Dehorter's lab has developed the first immune-induced Parkinson's model that enables testing of new drugs. This key tool will test molecules targeting the immune system to avoid neurodegeneration and therefore prevent Parkinson's disease, progressing towards clinical trials in people presenting with specific immune signatures.

The Sah lab's, Dr Marcin Kielar, is developing a potential smart medical device capable of assessing tremor, rigidity and bradykinesia in Parkinson's disease patients. This cost-effective wearable device prototype can measure multiple motor symptoms allowing patients to evaluate the effectiveness of their therapy in-house and make small adjustments as the disease progresses, improving the overall quality of life.

Stroke

Dr Matilde Balbi and her team identified the specific role of a subpopulation of neurons in driving neuroprotection after stroke following brain stimulation, discovering that non-invasive neuronal stimulation recruits cells involved in waste clearance from the brain. This will lead to the development of individualised treatments for people living with stroke and other neurodegenerative conditions, including vascular dementia.

A novel Brief Executive Language Screening Test (BELS) to assess cognition in the acute/early stage post-stroke was developed by Professor Gail Robinson's (pictured) team. Detecting subtle and focal cognitive impairments, that are normally not observed, this test will inform rehabilitation choices, which impacts relationships, daily living, and quality of life.

Dietary selenium supplementation in animals was identified as a successful treatment that can protect against the cognitive and motor deficits in ischemic stroke by Dr Tara Walker's lab.

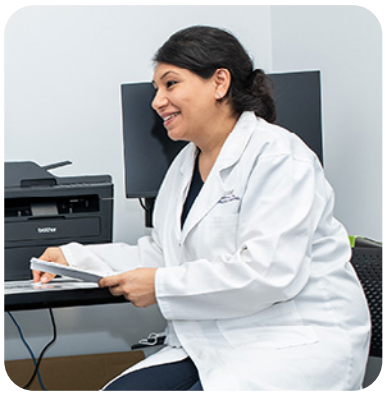
Autism Spectrum Disorder (ASD)

Research led by Professor Helen Cooper has functionally integrated unconnected ASD proteins of diverse function into a convergent signalling network that governs information flow across synapses, providing new insights into how information flow is disrupted by ASD genes. A better understanding of the complexities of ASD will help identify new therapeutic targets.

Professor Darryl Eyles' lab has established a model of Developmental Vitamin D deficiency to understand what developmental events are triggered in the developing brain to change behaviour consistent with ASD. Maternal vitamin D deficiency changes the way bacteria colonise the gut, which may indicate why certain individuals may be biologically at risk of altered gut biome independent of postnatal experience. Gut colonisation will now be studied, to see whether this can be rectified at birth via feacal microbiome transfer.

Dr Nathalie Dehorter's (pictured) lab has uncovered a key molecule that regulates specific brain cell activity that underlies social impairment, repetitive movements, and epilepsy in autism. This research will enable a better understanding of the neurobiology of autism and will open new perspectives for the early identification and use of new therapeutic targets for profound autism.

Concussion



Concussion research can make our athletes safer

Associate Professor Fatima Nasrallah (pictured) is progressing a world-leading study with Brisbane high school rugby athletes to identify a blood biomarker that accurately reflects how the brain responds to and recovers from concussion to inform diagnosis and treatment.

QBI has also established the Queensland Brain Injury Collaborative (QBIC) to help improve care for people with acquired brain injury. QBIC connects stroke, concussion and traumatic brain injury (TBI) researchers, health professionals and community across Queensland providing opportunities for clinicians and allied health professionals to help inform research directions.

Brain Development

Boosting neuroscience training to help children flourish

Professionals working with children and young people will be offered training in brain science in an Australia-first initiative between UQ/ QBI and the Australian Research Alliance for Children and Youth through the Thriving Queensland Kids Partnership. Thriving Kids Brain Builders is a neuroscience translation initiative being developed with QBI for people working across the health, education, social and community services, justice, and housing sectors.

Led by QBI Laureate Fellow Professor Karen Thorpe, this initiative will help build a stronger and more equitable early childhood education and care workforce and bridge the gap between research and practical application. The experiences and environments young children encounter have a profound impact on their brain development. The course is a series of modules on the foundational concepts of neuroscience, understanding neuroplasticity, the impact of stress and trauma on brain development and the vital role of executive functioning in supporting children's wellbeing. This initiative has been partially funded by the Ian Potter Foundation.

Young children failing to get adequate nutrition in early education centres

QBI's Dr Bonnie Searle has found meals provided in early education and childcare centres in some low socio-economic communities are not meeting national dietary recommendations. The study found in communities where the risk of food insecurity is high, the quality and quantity of food across the board was low, with meals only meeting 75% of estimated energy requirements. Research showed that without adequate nutrition it's harder for children to learn and regulate their behaviour.

Human Studies

Our valuable community of supporters have helped us progress discoveries made in the lab to human trials of new treatment options.

Therapeutic Ultrasound Program

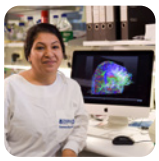
QBI successfully undertook a safety trial with 12 participants to determine whether the ultrasound could be safely delivered, following pioneering discoveries about its potential use to improve memory function. Design improvements for the second generation UltraThera system were also implemented based on feedback of the current system being used in clinic.

MND drug clinical trial

The first clinical study of an EphA4 fusion protein (Fc) therapy in patients with MND has been completed by Professor Perry Bartlett and his team. This treatment has shown positive results and will move to a Phase II clinical trial to determine if this delays or prevents the progression of MND in a larger cohort of patients.

Healthy ageing and exercise trial

The first manuscript has been submitted, —with publication expected in 2024 — on QBI's healthy ageing and exercise trial to help identify the 'sweet spot' for exercise to improve memory.



Concussion diagnosis and treatment study

Recruitment of year 9 to 11 athletes of our Brisbane GPS school concussion study continues. This study uses advanced neuroimaging methods to enhance the diagnosis of concussion to study the structural changes that are induced by a concussion and how they change over time. The ultimate aim is to identify a biomarker to monitor changes in the brain at time of impact.

Neuropsychological studies

Our neuropsychological studies are continuing to progress with testing for a range of mental functions, including cognition, language use, attention, learning, processing speed, reasoning, remembering and problem-solving.

Philanthropy in Action

Thank you to our generous community for supporting students to progress research.

Joan Lawrence Endowment Prize for High Achieving Women in Neuroscience 2023

Elise Kellett
Walker Laboratory

Vonnie Healy Fund Scholar

Josh Flavell
Nestor Laboratory

Aleks and Elise Brumby Summer Scholar

Ben Carman
Mattingley Laboratory

Donald and Joan Wilson Scholar Research Internships

Patrick Wang
Balbi Laboratory

Emma Hisley
Burne Laboratory

Alastair Rushworth PhD Fund Scholar

Montana Samantzis
Balbi Laboratory

Ipswich Hospital Foundation ARAFMI Mental Health Scholar

Dr Zilong Du
Eyles Laboratory

Thornton Foundation Scholar

Sean Keating
Walker Laboratory

Nanditha Krishna
Whitmire Laboratory

Thank you

"Philanthropy is the light by which QBI progresses its world-leading brain research."

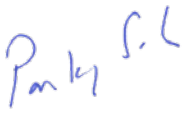
— Prof Pankaj Sah

Thank you for your generosity and the hope you instil in us through your support of QBI's research. Together, we have been able to propel discoveries and push the boundaries of human knowledge about the brain. Your contributions are critical in helping QBI explore better health outcomes for all.

I am privileged to lead our team of talented scientists who are striving to improve the lives of people around the world. We deeply appreciate your choice to support UQ's Queensland Brain Institute. Your generous support enables our researchers to understand the functions of the brain, and how its dysfunction leads to neurological and mental disorders. These are some of the most challenging questions in society today and the development of therapies are essential for better health outcomes.

This update underscores the profound impact you have had and highlights the ongoing achievements made possible thanks to your philanthropy, partnership, and trust. As our research continues to progress, and a number of projects enter human clinical trials, we need your support more than ever. Please consider a gift this end of financial year.

Thank you.



Professor Pankaj Sah
Executive Director

More information

Please contact the Advancement Team if you would like more information on making a gift to support brain research.

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