THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

Queensland Brain Institute

UQ's Queensland Brain Institute undertakes life-changing research to turn discoveries into innovative medical treatments.

Mrs Robyn Hilton, donor, and Dr Jocelyn Widagdo

A message from Professor Pankaj Sah

After 10 incredible years at the helm of QBI, I will be stepping down as Director and returning to lead my Group in July. It has been a privilege to guide QBI's talented scientists and dedicated support staff, and I have really enjoyed the journey.

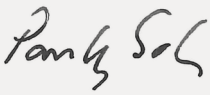
Your generosity in supporting us has played a crucial role in advancing research into understanding the brain and several treatments are now on the verge of going into the clinic. Basic research, that is fundamental research, explores natural phenomena often without obvious practical application, but lays the groundwork for major medical and technological advances. Many innovations that have revolutionised medicine - such as quantum computing, gene therapy, and mRNA vaccines—stem from basic research, which is decades old.

Sustained investment in basic science, which is the bedrock of QBI, is vital for continuing to tackle complex neurological and mental health conditions which account for nearly 50% of the burden of disease in Australia.

Your impact lays the foundations for scientific discovery. This report is a testament to the success we've achieved and a celebration of the legacy we leave together.

Thanks to you, our researchers have led breakthrough experiments, accessed cutting-edge technology, and developed innovative therapies — some of which have now passed Phase 1 safety trials, a critical step toward viable treatments.

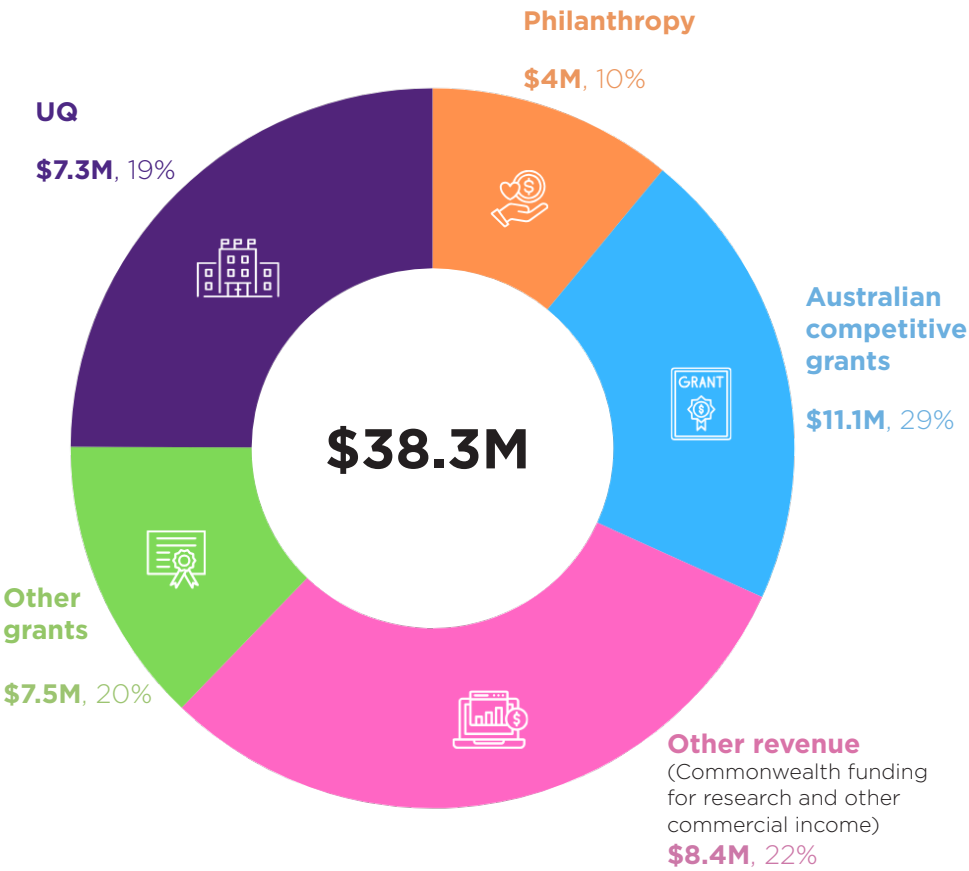
Your philanthropy helps nurture the next generation, empowering bright young minds to discover, innovate, and shape a healthier future for all. On behalf of QBI, I'd like to thank you for your generous support of scientific innovation and the valuable and respectful relationships we have built together.



Professor Pankaj Sah
QBI Executive Director

Learn more about UQ's commitment to donors here.

Funding Snapshot



QBI at a glance

29
groups

200+
researchers

300+
publications

95
HDR students

Dr Sevannah Steeves

A letter to our donors

Dear donors

I am incredibly grateful for your generous support of our research at QBI. Thanks to philanthropic grants, I have continued my postdoctoral work in the Meunier group on cognitive dysfunction in long-COVID.

With support from The Donald & Joan Wilson Foundation, we conducted the first multi-omic study using human brain organoids to explore how COVID-19 affects long-term potentiation—the key process behind learning and memory.

This research is deepening our understanding of how COVID-19 impacts memory and cognition pathways, paving the way for an exciting new collaboration. We investigate these effects using human brain organoids and an innovative long-COVID mouse model.

I sincerely thank our generous community for their genuine interest in our research. Sharing my findings with many thoughtful and curious people is an enriching experience.

"Your support reminds us that scientific discovery is not just about knowledge - it's about making a real difference in people's lives."

Thank you for being part of our scientific journey.

Warmest regards

Sevannah

A legacy of sibling love for Parkinson's research

"I couldn't save Ray's life, but maybe this can help someone else."

When Lynda Clarke returned to Australia after years abroad, she noticed subtle changes in her brother Ray—early signs of Parkinson's disease that would shape their next 16 years.

Ray, a lively primary school teacher, faced the diagnosis with strength and resilience, determined to make the most of life despite the disease's gradual toll on his body and personality. Lynda became his devoted carer, eventually moving Ray into her home, and later into residential care alongside their elderly parents.

"It was only mum, dad, Ray and I growing up, so the emphasis was always to support each other, always love each other, and at one stage my mum, my dad and Ray were all in the same residential care place," Lynda says.

"Dad was 98, mum was 99 but Ray was only 62 when he moved in. They would often meet for coffee while Ray could walk."

As his condition worsened, Ray maintained his optimistic outlook and found strength in the community around him, drawing inspiration from fellow residents. He passed away suddenly at age 66 from aspiration pneumonia.

Determined to honour Ray's life and help others living with Parkinson's, Lynda established the Ray Clarke Endowment Fund at QBI, kickstarting it with a $100,000 donation. She plans to continue contributing and has included the fund in her will.

Lynda's gift ensures Ray's legacy lives on—supporting critical brain research and offering hope for a future without Parkinson's disease.

To read more about Lynda's story click here.

Lynda and Ray Clarke

QBI Brain Research Endowment Fund

The QBI Brain Research Endowment Fund provides a perpetual income stream to support vital research. In 2024, funding was allocated to the van Swinderen group, which studies sleep and general anaesthesia using animal models. This support enabled the launch of a new program focused on improving recovery from general anaesthesia and development of innovative ways to screen and test anaesthesia reversal and recovery agents, in collaboration with clinicians at RBWH and UQ researchers. These new drugs aim to speed up recovery from general anaesthesia, particularly in vulnerable patients, such as the elderly. Support from donors enabled the generation of promising preliminary data, which was instrumental in the group securing major grants from the NHMRC and the Australian and New Zealand College of Anaesthetists.

The Endowment Fund also continued to support the University of Zürich (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.

QBI Brain Research Endowment Fund Dinner 2024

QBI Priority Research Fund

The QBI Priority Research Fund contributed to the purchase of essential equipment for QBI Histology, a core facility used by QBI and UQ research groups.

Philanthropy is directly helping enable faster, more accurate discoveries. With this support, the Leica TP1020-Automatic Tissue Processor was purchased, which streamlines and standardises the preparation of tissue samples, ranging from brain tissue to organoids, plants and tumours. This advanced equipment accelerates discoveries by offering bespoke processing cycles tailored to specific tissue types, improving tissue preservation and reducing artefacts.

The enhanced processing capabilities have opened the door for researchers to employ traditional and cutting-edge histological techniques, including spatial lipidomics, proteomics and transcriptomics.

> *"Without investment in basic science, progress slows, future breakthroughs may never happen, and society does not move forward."*
>
> **Professor Pankaj Sah**

Ageing and dementia


Professor Götz and group members

QBI's Clem Jones Centre for Ageing Dementia Research (CJCADR) continues to advance research to understand and combat ageing-related dementia. In 2024, a new start-up company, Ceretas, was launched with our ultrasound device, and will take it to stage 2 efficacy trials.

QBI researchers continue to advance the ultrasound technology to improve drug delivery and investigate its therapeutic potential. A $5 million Queensland Government grant is supporting a 2025 clinical trial in metropolitan and regional Queensland, while a $3 million NHMRC grant will establish the MIND-AD Centre for Research Excellence, led by Professor Jürgen Götz, to study neurodegeneration and its potential future treatments.

Changes to cell DNA that could revolutionise disease prevention

The Zuryn group has uncovered a key mechanism that regulates the inheritance of disease-causing mutations, providing a promising therapeutic pathway for preventing heritable and age-related diseases. Their research identified two enzymes that control chemical modifications in mitochondrial DNA, which, when removed, lead to harmful mutations. Increasing these enzyme levels could slow disease progression, offering new possibilities for targeted treatments for conditions including dementia, cancer and diabetes.

Brain changes due to normal ageing

The Anggono group studied protein levels in ageing mouse brains, focusing on a brain region crucial for learning and memory. They found increased levels of proteins related to adaptive immune response, molecular metabolic pathways and support cells. In contrast, proteins found in neurons and those involved in new brain connections were reduced, providing a deeper understanding of the molecular effects of the ageing brain.

New antibody restores brain protein balance by targeting tau

The Götz group have developed a tau antibody that targets harmful protein aggregrates in Alzheimer's, restoring protein balance and improving behaviour. This new antibody outperforms current treatments by triggering positive changes in numerous proteins. Combined with low-intensity scanning ultrasound, it may enhance therapeutic outcomes, offering a potential integrated pharmacological and non-pharmacological treatment for Alzheimer's.

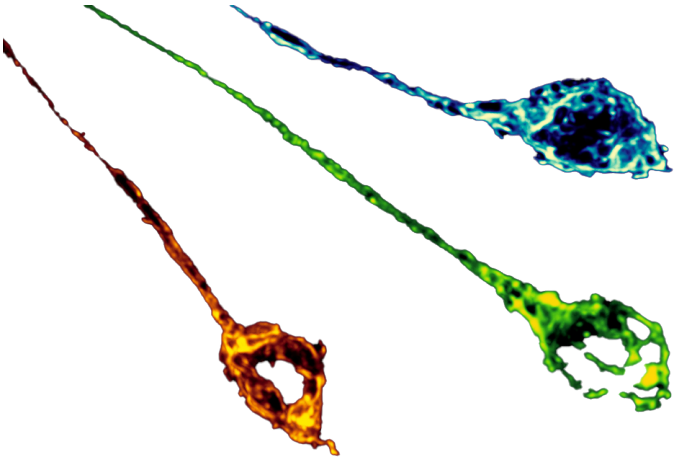

Dr Esteban Cruz

Exercise brain boost can last for years

The Bartlett group, in collaboration with UQ's School of Human Movement and Nutrition Sciences, showed that six months of high-intensity interval exercise improves cognitive function in older adults for up to five years. This is the first controlled study that has demonstrated that exercise can enhance cognition, not just delay cognitive decline, in healthy older adults.

Study reveals reasons for misdiagnosis of frontotemporal dementia

The Nestor group found that nearly 70% of patients given a diagnosis of frontotemporal dementia are likely to have been misdiagnosed. The study highlighted that misintepretation of brains scans and cognitive tests often led to misdiagnoses, especially in people with prior psychiatric histories, suggesting that improving diagnostic accuracy could lead to better patient outcomes.



Visualisation of OSP-1. Credit: *Alessandra Donato* and *Nick Valmas.*

New molecule may protect brain cells from damage

The Hilliard group discovered a molecule, OSP-1, which protects brain cells from damage caused by oxidative stress and dysregulated autophagy. OSP-1 could block harmful autophagy during acute events like stroke, and in numerous brain diseases, offering new therapeutic possibilities.

Clem Jones Student Development Awards

The Clem Jones Student Development Award supports PhD students in ageing dementia research and their academic careers in neuroscience. **Three awards were granted in 2024:**

Daniel Campbell
Zuryn Group

Godfrey Nkajja
Götz Group

Joshua Lowe
Walker Group

Neurodegenerative diseases

Motor neurone disease (MND)

Grants boost collaborative efforts to develop potential MND treatments

A UQ–QEDDI collaboration, led by Professor Adam Walker, has received a $550,000 FightMND grant to develop new molecules targeting MND. The project aims to boost nerve cells' protein recycling systems to clear toxic TDP-43 clumps found in most MND cases.

In a separate $1 million FightMND-funded study, Dr Rebecca San Gil will investigate how TDP-43 affects protein translation in brain cells. Her research aims to uncover molecular mechanisms and identify biomarkers for MND progression.

Major milestone for UQ spin-outs promising new drug

A potential new MND treatment, developed at QBI, has shown promise in a Phase 1 trial. The lead drug, NUN-004, was found safe and effective, marking a major milestone after 20 years of research by QBI Emeritus Professor Perry Bartlett and UQ Emeritus Professor Andrew Boyd. The six-month trial involved eight MND patients and 20 healthy volunteers. It showed NUN-004 may slow disease progression and improve motor function. The drug, an EphA4 blocker, was licensed to NuNerve, a UQ/QBI start-up.

Dr Margreet Ridder receives Dr Ian Davis grant for top-ranked FightMND project

Dr Margreet Ridder was awarded a $285,000 FightMND IMPACT grant and the inaugural Dr Ian Davis OAM Award for the top-ranked FightMND project in 2024. Her research focuses on combating hyperexcitability, a universal feature of all forms of MND. Using a gene therapy approach, Dr Ridder has developed an engineered silencing receptor to reduce this hyperactivity in an MND mouse model. Early results show promising potential, with the receptor delaying disease onset, increasing survival and preserving motor neurons in early-stage disease.

Mel Yang, Archie Davis and Dr Margreet Ridder

> *"Not many people combine electrophysiology and gene therapy to develop treatments for MND. It was challenging to get funding initially as everyone saw it as blue-sky research, but gene therapy for the treatment of MND has arrived."*
>
> **Dr Margreet Ridder**

Parkinson's disease

Uncovering the immune system's role in Parkinson's disease

The Dehorter group investigates how the immune system interacts with alpha-synuclein, a protein linked to Parkinson's disease, to determine whether this triggers disease onset. The goal is to identify molecular targets for therapies that could prevent the loss of dopaminergic cells responsible for Parkinson's symptoms. The team has developed a novel immune-induced mouse model, allowing for the tracking of early disease progression and exploration of potential detection and prevention strategies.


Dr Rebekah Parkinson

'Jumping genes' and brain cell diversity: understanding their role in disease

The human brain contains thousands of unique types of neurons, with distinct roles and developmental pathways essential for cognition and behaviour. The Faulkner group studies the genetic mechanism behind this neuronal diversity, focusing on how mobile genes like retrotransposons influence neuronal activity and contribute to disease. These 'jumping genes' can replicate and insert themselves at new random locations in the genome. The group investigates their links to schizophrenia and Parkinson's disease. Understanding neuronal diversity is the key to uncovering healthy brain function and developing strategies to prevent disease.

Advocating for wider access to Deep Brain Stimulation for Parkinson's disease

Parkinson's disease was identified over two centuries ago, and its link to dopamine neuron loss has been known for over 50 years. Despite this, pharmacological treatment for the disease has seen little progress. Deep brain stimulation (DBS) has emerged as an effective alternative therapy, but Medicare coverage remains limited in all states. In collaboration with health economists, the Sah group has analysed the economic benefits of expanding DBS access to treat Parkinson's disease, aiming to support its broader adoption in the health system.

Brain injury

Stroke

Understanding the impact of stroke on brain function and recovery

The Mattingley group has identified how stroke in different brain regions leads to specific cognitive and behavioural deficits. By combining cognitive testing and brain imaging following stroke, the research links language and memory impairments, number processing deficits and attention difficulties to specific patterns of brain damage. This deeper understanding of stroke-related impairment will help predict outcomes more accurately and guide targeted treatment strategies, ultimately improving recovery for stroke survivors.

Real-time sounds speed up motor skills learning

The Balbi group discovered that real-time auditory feedback linked to movement helps mice learn motor skills faster. They develped a closed-loop system, using advanced machine learning and real-time movement tracking, to play different sounds based on the mice's actions. Mice receiving continuous auditory feedback completed the tasks faster and with more consistent movement patterns than those without sound. Initially conducted in healthy adult mice, the team will now test motor learning in stroke models, aiming to enhance motor skills learning and improve rehabilitation after a stroke.

A faster, more effective cognitive screening tool to help stroke survivors

The Robinson group has developed the Brief Executive Language Screening (BELS). This 20–30-minute bedside test detects often missed cognitive impairments in stroke patients. Unlike conventional testing, which takes two to three hours, or brief screening that only detect severe impairments, BELS assesses memory, speech motor function, core language, and decision-making skills. Early detection in hospital allows for tailored rehabilitation, preventing challenges once a person returns home, when they're less likely to seek help. The team is adapting BELS to assess the cognitive skills in brain tumour and dementia patients.

Dr Matilde Balbi

Stroke PhD student award

The Balbi Group's Victor Vasquez Matsuda received the Stroke PhD Student Award, supported by donations. His research assesses the effectiveness of optogenetic stimulation in aged and stress-induced mice. Age and stress are the most prevalent risk factors for stroke.

Concussion

The Nasrallah group is leading several research projects advancing knowledge of concussion and traumatic brain injury (TBI):

Quantitative susceptibility mapping (QSM) shows promise for diagnosing and tracking moderate TBI recovery in contact sport head injury, addressing the limitations of routine imaging techniques. A study of 24 athletes found QSM could detect changes post-injury, assisting safe return-to-play decisions.

A multi-modal structure-aware field-wise learning (MSF) has been developed to analyse complex data patterns to improve TBI prognosis. Tested on a real-world dataset, it improves outcome prediction and recovery insights.

Compensatory strategy training and rehabilitation (COMP) slowed neural degeneration in moderate to severe TBI patients compared to standard care. This suggests COMP is an effective approach for managing prospective memory impairment after TBI.

QBI leads the **Queensland Brain Injury Collaborative (QBIC)**, a multidisciplinary platform transforming brain injury care in Australia. QBIC unites research, clinical practice, and lived experience to bridge critical gaps across the continuum of care – from acute injury to long-term recovery. QBIC's vision is to deliver personalised, evidence-based solutions that improve diagnosis, treatment, rehabilitation, and policy, ensuring every individual affected by brain injury receives the best possible support.

Mental health

Mood disorders

Connectomics approaches to understanding anxiety and depression

Professor Barry Dickson's 2025 $3 million NHMRC Investigator Grant will fund a new approach to studying anxiety and depression, focusing on how chronic stress affects neural connectivity. This research will explore how maladaptive brain changes, particularly in females, may contribute to neuropsychiatric and mood disorders. This research could lead to drug or behavioural therapies that target synaptic connectivity rather than just neurochemistry.

New animal cognitive test may bridge gap between preclinical and human research

Schizophrenia is debilitating due to cognitive dysfunction that impacts a person's daily life. Translating animal research to human clinical trials has been difficult due to a lack of precise cognitive tests in animals. The Burne group have developed the Dynamic Strategy Shifting Task (DSST). This innovative tool measures cognitive flexibility. This discovery could enhance our understanding of cognitive processes in neuropsychiatric and neurological conditions like schizophrenia, and accelerate the development of more effective treatments.

Key advances in mental health research

The Tye group is advancing new therapeutics in mental health, particularly in treatment-resistant mood disorders. Their work on deep brain stimulation (DBS) for bipolar disorder has shown that targeted neuromodulation can effectively reverse mania-like symptoms and restore dopamine balance in animal models, positioning DBS as a promising therapy.

A significant breakthrough in this research is the development of Smartstim, an AI-enabled DBS device offering real-time brain monitoring and adaptive stimulation, making treatments more personalised and effective.

The Tye group's studies on inflammation and metabolic dysfunction in antidepressant-resistant depression are uncovering critical insights into how immune and metabolic disturbances drive anhedonia.

Their findings in pharmacogenomic research are revealing genetic links between antidepressant response and mania risk, paving the way for personalised treatment strategies in bipolar disorder.

Researchers in the Tye lab

Early-life vitamin D linked to optimal brain development

Professor John McGrath has led a significant study finding that people with lower vitamin D concentration as babies have an increased risk of developing mental disorders such as ADHD, schizophrenia and autism spectrum disorder. In the largest population study of its kind, the researchers examined the vitamin D status of over 71,000 people and a range of mental disorders. They included evidence based on two vitamin D-related biomarkers and related genetics. The study was conducted at the National Centre for Register-Based Research, Aarhus University, and the State Serum Institute in Denmark.

Professor John McGrath

Brain development

The Thorpe group is leading several research projects to understand the effects of early life experiences on behaviour, learning, health, and wellbeing throughout life.

The Thriving Kids Brain Builders Initiative (TKBBI) unites research, government, NGOs and social enterprises to apply neuroscience for the wellbeing of Queensland children, young people, their families and communities. As part of TKBBI, Dr Sally Staton and Professor Karen Thorpe secured a $750,000 grant from The Tim Fairfax Family Foundation to develop a brain health focused workforce package and school resources.

Working with the Australian Education Research Organisation, the Thorpe group found that higher-quality Early Childhood Education and Care (ECEC) improves children's cognitive abilities and achievements. This large-scale study highlights the impact of ECEC quality on learning and child development in Australia.

Autism spectrum disorder (ASD)

Dr Xiaoyung Cui

No link between maternal adverse events and long-term gut microbiome in Australian autism biobank study

A study by the Eyles group using the Australian autism biobank found that while maternal immune activation (MIA) during pregnancy was linked to ASD, neither MIA nor prenatal maternal stress (MatS) led to lasting changes in the gut microbiome in children, in contrast to animal studies. The results suggest that lifestyle factors may overshadow prenatal impacts on the gut microbiome.

Understanding the impact of PTSD-like memory in ASD

The Dehorter group discovered that cognitive deficits in ASD play a key role in autism pathophysiology. Their study showed that mild stress triggers PTSD in mouse models of ASD, which in turn aggravates core autistic traits. Understanding this reciprocal link may lead to improved treatments.

Cognition and behaviour

Attention and decision-making

The Mattingley group has shown that the ability to control our attention - that is, to selectively focus and filter out distractions - is regulated by oscillations in neural activity. These oscillations provide a functional link to distant brain areas. Understanding these mechanisms is key to improving diagnosis and treatment of disorders of attention that can be caused by brain injury and disease.

In another research study, the team has found that our ability to reflect on our own thought processes - known as 'metacognition' - is dramatically altered when under time pressure. Some aspects of metacognition are actually improved when forced to make rapid decisions. The discovery has important implications for understanding how the brain regulates decision -making proceses in health and disease.

Other research by the team has advanced our understanding of the computations the brain undertakes when it has to integrate multiple sources of sensory information, such as when we are faced with a cluttered visual scene. The work shows that sensory processing regions in the left and right hemispheres of the brain combine information rapidly and in parallel. The discovery provides clues as to why sensory perception can sometimes be impaired after cerebral stroke.

Professor Jason Mattingley

Learning and memory

Dr Jocelyn Widagdo

Synaptic plasticity, the ability of brain cells to adjust the strength of their connections, underpins learning and memory. This complex process is being researched by several QBI laboratories using different approaches that could lead to new treatment pathways.

The Anggono group found that learning causes changes in existing inhibitory synapses, helping fine-tune excitatory connections in the motor cortex.

The Cooper group has discovered how the structural plasticity of synapses change during learning, strengthening communication between brain cells.

The Bredy group discovered an entirely new mechanism of memory. They found that DNA acts like a shape shifter and dynamically modifies its structure to control learning-related gene expression. Importantly, this process is required for formation and maintenance of long-term fear extinction memory. The extinction of conditioned fear is a natural learning process that is critical for survival. This major knowledge advance could lead to the development of new treatments for disorders like PTSD.

The Meunier group found mechanisms that control neurotransmitter transmission between brain cells at the synapse. These studies help advance understanding to develop new treatments for brain disorders and diseases.

Human studies

Understanding degenerative dementias

The Nestor group focuses on studying major forms of degenerative dementia through clinical assessment, brain imaging, and mental ability tests. By understanding how these diseases affect the brain, researchers aim to identify new therapeutic targets and improve diagnostic accuracy. For example, a recent study revealed that nearly 70% of those diagnosed with frontotemporal dementia were misdiagnosed. Identifying key factors that contributed to these errors is helping clinicians make more accurate diagnoses and reduce misdiagnosis risk.

Sleep apnoea and dementia

The Coulson group are exploring Alzheimer's disease and cognitive impairments linked to sleep apnoea. One study is investigating if cholinergic dysfunction can predict Alzheimer's progression. Additionally, research is underway at The Prince Charles Hospital Sleep Clinic to assess if Continuous Positive Airway Pressure (CPAP) therapy restores cognitive function in people with obstructive sleep apnoea and cognitive impairment. A further study is looking into whether these individuals have cholinergic dysfunction, with ethics approval pending.

Treatment-resistant depression

The Tye group's research on treatment-resistant depression focuses on developing a diagnostic tool to identify blood-based biomarkers predicting antidepressant outcomes. Conducted in Australia and the USA, these trials use samples from patients undergoing ketamine therapy. By applying artificial intelligence, our team at QBI has created a rapid scoring system and feedback method to help clinicians improve patient care and treatment effectiveness.

Philanthropy in action

We appreciate the generous donor support helping QBI students progress their research.

Montana Samantzis
Balbi group

Joan Lawrence Endowment Prize for High Achieving Women in Neuroscience 2024

Alastair Rushworth PhD Fund Scholar

Dr Josh Flavell
Nestor group

Vonnie Healy Fund Scholar

Madison Danalis
Sah group

Aleks and Elise Brumby Summer Scholar

Dr David Palmer
Mattingley group

Dr Gerald and Suzanne Murphy Endowment QBI Award

Dr Xiaoyung Cui
Eyles group

Ipswich Hospital Foundation ARAFMI Mental Health Scholar

Carly Johnson
Götz group

Eloise Sinclair-Ford
Zuryn group

Annie Yang
Whitmire group

Mackley Stalker
Vukovic group

The Donald & Joan Wilson Foundation Scholar Research Internships

Thank you for bringing impact closer

Jeff and Fran Maclean and family

I extend my gratitude on behalf of the QBI Advisory Board for your generous support. It is instrumental in advancing neuroscience research, helping QBI's scientists push the boundaries of knowledge to improve lives worldwide.

For me, this work is deeply personal. The journey of my father, Ross Maclean, who lived with MND and passed away in 2005, reinforces the urgency of our mission. Over the past 22 years, QBI has made remarkable strides, leading global discoveries in brain science. Two of our most promising research projects— scanning ultrasound technology for dementia and a pioneering MND treatment—are moving closer to commercialisation, bringing impact closer than ever.

These innovations begin with fundamental blue-sky research. The long-term discoveries that change lives are only possible with sustained investment in curiosity-driven science.

Finally, I want to acknowledge Professor Pankaj Sah's leadership over the past decade. His dedication has been pivotal in shaping QBI into the world-leading institute it is.

Thank you for joining QBI's mission. With your continued support, we will accelerate science and transform lives.

Jeff Maclean
Chairman, QBI Advisory Board and Donor

Donate today

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“To achieve the big medical breakthroughs of tomorrow, we need to invest in the discovery science of today.”

Professor John McGrath

Professor John McGrath

By supporting research at UQ’s Queensland Brain Institute, you can help improve the lives of millions of people impacted by brain disorders and diseases now and in the future.

Scan the QR code to donate today