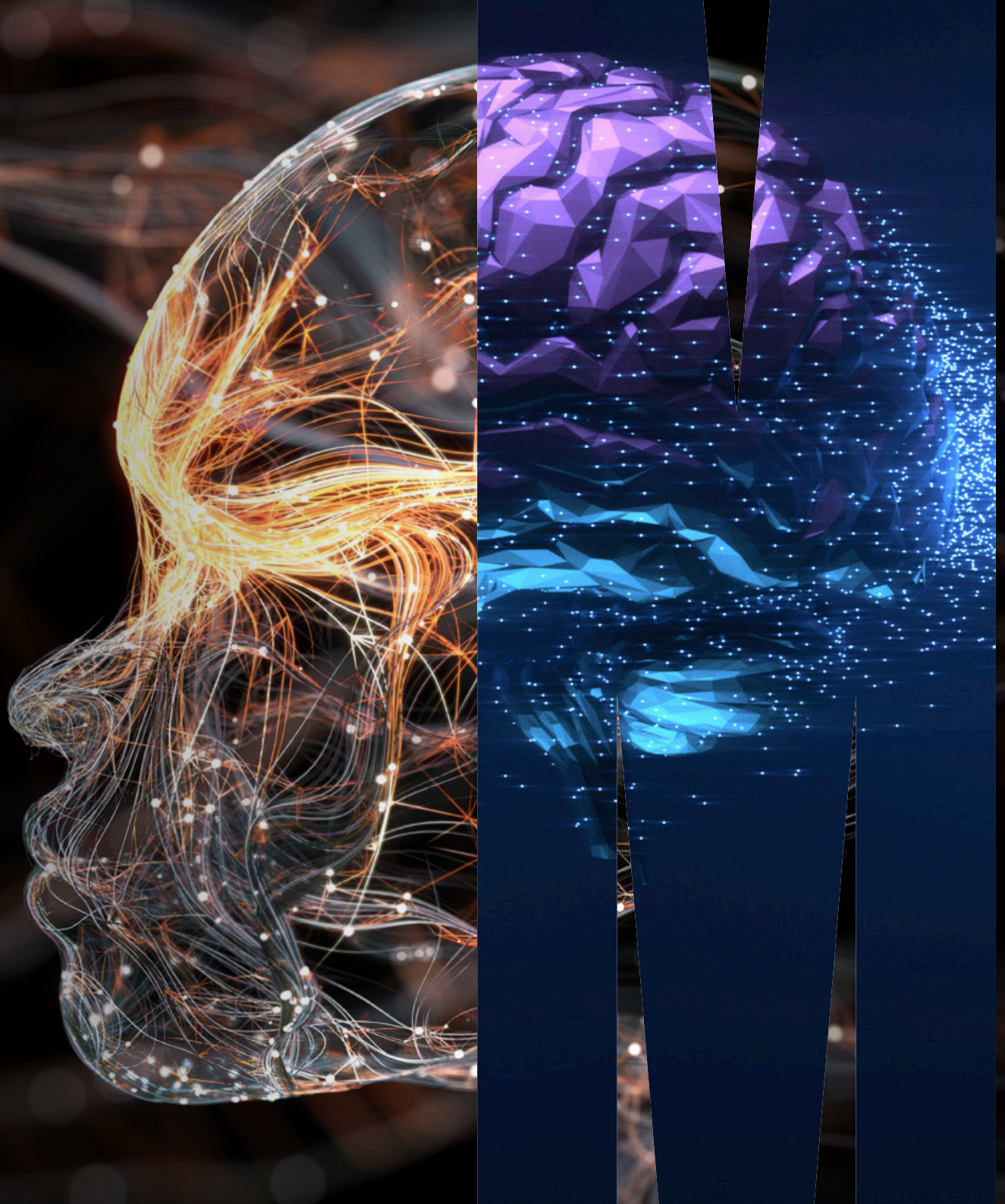




MONASH
University

MONASH NEUROSCIENCE

AT THE FOREFRONT OF
NEUROSCIENCE RESEARCH





ABOUT MONASH UNIVERSITY

MONASH IS A GLOBAL UNIVERSITY WITH A PRESENCE ON THREE CONTINENTS AND AMBITIOUS PLANS FOR THE FUTURE.

We make a difference, locally and internationally. As a young university, our outlook is progressive and optimistic.

We have a presence in China, Italy, India and Indonesia. Each location provides an environment that identifies and nurtures talent, and helps translate that talent into ability and action.

From collaborative research opportunities to building community relationships, our focus is always on how we can empower our people to make a positive impact on the world.

Monash is ranked in the top 1% of world universities and is a member of the Group of Eight, an alliance of leading Australian universities recognised for their excellence in teaching and research.

We play a critical role in the Australian economy through a \$5.2 billion contribution in annual economic activity.

Our motto Ancora Imparo (I am still learning) reminds us that the search for knowledge never ends. We are fired with a restless ambition that pushes us to do things better, to set new benchmarks and to break new ground.

ABOUT MONASH NEUROSCIENCE

MONASH IS AT THE FOREFRONT OF CUTTING-EDGE RESEARCH
IN NEUROSCIENCE THAT IS HELPING US TO BETTER UNDERSTAND
THE HUMAN BRAIN AND ITS CONNECTIONS.

Monash Neuroscience brings together world-class expertise from across medicine, engineering, pharmacy, science, design, IT and social science to advance scientific knowledge to meet the complex health, social and economic challenges facing our society.

With one in five Australians now suffering from neurological, mental health and substance use disorders, and with current treatments often inadequate, we are facing a growing health and social crisis. These disorders have a combined cost to Australia of over \$74 billion annually¹, and the impact of these conditions on patients, families and the broader community is enormous.

Our researchers are pioneering change in the way we approach the treatment of nervous system disorders, inform policy development, and use our knowledge of the human body's most complex organ to advance next-generation technologies.

Our goal is to create a culture and environment that supports research excellence in neuroscience, enabling us to tackle these complex challenges, and ultimately save and transform lives.

¹ Mindgardens Neuroscience Network (2019) Review of the burden of disease for neurological, mental health and substance use disorders Australia. www.mindgardens.org.au/news/whitepaper/



DEPARTMENT OF NEUROSCIENCE

Monash is home to Australia's only dedicated academic department focused on discovery and translational research to deliver better health outcomes for patients with neurological conditions. Established in 2018, in close partnership with Alfred Health, our Department of Neuroscience boasts new purpose-built facilities including the latest equipment, laboratories, a multimodal state of the art in-vivo imaging facility, and a 'first-in-disease' clinical trials facility.

\$43m

IN NEUROSCIENCE RESEARCH
INCOME IN 2019

500+

NUMBER OF NEUROSCIENCE
RESEARCHERS ACROSS THE
UNIVERSITY

230+

PHD STUDENTS IN
NEUROSCIENCE

600+

RESEARCH PUBLICATIONS IN 2018



80%

NEUROSCIENCE PROJECTS ARE
IN COLLABORATION WITH
EXTERNAL ENTITIES

26%

OF AUSTRALIA'S MENTAL HEALTH
CLINICAL TRIALS ARE CONDUCTED
BY MONASH AND ITS PARTNERS

170+

NEUROSCIENCE FUNDING
PARTNERS IN 2018

#1

RANKED IN AUSTRALIA FOR
NHMRC FUNDING IN 2018 AND 2019

OUR RESEARCH EXPERTISE AND EXCELLENCE

MONASH NEUROSCIENCE IS COMMITTED
TO RESEARCH EXCELLENCE AND STRIVES
TO ACHIEVE MAXIMUM IMPACT FOR
PATIENTS, THEIR FAMILIES AND THE
BROADER COMMUNITY.

Our multidisciplinary academic expertise is focused on
key disease areas:

- › Brain cancer
- › Cognitive neuroscience
- › Epilepsy
- › Headache and pain
- › Multiple sclerosis and inflammation
- › Neural circuitry and oculomotor
- › Neurodegenerative diseases
- › Neurodevelopmental disorders
- › Neuromuscular disease
- › Neurotrauma
- › Next-generation technology
- › Psychiatric disease
- › Sleep
- › Stroke

MONASH NEUROSCIENCE IS DEEPLY COMMITTED TO INTERDISCIPLINARY RESEARCH, AND BRINGS TOGETHER DIVERSE EXPERTISE FROM ACROSS THE UNIVERSITY



Art Design and Architecture

Designing human-centred neurological devices



Arts

Creating policies and systems that enhance autonomy for people with mental health conditions



Business and Economics

Health economic studies to optimize the value of treatment of brain diseases to the community. Improving psychology and behaviour in the workplace



Education

Understanding the psychology of children to improve learning outcomes and mental health



Engineering

Engineering neurological devices and materials



Information Technology

Using data analytics to understand healthy and injured brains



Law

Improving mental health in the justice system



Medicine, Nursing and Health Sciences

Developing and delivering better treatments, practices and policies for patients with neurological and mental health disorders



Pharmacy and Pharmaceutical Science

Identifying and developing novel therapeutic treatments for neurological conditions



Science

Understanding the genetic basis of neurological disease



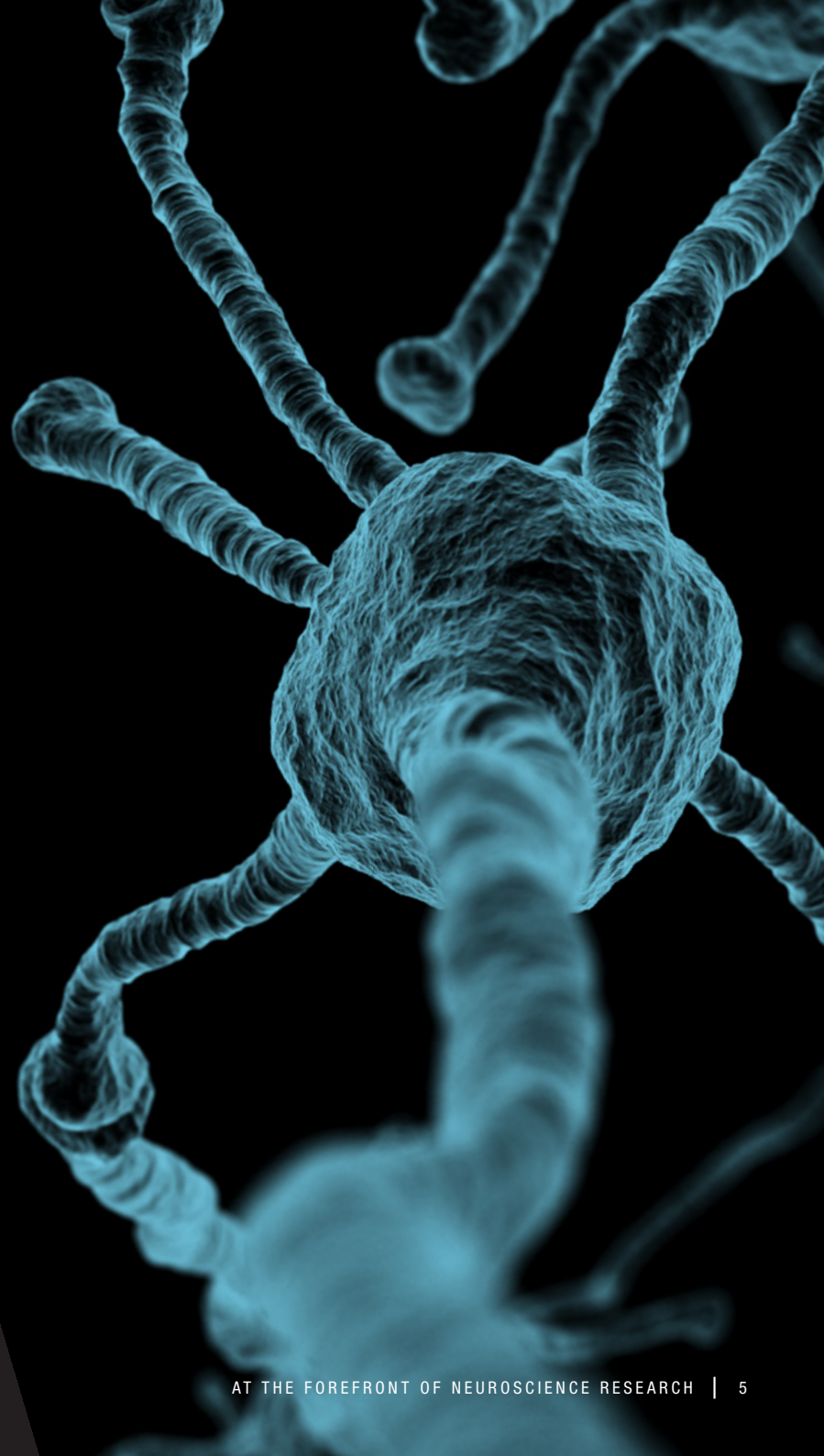
Institute of Safety, Compensation & Recovery Research

Understanding driver psychology, perception and performance to improve road safety



Monash Sustainability Institute

Understanding basis of decision making and behaviour for social good



PIONEERING NEW TREATMENTS AND THERAPIES

OUR RESEARCHERS ARE MAKING
NEW DISCOVERIES AND DEVELOPING
NEW METHODS OF TREATMENT TO
IMPROVE THE LIVES OF PEOPLE WITH
NEUROLOGICAL, MENTAL HEALTH AND
SUBSTANCE USE DISORDERS.

Cell receptor plays key role in neuroinflammation

Dr Mastura Monif and her research team are investigating neuroinflammation which occurs in several neurological conditions including multiple sclerosis, autoimmune encephalitis and brain tumours. Neuroinflammation involves the activation of immune cells in the brain. Her research has identified a particular cell membrane receptor, P2X7R, which plays a key role in neuroinflammation. Using translational techniques, she hopes to unravel the role of innate immunity and neuroinflammation in various brain diseases, and uncover the link between the peripheral and central immune responses.



Concussion recommendations for athletes

Associate Professor Sandy Shultz is running a world first trial involving amateur male and female footballers to understand when it is safe to return to play. Mild traumatic brain injuries (mTBI), such as concussions, are a common and serious medical condition worldwide. Of particular concern, repeated mTBIs are associated with lasting neurological damage and disease, with no interventions known or available to prevent these consequences. Associate Professor Shultz's overarching research goal is to better understand mTBIs and to identify means to improve their clinical management.



Epilepsy treatments require a paradigm shift

Professor Patrick Kwan is internationally recognised for his research into epilepsy including treatment outcomes, pharmacogenomics, health economic analysis and neurobionics. His team was among the first to identify HLA-B*15:02 as a strong genetic predictor of carbamazepine-induced severe skin reactions in Asians, resulting in a US Food and Drug Administration (FDA) recommendation and drug label change. He has played an instrumental role in developing health policy to adopt pharmacogenetic testing, and led post-policy health economic evaluation. His research has highlighted that, despite the introduction of many new antiepileptic drugs over the last two decades, there has been little improvement to the overall outcomes of people with newly diagnosed epilepsy.



Recent research discoveries at Monash BDI

A study led by Associate Professor Lee Wong has provided new insights into the biology of brain cancer, building a foundational understanding of the disease, which may generate future knowledge that underpins treatments. The important study supported by the Cure Brain Cancer Foundation, investigated brain cancer mutations in histone genes, which are found across a number of different cancers, including paediatric brain cancers. The researchers created a perfect copy of one of these histone H3.3 gene mutations in normal cells, to establish what it does to make them cancerous. (*Nature Communications*, 2018)



Recent research discoveries at ARMI

Professor James Bourne is leading research to uncover how specific molecules only present in the brain of infants can be reintroduced later in life to improve outcomes after Central Nervous System (CNS) injuries. This strategy has identified specific signalling cues that acts on reducing brain scarring and the subsequent loss of nerve cells after injury to the adult brain to protect normal function. This has led to the development and testing of drug candidates aimed at translating this strategy into clinical applications.



PIONEERING NOVEL TECHNOLOGIES

WE ARE WORKING TOGETHER TO DEVELOP
NOVEL TECHNOLOGIES AND DELIVER
INNOVATIVE SOLUTIONS TO ADDRESS
COMPLEX HEALTH CHALLENGES.

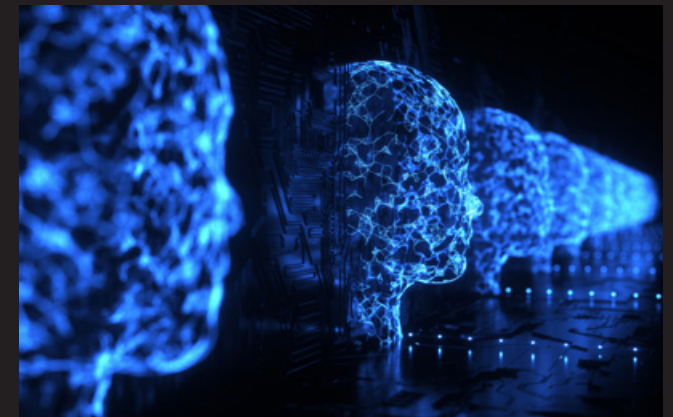
Electronic implants on brain surface restore vision

Monash Vision Group is working to develop the first direct to brain bionic vision device (Gennaris). This is a multi-electrode prosthesis for implantation into the visual cortex of the brain for patients with acquired blindness. Monash researchers, Professor Arthur Lowery, Professor Jeffrey Rosenfeld, Dr Yan Wong and Professor Marcello Rosa are exploring potential new applications for the technology, including the moderation of epilepsy and depression, brain-controlled prosthetics, and the restoration of vital senses beyond vision.



World-first suicide surveillance system

Professor Dan Lubman, Australia's sole recipient of a \$1.2 million dollar grant from Google, is leading a breakthrough project to develop a world-first suicide surveillance system with the potential to set the global standards for suicide prevention efforts. The project involves using artificial intelligence (AI) methodologies to streamline coding of national ambulance suicide-related attendance data. The resulting data will play a central role in informing public health prevention, policy and intervention, as well as identifying emerging trends, hidden populations and geographical hotspots for targeted responses relating to suicide.



Refining data mining and machine learning approaches to better reflect cognitive and executive reasoning

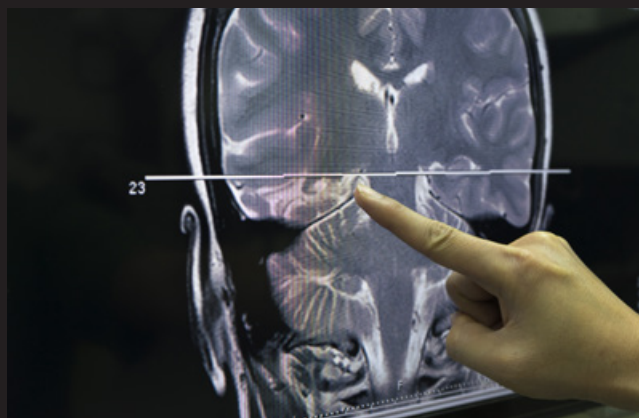
Monash researchers in the Faculty of IT have received contract research funding from Intelligence Advanced Research Projects Activity, a funding body of the US Government, to develop statistical models – Bayesian networks – to refine data mining and machine learning approaches to better reflect cognitive and executive reasoning. These approaches can be used to better predict and diagnose problems and prescribe solutions in a range of real-world areas including medicine, engineering and transport.

Firing up the brain to treat depression and mental health conditions

A multidisciplinary team of Monash clinician-researchers, engineers and designers, led by Professor Paul Fitzgerald, a clinical psychiatrist, are working to develop a brain stimulation device that can be used to treat a range neurological and mental health conditions. This device is already having a positive impact on patients with difficult-to-treat depression, a very common medical problem.

Using mobile technology to better understand MS progression

MSBase is a not-for-profit foundation, housed at Monash University's Department of Neuroscience, and supports 142 collaborating clinics in 35 countries and holds over 70,000 patient records (www.msbase.org). Mobile data from MS patients is linked to the independent MSBase Registry, the largest Multiple Sclerosis (MS) Registry in the world providing a collaborative governance framework for investigators to conduct data analyses and cohort studies. MSBase findings have already demonstrated early intervention using high-efficacy treatments reduces long-term disability in MS patients.



OUR PARTNERSHIPS WITH HEALTH SERVICES

MONASH NEUROSCIENCE IS LOCATED ALONGSIDE AND WITHIN VICTORIA'S LEADING HEALTH SERVICE PROVIDERS.

Our strong collaborations with healthcare providers across Victoria and other states, means we are working closely with clinicians and patients to translate our findings into tangible health and social benefits for the community. We lead clinical neuroscience research programs across our network of health service providers including Alfred Health, Eastern Health, Epworth Health, Monash Health and Peninsula Health.



ALFRED RESEARCH ALLIANCE (Melbourne)

- Central Clinical School
- School of Public Health And Preventative Medicine
- Institute of Safety Compensation Recovery Research

Co-located with:

- Alfred Health
- Baker Heart and Diabetes Institute
- Burnet Institute

EASTERN HEALTH PRECINCT (Box Hill)

- Eastern Health Clinical School

Co-located with:

- Eastern Health

EPWORTH HEALTH PRECINCT (Richmond)

- Monash Epworth Rehabilitation Research Centre

Co-located with:

- Epworth Health

MONASH UNIVERSITY (Clayton Campus)

- Australian Regenerative Medicine Institute
- ARC Centre of Excellence for Integrative Brain Function
- Biomedicine Discovery Institute
- Monash Institute of Medical Engineering
- Monash University Accident Research Centre
- Turner Institute for Brain and Mental Health

MONASH UNIVERSITY (Parkville Campus)

- Monash Institute of Pharmaceutical Sciences (MIPS)

MONASH HEALTH TRANSLATION PRECINCT (Clayton)

- School of Clinical Sciences at Monash Health

Co-located with:

- Monash Health
- Hudson Institute of Medical Research

PENINSULA HEALTH PRECINCT (Frankston)

- School of Primary and Allied Health Care
- Monash Addiction Research Centre (MARC)

Co-located with:

- Peninsula Health

INTERNATIONAL SITES

- Brain Research Institute Monash Sunway (BRIMS) (Malaysia)

OUR RESEARCH INSTITUTES AND CENTRES

MONASH IS HOME TO NUMEROUS RESEARCH INSTITUTES AND CENTRES THAT BRING TOGETHER EXPERTISE FROM ACROSS THE UNIVERSITY TO INNOVATE AND ADDRESS SOME OF THE WORLD'S MOST COMPLEX HEALTH AND SOCIAL CHALLENGES.

› **Australian Regenerative Medicine Institute (ARMI)**

ARMI is one of the largest regenerative medicine and stem cell research hubs in the world, with a dedicated neural regeneration program aimed at understanding the ability for self-repair in the brain and central nervous system.

› **Turner Institute for Brain and Mental Health**

The Turner Institute brings together world-leading researchers to tackle brain and mental health conditions and build mentally healthy communities, with research programs focused on three overarching themes – developing well, living well and ageing well.

› **ARC Centre of Excellence for Integrative Brain Function (CIBF)**

Monash leads the CIBF which fosters multidisciplinary research partnerships in Australia and internationally, to enable experts in cellular, systems and computational neuroscience and neural engineering to answer complex questions in neuroscience.



WORLD-CLASS TECHNOLOGY RESEARCH PLATFORMS

MONASH'S DEDICATED TECHNOLOGY RESEARCH PLATFORMS COMBINE INTERDISCIPLINARY RESEARCH EXPERTISE AND THOUGHT LEADERSHIP TO SUPPORT DISCOVERIES AND INNOVATION IN NEUROSCIENCE.

Our researchers and industry and academic collaborators benefit from our platform's proven reputation for quality.

› **National Non-human Primate Breeding and Research Facility**

Monash hosts Australia's only non-human primate breeding and research facility, providing high quality supply, care and technical support. With non-human primate models becoming increasingly more important in neuroscience research, Monash is leading the way in providing breeding colonies of marmosets and macaques for research use in Australia.

› **Monash Biomedical Imaging Facility (MBI)**

Monash Biomedical Imaging (MBI) facility provides a full suite of world-class biomedical imaging equipment and expertise for preclinical and clinical research, with a strong focus on neuroscience. MBI's cognitive neuroimaging team provides support for all human research studies. MBI has a node on the Clayton Campus and a second node embedded in the Alfred Research Alliance Predict, which in addition to high field MRI and PET imaging, will house the first magnetic particle imaging machine in Australia in 2020.

› **AquaCore**

Monash's AquaCore facility is unique amongst research institutions in Australia, providing the space where the Australian Regeneration Medicine Institute (ARMI) houses and breeds diverse aquatic freshwater and marine species including zebrafish, medaka, killifish, axolotl and sharks. Aquatic animals are important model organisms for biomedical research, and in particular for regenerative biology.

› **BrainPark**

Co-located at Monash Biomedical Imaging, BrainPark is a world-first neuroscience research clinic dedicated to improving the physical, mental and brain health of Australians. BrainPark provides facilities and assessment tools to determine the effectiveness of lifestyle and technology-based therapies, which can include physical exercise, meditation and yoga, therapeutic virtual reality, cognitive training, and non-invasive brain stimulation.

› **The Alfred-Monash Early Phase Neuroscience Clinical Trials Unit**

Opened in 2018, this is the only dedicated neuroscience early phase clinical trial unit in Australia, and one of the few in the world. The unit is embedded within the Neuroscience inpatient ward at The Alfred Hospital and has capacity for overnight and multiday stays, as well as continuous multimodality neurophysiological monitoring. The unit has already commenced over 50 clinical trials of new therapies for a large variety of neurological diseases including, epilepsy, multiple sclerosis, Alzheimer's disease, Parkinson's disease, frontotemporal dementia, Huntington's disease, migraine, concussion, and stroke.

OUR GLOBAL IMPACT

WE HAVE BUILT STRONG GLOBAL NETWORKS AND PARTNERSHIPS WITH RESEARCH CENTRES AND GOVERNMENTS.

› **NIH funded study to predict development of post-traumatic epilepsy**

Professor Terence O'Brien is leading Monash's key role in a \$25 million dollar international study to better predict the development of epilepsy after traumatic brain injury. Funded by the US's National Institute of Health (NIH), this important study lays the foundation for future clinical trials of therapies that may, for the first time, prevent the development of epilepsy.

› **Sleep in the military**

Sleep problems are prevalent in the military, particularly among service members who are currently in, or have been deployed in, highly stressful and volatile combat operations. Professor Sean Drummond is working with the US Defence Department to understand how sleep deprivation can affect decision-making in a group setting.

IN THE LAST FOUR YEARS WE HAVE SEEN SUBSTANTIAL GROWTH IN OUR COMPETITIVE RESEARCH INCOME. BETWEEN 2016 AND 2019 WE HAVE RECEIVED OVER \$18M FROM INTERNATIONAL SOURCES.

International research funding since 2016

2016	2017	2018	2019
\$2,304,070	\$2,877,985	\$4,599,275	\$8,432,705



OUR IMPACT THROUGH PARTNERSHIPS

MONASH NEUROSCIENCE RECOGNISES THAT THE IMPACT OF NEUROLOGICAL AND MENTAL HEALTH DISORDERS GOES FAR BEYOND THE CLINICAL SETTING, AND DEEP INTO THE COMMUNITY.

That is why a multidisciplinary approach to tackling these complex issues is paramount. **Monash Neuroscience** works collaboratively with government, industry and community partners to develop innovative solutions to manage the impact of neurological disorders within healthcare, education, employment and legal frameworks.

INDUSTRY

› Novo Nordisk

We are working with Novo Nordisk, a global healthcare company, to develop novel treatments for people suffering from diabetes and obesity. This strategic partnership, led by Professor Michael Cowley, aims to develop novel therapies that target the neural circuits involved in these disorders.

› TALi Health

TALi is a ground-breaking game-based training program for young children, designed by a team of neuroscientists at Monash. The program represents the culmination of over 25 years of research in developmental psychology and cognitive neuroscience. Through scientifically validated clinical trials, the program has proven to improve children's attention and cognitive processing. The program is accessed via a home-based tablet, making it available to users across a wide range of socio-demographic groups and geographic locations.

› Roche

In collaboration with global healthcare company, Roche, we launched the digital FLOODLIGHT platform and FLOODLIGHT Open study in 2019. Led by Professor Helmut Butzkueven and Associate Professor Anneke van der Walt, FLOODLIGHT allows people with MS to self-monitor neurological function by performing cognitive, hand and gait tasks using their mobile phone.

HEALTH SERVICES AND GOVERNMENT

› Peninsula Health

A new National Centre for Healthy Ageing at Monash's Peninsula campus will enable innovative approaches to complex challenges in the priority areas of ageing, rehabilitation, mental health and addiction. A health data and implementation platform and transformation facilities being created in partnership with Peninsula Health and the Australian Government underpin the Centre. The new infrastructure will provide a national exemplar for secure health data linkage and implementation expertise, and collaborative, cutting-edge environments to test new models of care and interventions with the potential to scale.

› Traffic Accident Commission (TAC)

Monash is working with the TAC to deliver world-leading research and insights into health and disability service delivery. One current project involves a longitudinal study following a large cohort of individuals who have sustained moderate to severe traumatic brain injury (TBI) over a 20-year period to provide a comprehensive picture of the impact of TBI on young people and their families. The findings of this study will be used in the development and evaluation of intervention strategies to improve quality of life in people who have sustained moderate to severe brain injuries.

› CSIRO

Dr Pablo Casillas-Espinosa and Professor Terence O'Brien are working with the CSIRO to develop machine learning algorithms that can better identify and predict seizures. Currently being validated in animal models with acute brain injury, this research has the potential to allow patients and their doctors to intervene before a seizure occurs.

- › Research led by Professor James Bourne at ARMI in collaboration with the CSIRO is developing novel implantable hydrogels that aims to minimise the impact of severe CNS trauma and neurosurgical procedures on adjacent surviving neurones. This collaboration capitalises on expertise in neurobiology, materials sciences and protein chemistry to develop a system that is capable of enabling controlled drug delivery while supporting brain mechanical and physiological integrity after implantation.

COMMUNITY

› David Winston Turner Endowment Fund

Monash University was the recipient of Australia's largest single gift to mental health, and is one step closer to providing ground-breaking research, training and treatment solutions for mental health conditions through the dedicated Turner Institute for Brain and Mental Health. Over the next five years, the David Winston Turner Endowment Fund will invest tens of millions of dollars into the Turner Institute, advancing research into obsessive-compulsive disorder (OCD), substance addiction, dementia, depression, ADHD, schizophrenia, and many other conditions.

› Grollo Ruzzene Foundation

A landmark study to better understand the health and wellbeing of young Australian women was made possible by philanthropic support from the Grollo Ruzzene Foundation. Conducted by Monash's Women's Health Group, the Grollo Ruzzene Younger Women's Health Study of 7,000 women aims to address the lack of research and understanding of the physical and mental health of young women, including commonly reported conditions such as polycystic ovary syndrome, also known as PCOS. Findings of this study will help Monash build an authoritative profile of the health of young women and their health care needs.

› Van Cleef Roet Endowment Fund

A \$3m endowment fund for the Professor of Neuroscience and Director of Neurology in the Department of Neurology, Central Clinical School and Alfred Health. The funds are used to support the work of outstanding early career translational neuroscientists in the Department of Neuroscience, including Associate Professor Richelle Mychasiuk (traumatic brain injury and gender effects), Associate Professor Piero Perucca (Epilepsy and Precision Medicine) & Dr Mastura Monif (Neuroinflammatory Diseases).

CONTACT US

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