Bionics Institute Annual Report

2022–23

Bionics Institute

The Bionics Institute is an internationally recognised, independent medical research institute that solves medical challenges with technology.

We lead the world in the research and development of innovative medical devices and therapies to improve human health.

Our multidisciplinary team comprises world-class scientists, engineers and researchers, and our laboratories are located at St Vincent's Hospital Melbourne, close to our clinical collaborators.

Together we transform the lives of people with a range of conditions, Alzheimer's disease, hearing impairment, Crohn's disease, limb loss, chronic pain, Parkinson's disease, epilepsy, stroke, and arthritis.

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Medical bionics is a multidisciplinary field of research combining **bio**(logy) and (electro)**nics** to develop devices that electrically modulate or monitor neural activity to provide innovative treatments for a range of medical conditions.

Our Year at a Glance

Graeme Clark Oration attended by 800 people

33 Research publications

Alzheimer's disease research launched

27 student placements

1 PhD conferral, 6 interns

News coverage

7 TV stories

5 radio features

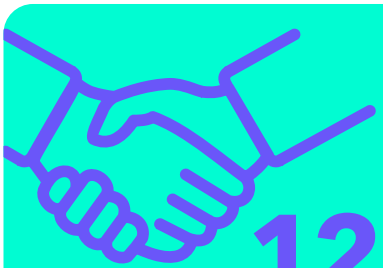
5 newspaper stories

27 new staff members recruited

Total government grant money awarded $1,377,522

Professor Kate Hoy recruited to lead Cognitive Therapeutics Program

Donations & philanthropic support $2,713,144



12 community events

GIRLS IN STEM MENTORING PROGRAM

expanded to 18 schools & 72 high school participants

White Paper: 'Building Australia Through Innovation' launched

Message from our Chair

I am delighted to present this Annual Report for the 2022–23 financial year. It highlights our achievements and the progress of our research to develop medical devices that could transform millions of lives around the world.

Innovation lies at the heart of the Bionics Institute. This is exemplified by our newest areas of ground-breaking research: using magnetic stimulation of the brain to delay memory loss in Alzheimer's disease; investigating a drug-free approach to chronic pain by stimulating nerves using a combination of light and electricity; and developing new bionic limb technologies to help patients who have undergone limb amputation as well as help those born with congenital limb malformation.

These treatments and therapies add to the novel projects into hearing impairment, Crohn's disease, Parkinson's disease, epilepsy, and rheumatoid arthritis led by our world-class team of scientists and engineers under the guidance of Professor James Fallon. All of which have the potential to help people worldwide to regain quality of life.

It was a great pleasure to join almost 1500 people at the industry and community-focused events we held over the last 12 months; events that highlighted our role as a world-class innovator.

Our White Paper launch, the Bionics Institute Graeme Clark Oration and two Innovation Lectures brought together key sector stakeholders – including entrepreneurs, government agencies and investors – to hear from med tech visionaries and explore ways to boost innovation in Australia. These initiatives have strengthened our position as an industry thought leader and I look forward to future opportunities to further develop partnerships across the med tech sector.

We welcomed four new members to the Board of Directors this year and will benefit enormously from the wealth of business experience each of them brings:

- Professor Sandra Kentish, chemical engineer and Redmond Barry Distinguished Professor at the University of Melbourne.
- Mr Michael Coleman, Director Macquarie Bank Ltd with a 40-year career in specialised financial and risk management.
- Ms Jennifer Dicker, Chair of the Steritech Pty Ltd Advisory Board for close to a decade.
- Ms Maureen O'Keefe, non-executive director of Vision 2020 Australia with a 30-year career in health, research, and education sectors.

I would like to express my deepest condolences to the friends and family of our Board member Brian Jamieson, following his passing in August 2023. Brian was an exceptional person who will be remembered for his kindness, generosity and significant contribution to the progress of the Institute.

I would also like to thank outgoing Board member Ken Jefferd for his contribution to the Board between December 2017 and November 2022.

> *"It is an honour to work with such a dedicated Board of Directors and I look forward to supporting the Bionics Institute team, under the leadership of CEO Robert Klupacs, to continue building our reputation as a world leader in medical device development."*

Mr John Stanhope AM
Chair

Message from our CEO

The 2022–23 year has seen rapid growth of the Bionics Institute. We have taken bold steps to speed up the development of medical devices to improve human health. It has been a year of moving forward and new beginnings.

At the Bionics Institute, we have a laser focus on translating our research concepts as quickly as possible into medical devices that will benefit patients.

A large proportion of medical research taking place today may take 20 to 30 years to benefit patients. In sharp contrast, we aim to translate our medical device prototypes from initial concept to first clinical trial within 5 years.

In addition, many of the medical devices under development at the Bionics Institute provide drug-free alternatives to current treatments and more accurate diagnostic tools, which could lead to huge savings in health costs.

Fast translation of research concepts into the clinic

I am tremendously proud of what all the teams across the Institute have accomplished this year.
In particular, several of our pioneering research projects matured into the next phase of development:

Vagus nerve stimulation research

We moved forward with the development of a device to reduce inflammation in rheumatoid arthritis. Based on the data generated this year, we now expect to enrol our first patient in a first-in-human clinical trial in June 2024 in collaboration with the Austin and St Vincent's Hospitals in Melbourne. The same device is set to commence a first-in-human trial in October 2023 in patients with inflammatory bowel disease (Crohn's disease) at the Austin Hospital.

EarGenie®

We began the first clinical trial in early 2023 of our EarGenie system, which tests sound discrimination in babies to help those born deaf or hard of hearing to develop speech. A new wireless prototype has been developed, which will be placed in four international clinical research labs to guide the final design needed for regulatory approval.

Alzheimer's disease

Since the establishment of our new Cognitive Therapeutics Program in August 2022, our researchers have set up a large-scale randomised clinical trial of a personalised treatment approach for Alzheimer's. Professor Kate Hoy has developed a treatment program using a non-invasive, painless brain stimulation technique that shows promise to improve memory loss in Alzheimer's patients.

These are just some of the medical devices and therapies we are developing to transform lives. You can learn more about all our ground-breaking projects throughout this Annual Report.

"We aim to translate our medical device prototypes from initial concept to first clinical trial within 5 years."

Investing in people with talent and vision

With a continued focus on research excellence, we have sought out world-class researchers with a visionary mindset and track record of achievements to join our team.

I am delighted that we have added bionic limbs and phantom limb pain research to our pillars of work, with the appointment of Professor Max Ortiz Catalán as Head of our Neural Prosthetics Research Program in June 2023.

Professor Ortiz Catalán is also the founder of the Center for Bionics and Pain Research (CBPR) in Sweden.

Professor Ortiz Catalán is leading the development of next generation bionic limb technology, which integrates prosthetics with a patient's bone, nerves and muscles – enabling a person to have sensory awareness of their artificial limb and accurately control their prosthesis as they would a biological limb.

Leading from the front

We have been steadfast in our mission to highlight the need for more strategic support of Australian research so that our nation can become a leader in med tech innovation.

In July 2022, we launched our Med Tech Talks podcast series, and have spoken to almost 30 influential sector leaders, researchers, entrepreneurs and investors about med tech commercialisation challenges and opportunities. We also held two highly successful Innovation Lectures, in September 2022 and May 2023.

We have synthesised the many stories and recommendations flowing from these initiatives into the Bionics Institute Innovation White Paper – Building Australia Through Innovation. It outlines four ways to supercharge innovation in our country to prompt our country's policymakers and leaders to take action so that Australia can realise its full R&D potential.

Inspiring the next generation of researchers

Our Girls in STEM Mentoring Program has grown exponentially, from just two students in 2019 to more than 70 students from 18 schools in 2023.

This year's participants were mentored by 30 leading female STEM professionals from across the sector including the Bionics Institute, Seer Medical, Orygen Specialist Program, Victoria Police and prominent universities.

I am delighted to say that the program is gaining momentum and we're expecting to have participants from across Australia taking part in 2024, aligning with our vision to have students from every high school in Australia benefit from the opportunity to take part.

I would like to thank our mentors, who take time out of their busy schedules to inspire the next generation of researchers, and also thank National Australia Bank for supporting our program.

Message from our CEO *cont.*

Thank you for supporting innovation for life

Our innovative research would not be possible without financial support. We are extremely grateful for the support of our individual donors, philanthropic trusts and foundations who believe in our mission. Your giving enables us to advance scientific discoveries and make a positive impact on the lives of people living with challenging medical conditions. Philanthropic donations provide vital funding for early-stage research and are essential for success in our applications for competitive government grants.

We gratefully acknowledge the research funding we receive from the Federal and State Governments. This funding included a $1.1 million Development Grant from the National Health and Medical Research Council (NHMRC) to further develop our EarGenie hearing assessment system and move the technology closer to commercialisation.

I would like to thank our dedicated Board, led by Chair John Stanhope AM, for their support and welcome our new Board members – Jennifer Dicker, Michael Coleman, Maureen O'Keefe and Professor Sandra Kentish.

It is with a great sense of loss that I acknowledge Brian Jamieson, who passed away in August, after a long illness. Brian will be remembered for his passion and drive, his mentorship and long-standing support of the Institute. Brian leaves behind a legacy of work that will continue long after he has gone.

Mr Robert Klupacs
CEO

"Together, we look forward to building on this growth to translate our research as quickly as possible so it can benefit people in just a few years.

We hope you enjoy reading about our progress in this year's Annual Report."

Vale Brian Jamieson, Bionics Institute Board Director

Current and former Bionics Institute Board members and staff were saddened to hear of the passing of Brian Jamieson on 7 August 2023. Mr Jamieson had a longstanding connection with the Bionics Institute over more than 21 years, first joining the Board in 2002 as Honorary Treasurer. During this time, the Institute benefited immensely from his expertise in financial management, in particular in his role as Chair of the Finance and Risk Committee. We also remember his warmth, keen sense of humour and wide circle of friends and work colleagues, many of whom he introduced to the Board.

Brian's contribution to the success of the Bionics Institute has been enormous and he will be sadly missed.

Our Board

We would like to thank the Board of Directors for their dedication and commitment to the mission of the Bionics Institute.

John Stanhope AM
Chair

John Bryson
Deputy Chair

Charles Bagot

Phil Binns

A/Prof Stella Clark AM

Michael Coleman

Hannah Crawford

Jennifer Dicker

Roger Gillespie OAM

Professor Sandra Kentish

Maureen O'Keefe

John Simpson AM

Sujata Stead

Dr Sherryl Wagstaff

Mike Younger

Our Impact

There are eight key research groups at the Bionics Institute, led by Professor James Fallon, Professor Kate Hoy, Professor Colette McKay, Associate Professor Chris Williams, Associate Professor Rachael Richardson, Associate Professor Andrew Wise, Professor Malcolm Horne and Dr Mehrnaz Shoushtarian.

These teams are supported by our excellent capability providers led by Dr Sheridan Laing: pre-clinical research (led by Dr Peta Grigsby), histology and in-vitro (led by Ella Trang), research support engineering (led by Dr Alex Thompson), design and development engineering (led by Owen Burns), data analytics (led by Dr Gautam Balasubramanian), and clinical research support (led by Dr Sally Herring) with electrode design and fabrication provided by our partners at Neo-Bionica (led by Ross Thomas and Jenny Zhou).

Report from our Chief Technology Officer and Head of Research Operations

Strengthened capability pillars

Consolidation and renewed engagement are the themes that summarise the last year for me.

The COVID-19 pandemic caused a significant structural change to the research operational model of the Institute, with the instigation of our capability pillars to support research across the entire Institute rather than in specific research projects. These capabilities (led by Dr Sheridan Laing) cover the full range of research activities undertaken at the Institute, from electrode design and fabrication (led by Ross Thomas and Jenny Zhou), research engineering (led by Dr Alex Thompson), animal based research (led by Dr Peta Grigsby), histology (led by Ella Trang), design and development engineering (led by Owen Burns), data analytics (led by Dr Gautam Balasubramanian), and clinical research (led by Dr Sally Herring). Each pillar provided the Bionics Institute additional resilience during the height of the pandemic and now provide world-leading foundations for all our research.

World class research leaders and programs

Consolidation of this model over the last year has not only allowed us to continue our exciting research across the diverse range of areas highlighted in this Annual Report but has also allowed us to attract new researchers and research programs to the Institute, including developing objective measures for movement disorders championed by Professor Malcolm Horne. Providing all our researchers with access to such a broad range of capabilities sets us apart from most academic institutions and allows us to nimbly adjust our research priorities as new opportunities present, while maintaining our deep expertise in stimulating and recording neural activity that underpins all our research.

The expert contributions from our capability pillars have also facilitated our researchers to re-engage with the broader research community while research activity continues apace. The last year has seen a flurry of ‘in real life’ attendances at conferences both nationally and internationally. For those of us with a few more grey hairs, we have been able to reinvigorate or start new projects with long-term collaborators, while for some others, particularly our PhD students, it has been a first taste of presenting their work on a larger stage. Of particular note, our researchers made a big impact at conferences this year, with prizes awarded to Dr Tommy Peng at the Association for Research in Otolaryngology MidWinter Meeting in Florida, and Elise Ajay at the SPIE Photonics West capitalise Conference in San Franscisco. These prizes highlight our continued excellence in hearing research which encompass potential treatments and diagnostic tools at all stages of life, from an infant hearing test to restoring age-related hearing loss as well as research into the next generation of cochlear implants utilising optogenetics to allow us to ‘hear’ light.

Exciting research milestones

Our optogenetics team, led by Associate Professor Rachael Richardson, is also harnessing the power of light in efforts to treat intractable pain by stimulating the sciatic nerve. This is the latest addition to our peripheral nervous system stimulation work which also includes our vagus nerve stimulation device to treat Crohn’s disease (we have started recruiting participants with the aim of having the first participant with this technology in the 2023–24 financial year) and rheumatoid arthritis (planned to be in trial in 2024). In parallel, we continued to develop technology to record activity from the peripheral nervous system to allow our devices to adapt to a patient’s changing needs. One of the things that sets the Institute apart is that all these technologies and devices are supported with both high-quality academic publication and intellectual property protection, maximising the likelihood that our innovations will transform as many lives as possible.

Innovation is at the heart of what we do

Our focus on innovations that can be rapidly translated into real world impact has also been evident in the continued commercial development of our epilepsy monitoring technology by Epi-Minder and innovative treatments for Parkinson's disease by Deep Brain Stimulation Technologies. The successful transition of these technologies to a commercial phase sees reduction in efforts in these areas from the Institute, opening up the opportunity to increase efforts focused on developing advances in treatments for Alzeimer's disease, led by Professor Kate Hoy. Similarly, our research programs previously focused on vagus nerve stimulation for diabetes and developing objective measures for Parkinson's disease have been replaced with programs utilising aspects of their underlying technologies aimed at developing novel treatments for a range of inflammatory conditions and non-invasive stimulation to improve gait in Parkinson's disease patients.

Our joint initiative with the University of Melbourne to set up a medical device prototype manufacturing facility, Neo-Bionica, continues to thrive and has proven to be an excellent avenue for our researchers to gain an insight into the global med tech industry, while providing our expertise to a range of both small and large companies developing the next generation of medical devices.

Professor James Fallon
Chief Technology Officer and
Head of Research Operations

"All in all, we had a very successful year. We are positioning ourselves to have continuing success by focusing on strengths, which are our people and their unified commitment to research and innovation to solve medical challenges and transform lives, while most importantly, ensuring we have fun doing it."

Bionics Incubator Fund projects

BIF supported project

Throughout this Annual Report, there are several projects listed with a BIF symbol. The **Bionics Incubator Fund (BIF)** supports our researchers to explore new research ideas. Look out for this symbol throughout the report and learn about some of our early-stage BIF projects on p37.

Brain Research

New research has launched at the Bionics Institute with the recruitment of internationally recognised researcher Professor Kate Hoy, who is preparing to launch a world-first clinical trial to investigate whether a treatment called Transcranial Magnetic Stimulation (TMS) could be effective in fighting memory loss in Alzheimer's disease. In the field of Parkinson's disease, our researchers are investigating peripheral stimulation for gait impairments, and a hybrid stimulation technique using light and electricity is being studied as a means of enhancing deep brain stimulation (DBS).

Case study
A new frontier in Alzheimer's disease research

New Alzheimer's disease research launched at the Bionics Institute in August 2022, with the recruitment of internationally recognised researcher Professor Kate Hoy.

Professor Hoy was appointed Head of the Cognitive Therapeutics Program to research a new potential treatment for memory loss in Alzheimer's disease, the most common form of dementia.

There are 55 million people worldwide living with dementia. Despite significant financial investment and decades of research there are still no effective treatments.

However, this may change with a potentially ground-breaking treatment being investigated by Professor Hoy who has found that a brain stimulation treatment called Transcranial Magnetic Stimulation (TMS), which is an effective treatment for depression, may also improve cognition.

Explaining the painless, non-invasive procedure, Professor Hoy says that TMS uses magnetic pulses to induce an electrical current in the brain, causing cells to fire.

> *"Results from initial research using TMS to improve cognition and fight memory loss in Alzheimer's patients are promising. We're about to launch a large-scale clinical trial to establish a personalised treatment approach – the first of its kind in the world."*

Professor Kate Hoy
Head of Cognitive Therapeutics Program

Case study
A carer's story

Having watched her 92-year-old mother deteriorate from Alzheimer's over the past 10 years, Cheryl Conway understands the importance of supporting research into a new treatment for the disease.

Cheryl says that with Alzheimer's, "You lose your parent while they're still alive".

"Before my mother went into the nursing home it was awful. She'd ring me 20 to 30 times a day. She couldn't remember how to use the oven or the washing machine. She ate like a bird and the weight just fell off.

> *"I just want Mum to enjoy her final years, come to family gatherings, hold her great grandchildren."*

Cheryl Conway,
Alzheimer's carer

Research report

Fighting memory loss in Alzheimer's disease

Alzheimer's disease is a devastating illness, not only for the individual but also for their loved ones. And yet, despite considerable financial investment and decades of research, there are still no effective treatments. This represents an extraordinary unmet global need.

At the Bionics Institute, our researchers are investigating a novel treatment approach, Transcranial Magnetic Stimulation (TMS). TMS uses magnetic pluses that pass freely into the brain and induce an electrical current that causes brain cells to fire. When this stimulation is applied repeatedly over several weeks, it can induce lasting changes throughout the brain.

This treatment aims to use brain stimulation to restore as much healthy brain function in Alzheimer's as possible.

In Alzheimer's disease, proteins such as amyloid and tau build up in and around brain cells, damaging how they function. This build-up leads to changes in the way brain cells fire, ultimately disrupting how the brain is connected. This is known as dysfunctional connectivity and has been closely linked to impaired cognition in Alzheimer's. Even if the protein burden can be reduced, the damage that is done to brain connections will remain and cognition will continue to be impaired.

The approach our researchers are taking with brain stimulation is to develop a personalised form of treatment to directly target and improve connectivity in people with Alzheimer's and, by extension, improve cognitive function. We hope that by personalising treatment, it will provide the best chance of improving cognition for as many people as possible.

Research highlights

Over the last 12 months our team has been working hard to set up a clinical trial into TMS. This includes obtaining ethics and governance approval, recruitment of staff, developing analysis pipelines to allow the generation of personalised treatment protocols and engaging with stakeholders to ensure the successful commencement of the trial.

Key project highlights during this time include:

- Recruitment of key research team members: Dr Sung Wook Chung (Data Analyst) and Danielle Holland (Clinical Research Assistant).
- Establishment of the Alzheimer's TMS Clinical Trial Network (AT-CTN), a network of clinical TMS services that will be able to provide trial treatments across a wider geographical area.
- Commencement of screening and enrollment of our first participant into the trial.

Meet the team

Professor Kate Hoy, Dr Oscar Murphy, Danielle Holland and Dr Sung Wook Chung.
External collaborators: Professor Paul Fitzgerald (Australian National University and Monarch Mental Health Group), Associate Professor Bernadette Fitzgibbon (Monarch Mental Health Group), Dr Neil Bailey (Australian National University and Monarch Mental Health Group), Associate Professor Sharna Jamadar (Monash University), Dr Natalie Thomas (University of Melbourne), Dr Renata Lemke (Alfred Health) and Associate Professor Caroline Gurvich (Monash University).

Research report

Peripheral stimulation for gait impairments

Parkinson's disease is a chronic, progressive movement disorder that affects over 10 million people worldwide. This challenging condition causes nerve cells (neurons) that are essential for normal movement and coordination to stop working properly.

Gait (walking) difficulties are among the most common symptoms of Parkinson's. Other symptoms of Parkinson's include difficulty initiating or turning while walking; and slower, shuffling steps that can result in increased falls, injury and reduced quality of life.

In this project we aim to apply non-invasive stimulation to the feet to restore regular walking ability for individuals with Parkinson's.

Despite the prominence of gait disorders in Parkinson's disease, few therapeutic options are available. Medication and deep brain stimulation (an invasive surgical technique) can help but often do not return walking ability to normal.

Therefore, a significant gap in the treatment of gait impairments exists, and new treatments are needed to prevent falls and risk of injury, especially in older people.

Funding and research communication highlights

This research is supported by funding from the Promobilia Foundation in Sweden.

Meet the team

Dr Mehrnaz Shoushtarian, Professor James Fallon, Michelle Bravo and Tom Playsted.
External collaborator: Professor Robert Isanek (Monash University).

Optogenetics and deep brain stimulation BIF

Deep brain stimulation (DBS) is a proven treatment for several neurological and psychiatric disorders, but side effects persist in contemporary DBS treatments. With optogenetics, a genetic modification in the specific target nerve type is used to make it sensitive to light.

This study explores hybrid stimulation (light and electricity) to precisely activate target neurons to mitigate the risk of side effects and enhance DBS therapy outcomes.

Meet the team

Dr Niliksha Gunewardene, Associate Professor Rachael Richardson, Dr Tomoko Hyakumura, Dr Joel Villalobos, Kyle May and Jerico Matarazzo.

Autoimmune and Chronic Condition Research

Using electricity to alter the activity of nerves has given rise to a broad range of promising new treatments for autoimmune diseases and chronic conditions that are poorly controlled by drugs. Using this technology, our researchers, led by Professor James Fallon, have developed a device that provides therapy via the vagus nerve to prevent the recurrence of Crohn's disease. Our researchers are using this vagus nerve technology to provide therapy for rheumatoid arthritis. We are also developing an innovative peripheral nerve recording technology that allows our researchers to listen or 'eavesdrop' on the activity of the peripheral nerve which may have several applications, including in helping bladder control in patients with incontinence.

Case study

Finding new solutions for autoimmune and chronic conditions.

Dr Sophie Payne

Dr Sophie Payne has been at the forefront of the development of an innovative medical device that harnesses the vagus nerve to treat inflammatory diseases for patients not responding to medication.

In a major milestone for Dr Payne and her team in 2022–23, this novel device began clinical trials for inflammatory bowel disease and is also being adapted for rheumatoid arthritis, with the aim to go into clinical trials in 2024.

With approximately 7 million people worldwide living with inflammatory bowel disease and 20 million people worldwide affected by rheumatoid arthritis, this anti-inflammatory technology has the potential to change the lives of millions of people around the world.

Inflammatory bowel disease and rheumatoid arthritis are chronic, progressive diseases. Current treatment options, such as life-long immuno-suppressant drug therapies, have unpleasant side effects and over time, these drug therapies often stop working, representing a clear gap in current treatment outcomes.

Seeking to address this unmet clinical need, Dr Payne has led a multi-disciplinary research team in her role as Senior Research Fellow and Head of the Peripheral Interface Neuromodulation Team to establish the efficacy and safety of this device. This included designing the electrode array in collaboration with the engineering team; developing surgical approaches in pre-clinical models in collaboration with senior clinicians; and completing all the requisite research to gain ethics approval for the first-in-human clinical trial, alongside Professor James Fallon, Chief Technology Officer of the Bionics Institute.

The device comprises an electrode array, the size of a thumbnail, implanted via keyhole surgery onto the vagus nerve under the diaphragm. The device uses electricity to stimulate the body's natural anti-inflammatory reflex to decrease pain and swelling associated with inflammatory bowel disease and rheumatoid arthritis.

Top female scientists changing the world

Dr Sophie Payne was named as one of Australia's 'Top 25 female doctors and scientists changing the world' (Herald Sun, Daily Telegraph) in March 2023.

Research report

Harnessing the body's natural anti-inflammatory pathways

Crohn's disease

In 2015, the Bionics Institute started research into a new bionic therapy for the treatment of inflammatory bowel disease. Around 80% of people with Crohn's disease, characterised by inflammation of the gut, eventually need surgery to remove sections of the bowel if drug treatments stop working. The benefits of surgery are often temporary. Our research aims to provide an alternative therapy to prevent recurrence and reduce the effects of the disease.

Within just 4 years, the research team - including Professor James Fallon, Professor Rob Shepherd, Professor John Furness and Dr Sophie Payne - designed, tested and validated a prototype device ready for a first-in-human clinical trial.

Our new medical device uses electricity to stimulate the vagus nerve – a nerve that runs from the brain to the gut and controls the body's natural anti-inflammatory response. A key innovation is the location of the device. We chose to stimulate the vagus nerve in the abdomen, rather than in the neck as others do, to maximise the therapeutic benefit while minimising any unwanted side effects to the heart and lungs. Powered by a small battery, the device is designed to stop inflammation from damaging the gut, preventing the need for further surgery, with the aim of transforming the lives of people living with Crohn's. The trial, called the ElectRx Study, is active and currently recruiting participants with the disease.

Rheumatoid arthritis BIF

Dr Sophie Payne's team is working on a revolutionary new treatment for rheumatoid arthritis. Based on the technology developed for Crohn's disease, the new device aims to stimulate the vagus nerve to kick-start the body's natural anti-inflammatory response in a similar way. This in turn dampens the inflammation causing joint pain and stiffness, allowing people with rheumatoid arthritis to move freely without constant pain.

Like the technology for Crohn's disease, this device is positioned on the vagus nerve in the abdominal cavity, rather than at neck level, which is in contrast to vagus nerve treatments for rheumatoid arthritis trialled by other research institutes. This means that unwanted side effects to the heart and lungs are avoided. In addition, the device is powered by a battery that sits under the skin at hip level and only needs to be changed every 10 years, which means it is a set-and-forget treatment.

Although a range of drug treatments is available for rheumatoid arthritis, they can cause unpleasant side effects and nearly half of patients with rheumatoid arthritis don't respond to treatment. This new device will provide a drug-free treatment to give people with rheumatoid arthritis a new lease on life. We are currently preparing to launch this technology into a clinical trial and anticipate we will be recruiting participants by mid-2024.

Funding and research communication highlights

Crohn's disease

Professor James Fallon's team is supported by the US Government's Defense Advanced Research Projects Agency.

Rheumatoid arthritis

Dr Sophie Payne's team is supported by the Bionics Incubator Fund and a generous donor.

Research highlights

Crohn's disease

After receiving ethics approval to start our first-in-human clinical trial in Crohn's disease patients with our collaborators at the Austin Hospital in Melbourne, we have started recruiting participants with the aim of implanting the first participant with this technology in the 2023–24 financial year. The first participants to receive the device will be patients already scheduled for bowel resection surgery and they will have our device implanted in the same operation.

Rheumatoid arthritis

We have secured significant funding that has kick-started our activities around preparing this technology for clinical trial. We have formed a clinical team that will be supporting the translation of our Vagus Nerve Stimulation technology (VNS) into a trial for patients with rheumatoid arthritis.

Meet the team

Crohn's disease

Professor James Fallon, Dr Sophie Payne, Owen Burns, Ross Thomas and Michelle Bravo.

External collaborators: Professor Rob Shepherd (University of Melbourne), Professor John Furness (University of Melbourne), Professor David Grayden (University of Melbourne), Dr Martin Stebbing (The Florey), Professor Bob Jones AM (University of Melbourne), Mr Graham Starkey (Austin Health), Mr David Proud (Austin Health) and Associate Professor Peter De Cruz (Austin Hospital).

Rheumatoid arthritis

Dr Sophie Payne, Professor James Fallon, Dr Tomoko Hyakumura, Dr Sally Herring and Dr Mikhail Korneev.

External collaborators: Associate Professor Evange Romas (St Vincent's Hospital), Dr Shereen Oon (St Vincent's Hospital) and Mr David Proud (Austin Health).

New targets for vagus nerve stimulation BIF

We found that abdominal vagus nerve stimulation can activate the key brain region important for treatment of some brain disorders. This indicates that abdominal vagus nerve stimulation has the potential to treat conditions such as drug-resistant epilepsy and depression similarly to cervical vagus nerve stimulation, but without the cardiac and respiratory side effects.

Meet the team

Dr Tomoko Hyakumura, Dr Sophie Payne, Jerico Matarazzo, Dr Wendy Adams and Professor James Fallon.

Research report BIF

Eavesdropping on the peripheral nerve

We have developed innovative peripheral nerve recording technology that allows us to listen in or 'eavesdrop' on the activity of peripheral nerves. So far, we have shown that our eavesdropping technology is safe and detects tiny nerve signals in the body over several weeks without a loss of signal quality. Eavesdropping on peripheral nerve activity will have many different benefits and applications. We have demonstrated that our technology is selective in picking up tiny neural signals during urination and could eventually be used in bionic systems bladder control in patients with incontinence.

As a next step, we have begun experiments that aim to eavesdrop on a peripheral nerve in the leg (sciatic nerve) to monitor motor and sensory signals, with potential application for neuroprosthetic devices.

Funding and research communication highlights

This project is supported by the NIH-SPARC fund (bladder work) and the Bionics Incubator Fund (eavesdropping on the sciatic nerve). Our paper describing the selectivity of our eavesdropping technology for use in bladder control is nearly published.

Research highlights

We have generated exciting pilot data that demonstrates we are able to detect multiple sensory fibre populations. This data is being used to secure funding for large government grants.

Meet the team

Professor James Fallon, Dr Sophie Payne, Jerico Matarazzo, Dr Tomoko Hyakumura, Dr Alex Thompson, Chiara Braida, Lisa Dyball and Alex Hill.

External collaborators: Janet Keast (University of Melbourne).

Developing miniaturised peripheral nerve-interfaced technology BIF

Using electricity to alter the activity of nerves, dubbed 'electroceutical therapy', is a viable alternative to drug treatment. In particular, stimulation of the vagus nerve is an effective treatment for a wide range of diseases including inflammatory bowel disease and rheumatoid arthritis. The overall goal of this proposal is to develop a miniature device for long-term use in mice using innovative fabrication techniques. This project will build the knowledge required to investigate vagus nerve stimulation for a wide range of diseases.

Meet the team

Dr Sophie Payne, Professor James Fallon, Dr Tomoko Hyakumura, Daniel Williams-Wynn, Ethan Duff and Isabel Day.

Hearing and Vision Research

The Bionics Institute has a long, proud history of developing medical devices to diagnose and treat hearing and vision impairment. We continue to seek new ways to improve the cochlear implant, originally developed by the Bionics Institute's founder Professor Graeme Clark AC, to develop diagnostic tools for infant hearing and tinnitus; restore hearing to people with age-related hearing impairment using nanotechnology and gene therapy; and conduct bionic eye research.

Case study

The next generation of research superstars

Elise Ajay

Elise Ajay's passion for music and her keen interest in the field of prosthetics led her to undertake a PhD with the Bionics Institute's hearing team in optogenetics under the supervision of Associate Professor Rachael Richardson, Professor James Fallon and Professor David Grayden. Elise's project is titled: 'Combined optogenetic and electrical stimulation in the cochlea'. She is expected to complete her degree in 2024 through the University of Melbourne on a Graduate Research Scholarship.

A prodigious research talent, Elise has achieved an impressive list of early-career achievements, including winning the 2021 Pitch it Clever competition and Best Student Speaker at the 2022 Australasian Auditory Neuroscience Workshop. She gave podium presentations at the BiOS Photonics West (San Francisco) Conference and the Association of Research in Otolaryngology (ARO) MidWinter Meeting (Florida) and has also achieved the significant milestone of having her first paper published in March 2023 in the *Journal of Neural Engineering*.

Elise is passionate about bionic devices and how her research at the Bionics Institute allows her to investigate using different types of stimulation to control disease and improve patient outcomes. Elise said,

> *"I feel incredibly privileged to have been able to do a PhD at the Bionics Institute – I am very proud of the work I've done here and feel immense gratitude for the training and support I have received from every person here throughout my project."*

Onn Wah (Steven) Lee

A talented PhD student, Steven Lee won Best Student at the 2022 Bionics Institute Field Rickards Awards. Steven is working on the project 'Assessing speech detection and discrimination in sleeping infants using functional near-infrared spectroscopy (fNIRS)', under the guidance of Professor Colette McKay and Dr Julia Wunderlich. Supported by the University of Melbourne's Graduate Research Scholarship, he is expected to complete his degree in 2024.

Steven's most recent achievements are the publication of his first study in *Ear and Hearing* in January 2023 and the award of Best Poster Presenter at the fNIRS UK Symposium 2023. Steven's investigation revealed novel fNIRS responses associated with sleeping infants, prompting the initiation of a patent application process.

Steven regards the Bionics Institute as an ideal platform for intellectual growth – a perspective driven by its positive, supportive and forgiving work environment.

Steven says that the "culture of sharing ideas and mutual support sets the Institute apart, fostering an atmosphere that contrasts with the competitive nature often found in other academic institutions".

> *"Never in my life have I felt so comfortable in approaching my supervisors and team to admit my mistakes; it is testament to the culture that the Institute has created."*

Research report

Establishing an objective measure of tinnitus

Tinnitus is described differently by everyone who experiences it, and reliance on self-reported symptoms makes diagnosis and monitoring of this condition difficult.

Our Tinnitus Research team, led by Dr Mehrnaz Shoushtarian, has developed a new way to objectively measure tinnitus using a non-invasive optical imaging device.

The device shines near-infrared light into the head using light sources set into a cap. This technology, called functional near-infrared spectroscopy (fNIRS), measures changes in blood oxygen levels in the brain.

The light reflected back is recorded, providing detailed information on brain activity. Our data has shown over 80% accuracy in distinguishing between tinnitus and controls and mild versus severe tinnitus.

Finding a way to measure the presence and severity of tinnitus will inform diagnosis and treatment selection and could lead to the development of new treatments.

Research highlights

Over the past 12 months, we have continued our data collection and now have a dataset of more than 160 individuals. This dataset has enabled us to validate our initial findings (published in November 2020) and to further increase the accuracy of our algorithms. Thanks to generous philanthropic support, we have engaged a data scientist for 6 months to assist in further development of our algorithms.

In recent months we have also completed a study to use peripheral measures such as heart rate in addition to fNIRS, to further improve our algorithms. Findings from the study have been submitted for publication and are currently under review.

Our main goal for the next 12 to 48 months is to develop a prototype fNIRS device with our algorithms integrated, to enable large multi-site clinical trials of our objective measure with potential tinnitus treatments.

Funding and research communication highlights

This research was presented to the American Academy of Audiology in Seattle in April 2023.

The research was also highlighted on the Treble Health podcast (a remote telehealth audiology practice based in the USA).

Meet the team

Dr Mehrnaz Shoushtarian, Michelle Bravo and Professor James Fallon.
External collaborator: Dr Nandakishor (University of Melbourne).

Research report

Ensuring hearing impaired infants get the best start in life

Professor Colette McKay's EarGenie® team has developed an advanced hearing test device to support speech and language development in infants with hearing challenges.

Unlike traditional tests, EarGenie offers vital insights into a baby's hearing during the crucial early months. This early stage is pivotal for effective intervention; untreated hearing issues can lead to persistent communication difficulties.

EarGenie employs light-based imaging (fNIRS; functional near-infrared spectroscopy) to track changes in brain oxygen levels, indicating a baby's response to a sound or a change in sound. This technology assesses the effectiveness of hearing aids or cochlear implants for hearing and speech success. Additionally, it aids babies who have auditory neuropathy, a condition where current tests methods fail, by measuring the severity of the hearing condition and enabling early intervention.

Project highlights

This year, the EarGenie team achieved significant milestones with the development of our EarGenie Minimal Viable Product (MVP) prototype and the start of our first clinical trial.

Thanks to investments from the University of Melbourne Genesis Pre-Seed Fund and the Bionics Institute, plus generous grants and donations from government, supporters and groups detailed on the next page, our hearing assessment technology is progressing toward global accessibility for audiologists.

In partnership with Design + Industry, a commercial medical device design company, we have enhanced our previous prototype into a wireless version. The baby's headband, equipped with custom electronics and near-infrared light components, will connect via bluetooth to the audiologist's computer. This user-friendly design will eliminate cable clutter during testing, enhancing convenience for parents and audiologists alike.

The intuitive EarGenie software aims to automatically analyse the infant's brain responses in real-time during testing, providing instant results. Over the next 12 months, our devices will be deployed in international clinical research labs (UK, Denmark, USA) to refine the final design for regulatory approval.

Our first clinical trial for babies with hearing loss began this year, utilising the research version of EarGenie tests. With the upcoming EarGenie MVP, we plan to expand the trial in early 2024 through collaborations with Hearing Australia, Royal Victorian Eye and Ear Hospital's Cochlear Implant Clinic, and University Hospital Geelong's Audiology Department.

Our dedicated PhD students, Onn Wah (Steven) Lee and Ishara Paranawithana, are in the final stages of their studies and are diligently preparing journal manuscripts and refining their theses.

Steven has made noteworthy progress in understanding fNIRS brain responses in sleeping infants, uncovering two distinct contributions – one of which evolves throughout the test duration.

He is exploring how this insight can enhance our understanding of speech detection and discrimination responses in sleeping infants and lead to even greater test accuracy.

Research report

Ensuring hearing impaired infants get the best start in life *cont.*

Ishara's research has demonstrated the application of our non-invasive optical brain imaging technology to chart age-related changes in connectivity among different language regions of the brain. This innovative technique holds potential for advancing our understanding of speech and language challenges often observed in children with hearing impairments.

Both Steven and Ishara have significantly contributed to the EarGenie research initiative, which is poised to greatly benefit infants with hearing loss, aiding their journey toward successful hearing and speech development.

Funding and research communication highlights

Professor Colette McKay's EarGenie work is supported by government grants from the National Health and Medical Research Council (NHMRC), the Medical Research Future Fund (MRFF) and the Victorian Medical Research Acceleration Fund (VMRAF), as well as funding from Lions Clubs Australia, the Passe and Williams Foundation and the Royal National Institute for Deaf People (RNID) in the United Kingdom.

Meet the team

Professor Colette McKay, Dr Julia Wunderlich, Dr Darren Mao, Dr Gautam Balasubramanian, Dr Demi Gao, Linty McDonald, Onn Wah (Steven) Lee, Ishara Paranawithana and Mark Harrison.

Victorian Government accelerates EarGenie

As featured on Channel 9 News, the Bionics Institute's new hearing diagnostic system for babies, EarGenie, is one step closer to being available in clinics, with the announcement of a $500,000 grant from the Victorian Government's Victorian Medical Research Acceleration Fund (VMRAF).

The Minister for Health, The Honorable Mary-Anne Thomas made the announcement at the Bionics Institute in May 2023. The funding will be used for further clinical trials for this revolutionary technology.

Research report

Individual optimisation for cochlear implant users

Researchers in Professor Colette McKay's hearing research group are investigating why some cochlear implant recipients do not understand speech as well as others.

Led by Dr Tommy Peng and Professor Colette McKay, this work aims to help clinicians (and patients) build an understanding of an individual's specific neurological barriers, with the aim of enabling cochlear implant users to hear with confidence.

Long term goals of the project are to design, implement and evaluate clinical techniques that will overcome the unique barriers of each patient, meaning that cochlear implant recipients will be able to hear better in noisy classrooms, communicate better in workplaces and confidently participate in interactions with loved ones.

Research highlights

In a longitudinal study, our researchers have been assessing three factors that can affect speech understanding with the cochlear implant: uneven or poor survival of auditory neurons in the cochlea; difficulty processing information in the auditory brain pathways; and detrimental brain changes because of deafness. We have recruited 41 study participants so far and published three papers that showed the brain regions that respond strongly when people are listening to a story, and how those differ for very new cochlear implant users.

Our preliminary results show that a larger variation in neural survival in the cochlea is associated with poorer speech understanding outcomes for cochlear implant users. We have also found that brain activation during lip-reading tasks can predict speech understanding outcomes. This work was ably assisted by Master of Clinical Audiology student Jessalynn Sukamto.

These research findings were presented at the 2023 Association for Research in Otolaryngology MidWinter Meeting (Florida).

Our next steps are to use this patient-specific information to guide how devices are programmed and tailor clinical rehabilitation techniques to improve speech perception for cochlear implant recipients.

Funding and research communication highlights

This research is funded by a Project Grant awarded to Professor Colette McKay from the National Health and Medical Research Council (NHMRC). Dr Tommy Peng is supported by a Passe and Williams Foundation Junior Fellowship.

Meet the team

Dr Tommy Peng, Professor Colette McKay, Linty McDonald and Jamal Esmaelpoor.

External collaborators: Professor Maureen Shader (Purdue University), Assistant Professor Beth Jelfs (University of Birmingham), Dr Bob Carlyon and Dr Charlotte Garcia (Cambridge University).

Research report BIF

A hybrid approach using light and electricity

Devices like the cochlear implant use tiny pulses of electrical current to efficiently activate nerves in the body. However, because the electrical current spreads out from the stimulating electrodes, it is difficult to confine the current to a small area. Furthermore, the electrical current cannot target a particular type of nerve in a mixed nerve population. This lack of precision and selectivity can lead to unpleasant or serious side effects.

Optogenetic techniques can improve precision and selectivity of nerve activation. With optogenetics, a genetic modification in the specific target nerve type is used to make it sensitive to light. When light is applied to the tissue, only the modified nerves respond to the light, giving extraordinary control over the selectivity of nerve activation in mixed neural populations. Since light can be easily focused, this technique gives a high degree of control over the area that is stimulated.

Our Optogenetics team, led by Associate Professor Rachael Richardson, is investigating the use of optogenetic techniques in three areas: the auditory system, the visual system and the peripheral nervous system. The team is particularly interested in examining how light can be combined with electrical stimulation to take advantage of the best properties of each type of stimulus.

Research highlights

Different electrodes or 'channels' of the cochlear implant are used to convey different pitches of sound, so it is important that each electrode can activate distinct auditory nerves without overlap from neighbouring channels. Our research shows that optogenetic methods can improve the independence of each stimulating channel without interference from a neighbouring channel. We found that combining optogenetics with electrical stimulation allows us to use less light, which is useful for clinical implementation in a device and increases fidelity of the responses of the nerves to the stimulation, which is important for speech processing strategies in the cochlear implant.

We are applying a similar strategy for the development of a retinal prosthesis for people experiencing blindness as a result of loss of photoreceptors in the retina. Our research shows that with the combined strategy, we can use less light and activate visual nerves with higher spatial precision. Both of these aspects will be important in the development of a retinal prosthesis that restores vision with higher resolution than is currently possible with electrical-only methods.

Damage to the sciatic nerve is a common cause of debilitating back pain. The sciatic nerve is a bundle of mixed nerve fibres, each with many distinct functions. Application of electrical pulses to the sciatic nerve can relieve chronic pain associated with nerve injury, but the electrical current non-selectively activates all the nerve fibres, which can cause unpleasant sensations and unwanted twitching of the muscle. Optogenetic techniques allow us to activate a selective group of fibres such as those involved in pain circuits, while leaving other nerve fibres unaffected. We have developed a technique to target the nerve fibres of interest with a genetic modification that allows these nerves to respond to light and demonstrated exclusive activation of these nerve fibres. Furthermore, we applied combined optogenetic and electrical stimulation to the modified nerve and demonstrated that we could improve the size and fidelity of the response without affecting selectivity.

A hybrid approach using light and electricity *cont.*

Funding and research communication highlights

The Optogenetics team is supported by funding from the National Health and Medical Research Council (NHMRC), the Victorian Medical Research Acceleration Fund (VMRAF), the CASS Foundation and the Bionics Incubator Fund.

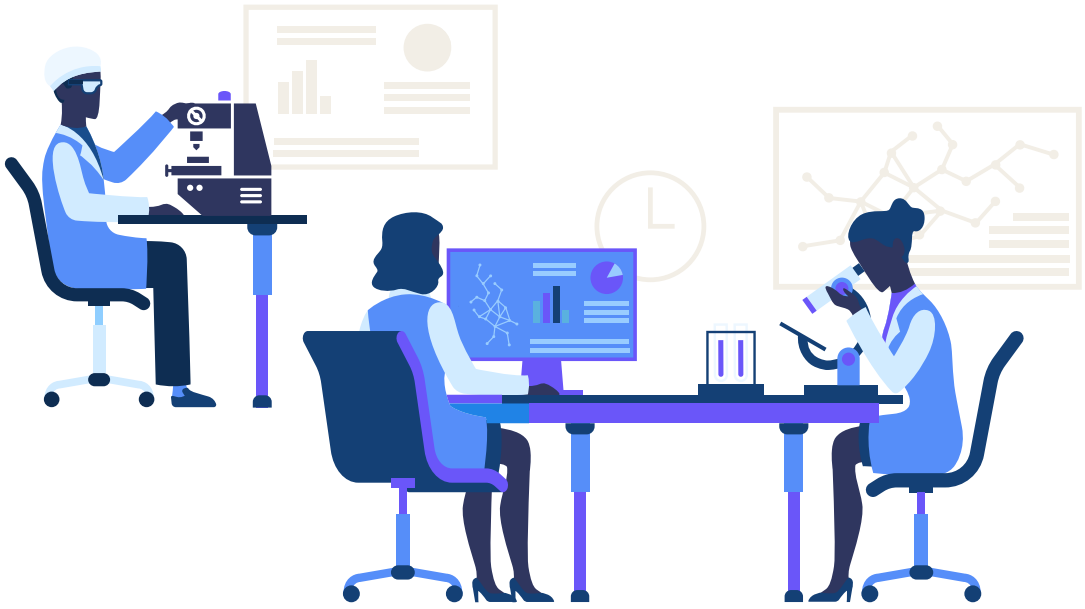
Associate Professor Rachael Richardson was an invited speaker at the Australian Pain Society Meeting (Canberra, April 2023), Optogenetics Australia Meeting (Adelaide, February 2023), Australasian Neuroscience Society Forum (Melbourne, January 2023) and the Brain Neuromodulation Research Symposium (Newcastle, September 2022). She also presented at the online Association for Research in Otolaryngology International Lecture Series (January 2023).

Our work has also been presented at the Association for Research in Otolaryngology MidWinter Meeting (USA, February 2023) and the SPIE International Society for Optics and Photonics Conference (USA, January 2023). Our research has been published in peer-reviewed journals such as *Frontiers in Neuroscience, Journal of Biological Signal Processing and Control* and the *Journal of Neural Engineering*.

Meet the team

Associate Professor Rachael Richardson, Professor James Fallon, Associate Professor Andrew Wise, Dr Sophie Payne, Dr Alex Thompson, Dr Niliksha Gunewardene, Dr Mary Ardren, Jerico Matarazzo, Flip Kammerer, Elise Ajay and Ajmal Azees.

External collaborators: Professor Paul Stoddart (Swinburne University), Dr Anita Quigley (RMIT), Professor David Garrett (RMIT), Professor Michael Ibbotson (National Vision Research Institute), Dr Wei Tong (National Vision Research Institute), Dr Emma Brunton (National Vision Research Institute), James Begeng (National Vision Research Institute), Professor Stephen O'Leary (University of Melbourne), Professor David Grayden (University of Melbourne) and Dr Patrick Ruther (University of Freiburg).



Research report BIF

Restoring hearing loss using gene therapy

Dr Niliksha Gunewardene's research team is focused on testing a novel gene therapy approach to regenerate the sensory hair cells in the cochlea as a treatment for deafness.

Hair cells are the sensory cells that respond to sound in the cochlea. Hair cell loss is a hallmark of deafness affecting more than 430 million people worldwide and more than 3.6 million Australians, representing a significant socio-economic burden on our healthcare system. Critically, there is no cure for deafness once hair cells are lost. Thus, regenerative therapy to replace lost hair cells is a highly attractive solution that has not yet reached the clinic.

Gene therapy is an emerging treatment for deafness. It involves replacing a mutated gene by delivering a functional copy using a viral vector. Although gene replacement strategies are promising, only a small number of patients are eligible for the treatment. Cell reprogramming could be the solution. By activating a certain combination of genes to reprogram cell identity, it is possible to reprogram the resident stem cells of the cochlea (supporting cells), to convert into hair cells.

This project aims to develop a novel cell reprogramming therapy to stimulate hair cell regeneration and reverse hearing loss. Our research aims to provide a therapeutic solution for people with sensorineural hearing loss.

Research highlights

This year, we completed pre-clinical studies and are now preparing a patent and manuscript for publication. Our results show that in a pre-clinical deafness model, the application of a multi-factor gene therapy can effectively generate new hair-like cells in the damaged inner ear.

Funding and research communication highlights

This research was presented at the Association of Research in Otolaryngology MidWinter Meeting in Florida, USA (February 2023). The gene hearing therapeutics team is supported by the Bionics Incubator Fund.

Meet the team

Dr Niliksha Gunewardene, Patrick Lam, Associate Professor Andrew Wise, Associate Professor Rachael Richardson, Jiwei Song, Dr Peta Grigsby, Dr Trung Nguyen and Flip Kammerer.

External collaborators: Associate Professor Raymond Wong (University of Melbourne) and Dr Ben Wei (St Vincent's Hospital).

Research report

Treating hearing loss with nanotechnology

The most common complaint of patients seeking treatment for hearing loss is difficulty in understanding a conversation in a noisy setting. This condition is largely due to exposure to loud sounds and as a consequence of ageing. Hearing impairment not only impacts our ability to communicate with loved ones; it is also associated with cognitive decline, social isolation and depression.

Unfortunately, there are no therapeutic treatments for hearing impairment, with the bleak reality that your ability to hear is likely to deteriorate further over time.

Researchers at the Bionics Institute are developing therapeutic technology to change this reality.

We have developed a new way of delivering novel therapeutic compounds to the inner ear using nanotechnology that overcomes some of the significant barriers that have prevented the development of successful drug therapies for hearing. Using small particles, we are able to deliver growth factors to the inner ear to repair damage that has occurred to the delicate sensory cells that are critical for the perception of sound.

Research highlights

Our pre-clinical studies testing the potential of this new approach to treat hearing loss have yielded positive results. We are now developing this technology further so that we can test it in patients with hearing loss in a first-in-human clinical trial.

Funding and research communication highlights

Associate Professor Andrew Wise's research is supported by grants from the US Department of Defense, the National Health and Medical Research Council (NHMRC), the Passe and Williams Foundation, the H & L Hecht Trust and the Robert Bulley Charitable Trust.

Meet the team

Associate Professor Andrew Wise, Dr Yingjie Hu, Professor James Fallon, Associate Professor Rachael Richardson, Dr Erol Harvey, Robert Klupacs, Dr Mikhail Korneev, James Firth, Sayward Barone, Dr Peta Grigsby, Dr Trung Nguyen, Ella Trang and Patrick Lam.

Research report

Investigating combination treatments for hearing loss

Initially, cochlear implants were provided only to people who were profoundly deaf, but they are now routinely provided to people with partial hearing loss. This is because listening with both a cochlear implant and a hearing aid in the same ear has been shown to improve speech understanding, particularly in noisy environments, and increase the aesthetic quality of sound. However, very little is known about the physiological mechanisms underlying these benefits or why all patients don't receive a benefit.

Our research aims to address this knowledge gap by measuring the patterns of neural activity in the auditory centre of the brain evoked by speech sounds. We will then assess how the pattern of neural activity relates to discrimination between the different speech sounds, and the influence of pathophysiological changes in the cochlea on the outcomes of combining electric and acoustic hearing.

Research highlights

In 2022-23, our team continued to record data from both normal hearing and partially deaf cats with cochlear implants. In addition, we have established measures to determine how well different speech sounds can be discriminated in different levels of background noise and begun quantifying the differences in this discrimination that occur with deafness. We also recruited a new member to the team, Anu Sabu, to spearhead the analysis and fast-track future research.

Funding and research communication highlights

Professor James Fallon's team is supported by a Discovery Projects Grant from the Australian Research Council.

Meet the team

Professor James Fallon, Professor Dexter Irvine, Associate Professor Andrew Wise, Dr Alex Thompson, Anu Sabu, James Firth, Sayward Barone, Dr Peta Grigsby, Dr Trung Nguyen and Daniel Williams-Wynn.

External collaborators: Professor David Grayden (University of Melbourne).

Research report

Second generation Australian bionic eye clinical trial

This bionic eye device is most suitable for people suffering from the later stages of inherited retinal diseases such as retinitis pigmentosa. In partnership with the Australian medical technology company Bionic Vision Technologies Pty Ltd, the next step is to initiate worldwide clinical trials ahead of seeking regulatory approval in key markets, subject to additional capital funding.

Research highlights

Upgrades to the external video processing unit were successfully trialled with the Melbourne bionic eye recipients throughout 2022–23. This work uses artificial intelligence to localise faces. Results were presented at the Annual Meeting of the Association for Research in Vision and Ophthalmology in New Orleans, USA (April 2023).

Funding and research communication highlights

Our PhD graduate Dr Sam Titchener published his findings in the clinical ophthalmology journal *Translational Vision Science and Technology*. The results demonstrate that we can use eye movements to optimise visual perception for bionic eye recipients.

Meet the team

Dr Matt Petoe, Associate Professor Chris Williams and Owen Burns.

External collaborators: Associate Professor Penny Allen, Lisa Lombardi, Lauren Moussallem and Dr Carla Abbott (all from Centre for Eye Research Australia).

Research report

Pre-clinical bionic eye research

Our current retinal implant has restored some vision to a group of patients blinded by the retinal disease retinitis pigmentosa. However, the level of vision is relatively low. This project will develop a prototype retinal implant that aims to dramatically improve the level of vision provided.

Research highlights

Work on the next generation bionic eye that will incorporate a multichannel stimulation strategy to improve visual acuity has commenced. We have performed initial proof-of-concept studies in rat retina as we prepare to test the efficacy and long-term safety of the stimulation, a requirement to achieve approval for a first-in-human clinical trial.

Funding and research communication highlights

Professor James Fallon and this team are funded by a National Health and Medical Research Council (NHMRC) Development Grant.

Meet the team

Professor James Fallon, Dr Anu Sabu, Dr Alex Thompson, Daniel Williams-Wynn, Dr Peta Grigsby, Jerico Matarazzo, James Firth, Amy Morley and Joshua McLaughlin.

External collaborators: Associate Professor Hamish Meffin (University of Melbourne), Professor Anthony Burkitt (University of Melbourne), Professor Michael Ibbotson (University of Melbourne), Professor David Grayden (University of Melbourne), Dr Martin Spencer (University of Melbourne), Dr Wei Tong (University of Melbourne), Associate Professor Penny Allen (Centre for Eye Research Australia), Dr Mohit Shivdasani (University of New South Wales) and Dr Tatiana Kameneva (Swinburne University of Technology).

Investing in the Future

The Bionics Institute has bold plans for growth and the development of innovative medical devices. To realise this plan, we are investing in training the next generation of researchers and ensuring they have access to multidisciplinary experts and world-class research facilities. We are proud to offer unique study opportunities for short-term student research projects and internships, as well as major graduate research projects for PhD and Masters by Research degrees.

Bionics Incubator Fund Highlights

The Bionics Incubator Fund (BIF) supports our researchers to explore new research areas and establish strong clinical collaborations.

To apply for funding, researchers pitch an idea for a new medical device or adaptation of existing technology for a different condition – focusing on innovation and invention. BIF projects have been featured throughout this Annual Report.

Some of our other BIF projects include:

Counting the cost: three-dimensional quantification of the cochlear

Researchers at the Bionics Institute have developed a method of analysing cellular morphology within an intact cochlea to provide a high resolution, three-dimensional image where cells can be qualitatively and quantitatively assessed. The complexity of the cochlea, a structure in the inner ear, presents many challenges to researchers wishing to study hearing. Traditional histological preparation of the cochlea via sectioning and staining is not only time and labour intensive but can only provide a partial understanding of the cellular morphology of the tissue. This technique enables unprecedented insight into the response of the cochlea to a wide variety of injuries and treatments.

Meet the team: Ella Trang, Chiara Braida and Alex Hill.

Developing an objective measure of tinnitus in a pre-clinical model

The Bionics Institute has developed an objective test of tinnitus in humans, using a non-invasive brain imaging technique called functional near-infrared spectroscopy (fNIRS) together with machine learning analysis techniques. An important application of this objective test is the evaluation of therapeutic efficacy of tinnitus drugs. We now aim to adapt this measure for use in a pre-clinical animal model of tinnitus, to enable evaluation of the safety and efficacy of early-phase drugs. Adapting our fNIRS-based objective measure of tinnitus to a pre-clinical model will create a unique platform at the Bionics Institute to objectively evaluate the effectiveness of tinnitus therapeutics and behavioural treatments, from early animal studies to human trials and clinical use.

Bionics Institute researchers: Dr Mehrnaz Shoushtarian, Professor James Fallon and Michelle Bravo.

Bionics Incubator Fund Highlights *cont.*

Magnetic percutaneous plug

This project was initiated to benefit both the animals we work with and the researchers who care for them. All previous designs of rodent percutaneous connectors (the interface between an implanted array and external stimulating/recording device) have used regular pin termination connectors that require a degree of force to connect. This project has developed a magnetic connector for animal research that removes any need for force when connecting. Such a simple modification has allowed for a marked improvement to animal welfare as it has made connection and disconnection of the percutaneous connector a seamless and simple exercise for researchers at the Bionics Institute.

Meet the team: Jerico Matarazzo, Dr Sophie Payne, Dr David Hill and Ross Thomas.

Optimising hematoxylin and eosin staining for resin embedded tissue sections

This successful project developed a new staining technique, hematoxylin and eosin (H&E), for use in resin embedded tissue samples. We had previously used a basic stain (metachromatic toluidine blue stain) on our resin samples, which does not differentiate between different tissue types. Using the new H&E staining method allows for more precise histological analysis on how neural tissue interacts with electrodes.

Meet the team: Chiara Braida, Dr Sophie Payne, Ella Trang and Lisa Dyball.

Field Rickards Annual Awards for Leadership and Impact

We were delighted to welcome Professor Field Rickards to our final staff meeting of 2022 to present the annual Field Rickards Awards. Professor Rickards started his career as a PhD student with Professor Graeme Clark in the Bionic Ear program.

He made a substantial contribution to hearing research during his career and was part of the team that created Australia's cochlear implant. Professor Rickards held a number of prestigious roles at the University of Melbourne and was a member of the Bionics Institute Board of Directors from 1988 to 2020. In recognition of his long service, the Bionics Institute honours Professor Rickards' legacy through the annual Field Rickards Awards for Leadership and Impact.

In 2022, these were awarded to:

Best Researcher
Dr Tommy Peng

Best Research Team
Tinnitus Team

Best Student
Stephen Lee

Biggest Impact
Dr Sally Herring, Lisa Dyball

Bionics Institute researcher Dr Tommy Peng and Professor Field Rickards

Girls in STEM Mentoring Program

The Bionics Institute is passionate about inspiring young women to pursue a career in science, technology, engineering and mathematics (STEM). In 2023, the Girls in STEM Mentoring Program expanded from 5 schools and 24 students to 18 schools and 72 students. This is tremendous growth for the program and has enabled more students to learn about pioneering research.

Over a 6-month period, this cohort of 72 students were given insights into study pathways into STEM and mentorship in science communication by leading female researchers from the Bionics Institute and various organisations such as the University of Melbourne, Illumina, Monash University and Victoria Police.

The program's welcome event in May 2023 allowed students to meet with their mentors in person and tour our lab spaces before beginning monthly online meetings to develop their science communication and research presentation skills. We are proud to be supporting the scientists of the future and are pleased to extend the program to more schools in 2024. The Bionics Institute would also like to thank National Australia Bank for supporting the Girls in STEM Mentoring Program by providing funding towards administrative costs, with the aim of inspiring women to pursue innovative careers.

Students receiving their certificates at the 2022 Girls in STEM Mentoring Program Celebration Event

2022 Bionics Institute Graeme Clark Oration

After a two-year hiatus, the 2022 Graeme Clark Oration was held at the Melbourne Convention and Exhibition Centre on 12 July.

The free event was a resounding success, with over 800 members of the public attending to hear from the Orator, renowned international cardiac researcher Professor Natalia Trayanova from the Department of Biomedical Engineering at Johns Hopkins University, USA.

Professor Trayanova explored how her artificial intelligence and bioengineering tool could prove to be life-saving for more than four million Australians affected by cardiovascular disease (CVD).

Using machine learning, Professor Trayanova has created 'digital heart twins' which act as virtual replicas of the heart that can be used to forecast progress of heart disease, estimate the risk of adverse events, and predict treatment responses.

This exciting technology aims to inform clinical decisions and improve the lives of people with heart disease.

Professor Natalia Trayanova presenting at the 2022 Bionics Institute Graeme Clark Oration

The Bionics Institute 2022 Graeme Clark Oration event program included a Women in STEMM Lunch, a Biomedical Innovation Showcase, the Oration and a Gala Dinner.

The Graeme Clark Oration was established in honour of Bionics Institute Founder and pioneer of the Bionic Ear, Laureate Professor Graeme Clark AC. This event aims to informs the community about scientific advances in health and medical research, delivered by recognised global leaders in their field.

Past PhD students: where are they now?

Dr Darren Mao

Dr Darren Mao completed his PhD in 2020 and is now working as a Development Engineer in the Translational Hearing Research team.

He says:

> *"As a former PhD student at the Bionics Institute, I learnt to be an effective researcher and had an opportunity to be very hands-on with my work."*

"Now I am continuing to use these skills at the Bionics Institute to develop EarGenie®, aiming to optimise treatments for infants with hearing loss."

Dr Tomoko Hyakumura

Dr Tomoko Hyakumura completed her PhD in 2018 and is now working as a Research Fellow in the Peripheral Interface and Neuromodulation Team (PINT) developing a vagus nerve stimulation treatment for Crohn's disease and rheumatoid arthritis.

She says:

> *"Working at the Bionics Institute is inspiring. I'm excited about the research projects I work on, and grateful to be working with teams of talented and dedicated people."*

Dr San San Xu

Dr San San Xu completed her PhD in 2020 and is now undertaking a Fellowship in the UK.

She says:

> *"It gave me the opportunity to work on projects that were highly relevant and translatable to clinical practice in a supportive and collaborative environment."*

"I am now working in a postdoctoral role as a research fellow and neurologist in the deep brain stimulation unit at the UCL Queen Square Institute of Neurology in London."

A new home for the Bionics Institute

The Bionics Institute has bold plans for expansion to speed up the development of medical devices that transform the way we treat disease.

And our team of global scientists, engineers and clinicians need world-class facilities to carry out their ground-breaking research into Alzheimer's disease, rheumatoid arthritis, hearing loss, tinnitus, chronic pain and bionic limbs.

From 2025, the Bionics Institute will be headquartered in the Aikenhead Centre for Medical Discovery (ACMD) – Australia's first hospital-based biomedical engineering research centre, currently under construction at St Vincent's Hospital Melbourne.

One of eight independent partners sharing the new building, the Bionics Institute will benefit from co-location and collaboration with leading universities, research institutes and major industry partners. In addition, our position on the campus of a leading tertiary hospital means we will continue to work shoulder to shoulder with the clinicians and specialists who guide and inform device development to meet clinical needs.

ACMD partners

ACU Australian Catholic University · Bionics Institute · Centre for Eye Research Australia · RMIT University · St Vincent's Hospital Melbourne · SVI St Vincent's Institute Medical Research · Swinburne University of Technology · The University of Melbourne

Benefits of being an independent partner in the ACMD

Collaboration lies at the heart of the ACMD. Bionics Institute staff will be allocated space across three floors of the ACMD to enable better communication and innovative idea generation between partners. We will also have access to shared meeting rooms, a lecture theatre for research seminars and specialised research facilities.

Sharing running costs between eight partners will bring cost savings and our researchers will be able to access state-of-the-art equipment we would not be able to purchase as a single entity. For example, the ACMD will be equipped with a machine that is used to visualise and track bone and joint motion in 3D. This will give our researchers the ability to evaluate the effectiveness of bone implants with incredible accuracy.

Maintaining our existing laboratories

Research undertaken at the Bionics Institute is very specialised and we lead the world in the evaluation of the safety and efficacy of medical devices before they are trialled in humans. For this reason, we will maintain our laboratories within the St Vincent's campus, just a 5-minute walk from the new building.

Philanthropy

Our life-changing research is made possible thanks to the generosity of our supporters. Every donation, no matter what size, makes a real difference – helping our engineers and scientists to continue their pioneering work for real world impact.

Philanthropy highlights

We are immensely grateful to all our donors who have helped us achieve so much at the Bionics Institute this year.

With the arrival of new researchers Professor Kate Hoy and Dr Oscar Murphy, we selected Alzheimer's disease for our end-of-year appeal. We are delighted to report that more than $85,000 was raised, which gave a much-needed boost to run a clinical trial into a Transcranial Magnetic Stimulation treatment to fight memory loss.

We held a Meet the Researcher event in March 2023, giving people living with Alzheimer's disease and their families a chance to learn more about our innovative research. We thank Paul and Angela Wheelton for co-hosting this event, and for their generous financial support of our research into Alzheimer's disease.

Roger and Lesley Gillespie kindly co-hosted a similar event focused on our tinnitus research, also in March 2023. Dr Mehrnaz Shoushtarian explained how she and her team are developing the world's first objective test for tinnitus, which could lead to effective treatments for this debilitating and distressing condition.

Bionics Institute supporters Peter Griffin AM and Terry Swann

Our first trivia night was a great success with over 100 people, and we were grateful to receive a range of auction prizes, including a Collingwood AFL jersey, Richmond AFL football and a voucher for the Royal Mail Hotel in Dunkeld, kindly donated by Allan and Maria Myers.

Students are the research superstars of the future, and we were thrilled that so many of you responded to our tax appeal for student support. We are now recruiting a PhD student to work on our Alzheimer's disease research, thanks to a full student scholarship donated by Peter Griffin AM and Terry Swann.

With very generous support from Di and Neville Bertalli, we have been able to move forward more quickly with our research into a vagus nerve stimulation device to reduce inflammation in rheumatoid arthritis, with the aim of starting the clinical trial in 2024. This work is led by Dr Sophie Payne, and we are grateful to the Victorian Lions Foundation for their support of her research with a 3-year fellowship.

Bionics Institute supporters Neville and Di Bertalli

We were delighted that Dr Tommy Peng was awarded an early career research fellowship by the Passe and Williams Foundation. This vital funding will support his work on refining and improving hearing for people fitted with cochlear implants, which is where the research at the Bionics Institute first began.

> *"Thank you to everyone who has contributed to our wide-ranging research this last year. We make every gift count, and we are honoured that you have chosen to support the Bionics Institute."*

Kick-starting a clinical trial into Alzheimer's treatment

> *"It's good to know that the donation we made to kick-start the Bionics Institute clinical trial will make an impact in such a short space of time."*

When Paul Wheelton first heard a presentation by Professor Kate Hoy about Bionics Institute research into Alzheimer's disease, he was very interested.

Despite billions of dollars and decades of research, there are still no truly effective treatments for Alzheimer's and there is currently no cure for this devastating disease.

Paul says his interest was sparked by how the Bionics Institute is approaching treatment in a different way – by adapting and personalising a brain stimulation treatment already established for depression – and that preparations for a clinical trial of this treatment for Alzheimer's were underway.

He said:

> *"My wife Angela and I are very supportive of medical research, but it is often a long way from benefitting a patient. It is good to know that the donation we have made to kick-start the Bionics Institute clinical trial will make an impact in such a short space of time."*

"Alzheimer's has affected our family and we are keen to do what we can to make a difference to everyone in our situation. We will be watching progress of the trial very closely," he concluded.

Thanks to generous donors like Paul and Angela, who have made the commencement of our Alzheimer's treatment trial possible, Professor Kate Hoy and her team will now aim to recruit over 100 participants.

Trial participants will take part in the trial of a non-invasive brain stimulation treatment called Transcranial Magnetic Stimulation that shows promise in the fight against memory loss.

The trial aims to establish how Transcranial Magnetic Stimulation can restore dysfunctional connections in the brain with the aim of improving brain function.

The research team hopes to expand this trial across the country and, if the outcomes of the trial are positive, ultimately turn this treatment into reality for people living with Alzheimer's disease and their carers.

Professor Kate Hoy demonstrating Transcranial Magnetic Stimulation

Bionics Institute supporters Angela and Paul Wheelton

From small beginnings big things grow

> *"It's wonderful to see how funding from The Ian Potter Foundation has been leveraged by the Bionics Institute."*

Since 1964, The Ian Potter Foundation has contributed over $420 million to thousands of projects across Australia, with a focus on the arts, medical research, public health, the environment, education and community wellbeing.

When Bionics Institute CEO Robert Klupacs and Head of Development and Research Translation Dr Erol Harvey sought funding to set up a medical device prototype manufacturing facility, they turned to The Ian Potter Foundation, which kindly contributed $100,000 towards the project.

This early funding gave impetus to what is now Neo-Bionica, which offers clients both in Australia and overseas the bioengineering expertise, fabrication skills and regulatory know-how to develop medical technologies.

Neo-Bionica is a joint initiative of the Bionics Institute and the University of Melbourne, and its purpose-built clean rooms and laboratory are located on the St Vincent's Hospital Melbourne campus, near leading clinicians.

Soon after taking over the role of CEO of The Ian Potter Foundation, Paul Conroy visited to see how Neo-Bionica has grown since it was opened in September 2021.

He was fascinated to find out about the process for developing electrodes that are often a key element of medical devices, including the vagus nerve stimulation device developed at the Bionics Institute and currently in clinical trials to treat Crohn's disease.

Senior Product Designer Ross Thomas explained how the electrode fabrication team are often handling wires that are just a quarter the diameter of a human hair using a high precision microscope.

Neo-Bionica is the only facility in Australia with the combination of bioengineering expertise and cleanroom technology required to manufacture small batch prototypes for clinical trial, which previously had to be done in the USA.

Paul Conroy says:

> *"It's wonderful to see how funding from The Ian Potter Foundation has been leveraged by the Bionics Institute in partnership with the University of Melbourne. The resulting initiative, Neo-Bionica, is facilitating innovation faster while creating technology jobs and contributing to the development of the high-tech sector in Australia."*

Neo-Bionica Senior Product Designer Ross Thomas with The Ian Potter Foundation CEO, Paul Conroy

The impact of a gift in Will

> *"The Institute changed our lives. I hope that by leaving a gift in my Will I can leave a legacy to help change someone else's life for the better."*

Belinda Rodman, a longstanding supporter and ambassador of the Bionics Institute, said that her son receiving a cochlear implant enabled him to achieve his dreams of becoming a pilot.

"Simon received a cochlear implant when he was only three, after contracting a severe form of meningitis and becoming profoundly deaf in both ears," Belinda explained.

Tests showed that there was unfortunately no chance of Simon's hearing regenerating. After just three months, Simon received a cochlear implant in one ear, as was most common at the time.

Simon attended rehabilitation in Sydney and Belinda committed a lot of time and effort to ensure her son adjusted as quickly as possible.

"He adapted really, really quickly, finishing all of the rehab in just a few weeks and adapting to hearing in just one ear," she says with pride. Belinda feels that the cochlear implant technology developed by the Bionics Institute had a significant impact on Simon's life.

As Simon is profoundly deaf, hearing aids were never going to be an option and his future looked very uncertain.

Thanks to his cochlear implant, Simon was able to attend a mainstream school and university and has gone on to achieve his dream of becoming a commercial airline pilot.

"He is, to the best of our knowledge, the first implant recipient in Australia and possibly in the world with a cochlear implant to become a commercial pilot working for a major airline, something we are incredibly proud of," Belinda explains.

"We cannot thank the Institute enough for their hard work in creating the opportunity for Simon to have this device and lead the life he does. It has transformed our lives. Not just Simon, but all of us as a family."

Although her initial motivation for supporting the Bionics Institute stemmed from gratitude for what the research has enabled Simon to achieve, Belinda has kept up to date with other advancements being made by the Institute and wanted to continue her family's legacy through a gift in her Will.

> *"It is just so incredible to see all of the devices and treatments the teams are developing. Having personally experienced the power of that research and what it has done for us, leaving a gift in my Will is a way for me to consolidate my gratitude. It has given me the comfort of feeling that I am giving back."*

"It's a nice feeling to think that even when I'm no longer here, I am helping something continue that other people are going to benefit from, just like Simon."

Belinda and Simon Rodman

Thank you to our supporters

We would like to acknowledge all the individuals and organisations who have supported us this year – your support really does make a difference.

Barry and Leonora Abeshouse
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John Adams
Donald Adams
Peter Adams
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The Passe and Williams Foundation
The William Angliss (Victoria) Charitable Fund
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Thank you to our generous in-kind donors

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Terry Swann
Willow Urban Retreat

We also extend our grateful thanks to those supporters who wish to remain anonymous.

Thank you

External Engagement Committee

Our External Engagement Committee provides valuable assistance in driving engagement with our supporters.

John Simpson
Chair

Caroline Chernov

Jim Hayman

Kunal Rastogi

Michael Stillwell

Rotary partnership

> *"We were very proud to feature the groundbreaking work of the Bionics Institute at this once-in-a-lifetime event. We look forward to continuing our relationship with the Bionics Institute in 2024 and beyond."*
>
> *– Rotary Club of Melbourne 2023 President Adrian Nelson*

The Bionics Institute was inducted as a member of the Rotary Club of Melbourne in January 2023. Through this partnership with Rotary, we seek to work together in our dual vision to make a profound impact in the world, especially for people living with challenging diseases.

In May 2023, the Bionics Institute participated in the Rotary International Convention, the first global Rotary event held in Melbourne in 30 years. Almost 15,000 people from 120 countries enjoyed 4 days of networking and events.

Rotary Club of Melbourne 2023 President Adrian Nelson said: "We were very proud to feature the groundbreaking work of the Bionics Institute at this once-in-a-lifetime event. We look forward to continuing our relationship with the Bionics Institute in 2024 and beyond."

The Convention offered the opportunity to brainstorm solutions to some of the most pressing health challenges we face today.

Our booth had prime position and gave our early career researchers the opportunity to engage with more than 450 delegates.

Thanks to the enthusiasm of Bionics Institute supporter and dedicated Rotarian Mr Kevin Sheehan, the Bionics Institute was also featured on 3AW with Darren James.

Kevin said:

> *"The Bionics Institute does great work – from developing a hearing test for babies to a treatment for Alzheimer's disease. People need to know that pioneering research is happening right here in Melbourne."*

We are excited to work with Rotary to generate awareness about the Bionics Institute's innovative medical devices and our vision to improve the quality of life for patients locally and across the globe.

Lucy Hooper and Ann Fazakerley at the Rotary International Convention

White Paper: Building Australia from Innovation

In March 2023, the Bionics Institute launched its inaugural White Paper: Building Australia Through Innovation.

This White Paper aims to spark conversations about the value of Australian innovation, and the changes needed to bridge the gap between med tech innovation and commercialisation in our country.

With forewords and contributions from David Thodey AO, Kylie Walker (ATSE), Dr Jill Freyne (CSIRO), Dr Erol Harvey (ACMD) and Robert Klupacs (Bionics Institute), the White Paper builds on the insights gained from the Bionics Institute 2022 Innovation Lecture and our Med Tech Talks podcast series.

The White Paper details four ways to supercharge innovation: co-location through precincts and hubs, improving skill development and funding, storytelling and persistence as well as leveraging mentorships and partnerships.

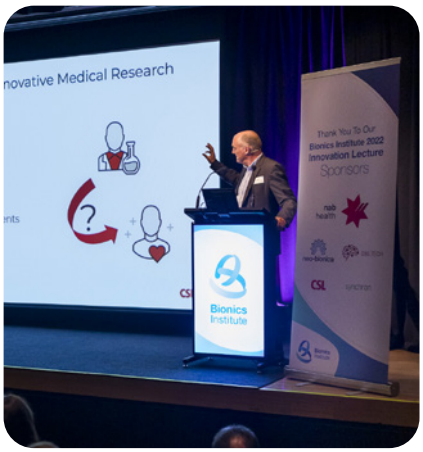
The full White Paper is available on the Bionics Institute website.

Bionics Institute White Paper: Building Australia from Innovation

Bionics Institute Innovation Lecture Series

We launched our successful Innovation Lecture series in 2022, with more than 500 med tech leaders, researchers, clinicians, government staff and investors joining us to explore how Australia can accurately measure innovation, boost the med tech ecosystem and strengthen industry connections.

Our inaugural event in September 2022, headlined by keynote speakers Dr Andrew Nash (Chief Scientific Officer, CSL) and Associate Professor Tom Oxley (Founding CEO, Synchron), highlighted some of the opportunities and barriers to med tech commercialisation in Australia. Dr Nash and a panel of experts – Professor Michelle McIntosh (Director, Medicines Manufacturing Innovation Centre and Theme Leader at the Monash Institute of Pharmaceutical Sciences), Dr Megan O'Connor (Managing Director, Kantara Consulting) and George Kenley (Chief Operating Officer, Seer Medical) – then delved into how we can build Australia from innovation.



Bionics Institute 2023 Innovation Lecture

At our 2023 Innovation Lecture in May, keynote speakers Dr Andreas Fouras (CEO, 4DMedical) and Kylie Walker (CEO, ATSE) were joined by panellists Dr Jill Freyne (Deputy Chief Scientist, CSIRO) and Christine Ann Williams (former GM of the Innovation Metrics Review) to discuss how metrics can be better utilised to improve Australia's innovation ecosystem.

The Bionics Institute is grateful to our sponsors for their generous support of these events:

2022: NAB Health, Neo-Bionica, DBS Tech, CSL, Synchron.

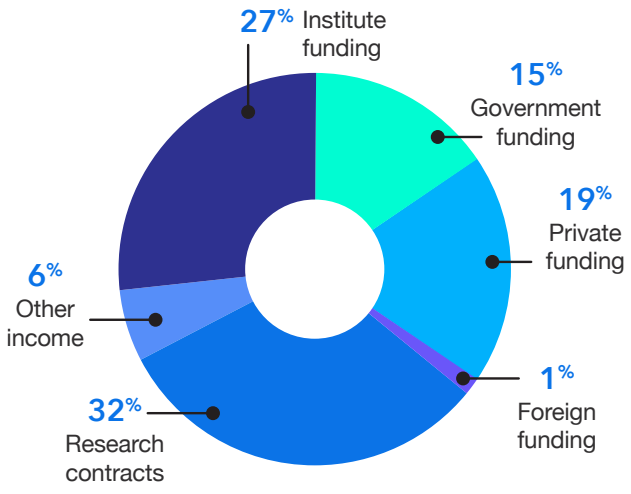
2023: DBS Tech, Epiminder, Neo-Bionica, University of Melbourne School of Health Sciences, Monash University Medicines Manufacturing Innovation Centre, Hemideina, 4DMedical, Australian Academy of Technological Sciences & Engineering, Schwartz Media.

Financial Statement

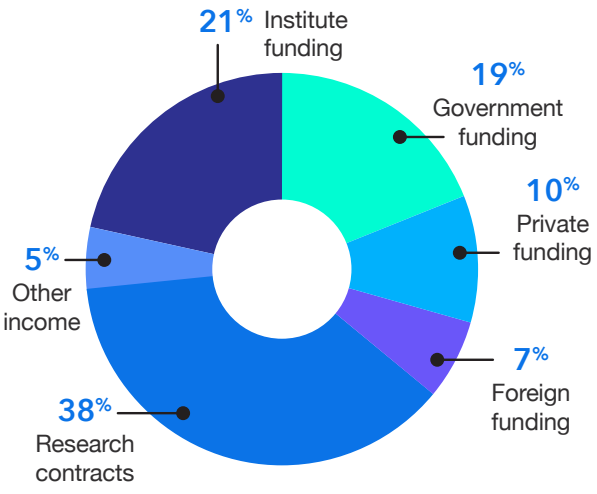
ABRIDGED FINANCIAL STATEMENT
for the year ended 30 June 2023

CONSOLIDATED INCOME STATEMENT	2023 $	2022 $
REVENUES FROM ORDINARY ACTIVITIES		
Federal Government grants	1,615,188	1,600,558
State Government grants	733,105	1,041,863
Foreign grants	174,425	913,223
Trusts & foundations	1,179,530	864,057
Public fundraising	1,741,565	610,918
Research contracts	4,954,679	5,392,959
Investment & interest income	1,114,862	1,815,836
Other income	910,078	701,600
TOTAL REVENUE FROM ORDINARY ACTIVITIES	12,423,432	12,941,014
less Expenditure on ordinary activities	(15,478,466)	(14,137,545)
DEFICIT ON ORDINARY ACTIVITIES	(3,055,034)	(1,196,531)
Gain on sale of property and fixed assets	(343)	687,979
(Loss)/gain on available-for-sale financial assets	1,013,881	(1,623,038)
Share of loss in associates	(1,034,564)	(2,037,513)
NET DEFICIT	(3,076,060)	(4,169,103)

FUNDING OF OUR RESEARCH



2023



2022

CONSOLIDATED STATEMENT OF FINANCIAL POSITION	2023 $	2022 $
Current Assets	7,064,586	6,815,863
Non-Current Assets	18,603,768	22,216,275
TOTAL ASSETS	25,668,354	29,032,138
Current Liabilities	5,712,612	5,785,821
Non-Current Liabilities	1,493,234	1,707,749
TOTAL LIABILITIES	7,205,846	7,493,570
NET ASSETS	18,462,508	21,538,568
TOTAL INSTITUTE FUNDS	18,462,508	21,538,568

Full audited financial statements are available from the Institute's registered office by request.

Bionics
Institute

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