Bionics Institute

Annual Report

2023–24

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, including Alzheimer's disease, hearing impairment, Crohn's disease, chronic pain, Parkinson's disease, epilepsy, and arthritis.

Contents

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

First patient implanted with our vagus nerve stimulation device to treat Crohn's disease

48
Research Publications

10
Patents Granted

3
PhD conferrals

30+
student placements

Donations and philanthropic support
$3,107,534

Total government grant funding raised
$4,422,084

Social media content
1.8million+
impressions

Alzheimer's clinical trial commenced

Our first Giving Day for Hearing Research raises
$146K

900+
attendees at tours & community events

News coverage

4 radio pieces
70+ online articles
2 print articles
3 TV news stories

Message from our Chair

As Chair of the Bionics Institute Board of Directors since 2016, I am delighted to present this Annual Report for the 2023–24 financial year.

I am incredibly proud to lead an institute that is striving to make life better for people living with challenging medical conditions. Our research continues to push boundaries with the aim of developing cutting-edge technologies and therapies for Alzheimer's, Parkinson's, Crohn's disease, hearing impairment, epilepsy, movement disorders, chronic pain and rheumatoid arthritis. The good news about our research spread far and wide this year with over 900 people attending a range of industry and community-focused events that showcased the Bionics Institute as a world-class innovator.

The achievements highlighted in this report are a testament to the hard work and dedication of the researchers and support staff, led by CEO Robert Klupacs. Our success is all the more impressive when you realise that our senior researchers spend weeks and months writing government grant applications that have a one in 10 chance of being successful, and typically cover only 60% of direct research costs.

Like all medical research institutes, we depend on philanthropic gifts from our loyal supporters, and I speak on behalf of everyone to express our heartfelt appreciation for your generosity and your continued support of our research.

To increase our impact on the treatment of challenging conditions, we have developed a strategy of sourcing research funding from investment, contract research and, in recent years, spin-off companies to complement funding from government grants and philanthropic donors. The benefit of creating spin-off companies is twofold. Firstly, patients will only benefit from our technology if our early-stage research is developed and commercialised by a company. Secondly, the equity we hold in these companies can be sold to fund future research.

The Bionics Institute owns equity in several spin-off companies, including Epi-Minder, DBS Tech, Neo-Bionica, NIRGenie, Bionic Vision Technologies and PolyActiva. We recognise that the road to success of these types of companies is challenging. However, as shown by companies such as Cochlear, when successful they can bring product to market to significantly impact people's lives and also create substantial economic benefit.

We have great hopes for our current and future spin-offs, and at the appropriate time we will sell part of the equity we hold to enable us to re-invest into our ongoing research and development activity. This is a calculated strategy to enable us to meet our goals of high-impact translational research activity and also create potential additional funding streams for our organisation.

I am very grateful to my Board of Directors who devote their time and decades of experience to guide the Bionics Institute through the challenges of funding and managing a world-class medical research institute.

I would especially like to thank our outgoing Board members in 2023, Roger Gillespie OAM, John Simpson AM and Sujata Stead, who were instrumental in ensuring significant progress of the Institute.

Mr John Stanhope AM
Chair

Message from our CEO

As I reflect on the past twelve months, I am filled with pride at the progress the Bionics Institute has made across our research translation initiatives as we seek to fulfill our mission of creating cutting-edge medical innovations to improve lives and provide hope for patients living with difficult to treat conditions.

Our commitment to fast-tracking the translation of research from the lab to clinical trials remains steadfast. In contrast to the traditional timeline of 20 to 30 years for pharmaceuticals, our aim is to bring medical device prototypes into clinical trials within five years from initial concept. This rapid progress is critical for ensuring that patients can access innovative treatments and diagnostics that are drug-free and more effective, ultimately leading to substantial savings in healthcare costs.

We achieved several major milestones this year and were delighted by the continuing achievements of our spin-off companies Epi-Minder, DBS Tech, NIRGenie and Neo-Bionica.

World-First Clinical Trials

Among our significant achievements this year was the launch of two ground-breaking clinical trials:

Improving memory loss in Alzheimer's disease

World-renowned neuropsychologist Professor Hoy and her team are conducting a pioneering Alzheimer's disease clinical trial focused on neuroplasticity – the brain's ability to adapt and change. Professor Hoy is using non-invasive brain stimulation technology to apply personalised magnetic pulses to areas of the brain affected by Alzheimer's. This approach shows promise in strengthening brain connectivity and improving cognition in people with the disease and could help delay memory loss and prolong independent living for those affected by the condition.

The first participant in our Alzheimer's clinical trial was enrolled in August 2023, marking the beginning of an ambitious project that aims to enrol over 130 patients with mild to moderate Alzheimer's. This is a significant step forward in the global effort to develop more effective treatments for this devastating disease, and we are excited about the potential this trial holds for improving the quality of life for patients and their families.

Advancing treatment for Crohn's disease and other inflammatory conditions

Professor James Fallon, Associate Professor Sophie Payne and their team have developed a revolutionary tiny electrode array, designed to be implanted on the abdominal vagus nerve below the diaphragm. This device uses electrical stimulation to trigger the body's natural anti-inflammatory response, with the aim of dampening inflammation in Crohn's disease.

In a world-first, the first patient underwent implantation of this device in late 2023 at the Austin Hospital (ElectRx Study: NCT05469607), and the initial results are most promising – see the Crohn's Research Report in the following pages which details this further. For patients living with Crohn's, this technology offers hope of preventing disease recurrence following bowel surgery, allowing them to live free from the fear of further invasive procedures and debilitating symptoms. We also see immense potential for this technology to be adapted to treat other conditions, such as rheumatoid arthritis and epilepsy. We are preparing to launch a clinical trial involving patients with drug refractory rheumatoid arthritis using the same device in early 2025.

Major Publication and Grant Success

In the 2023-24FY we had our highest ever annual number of peer reviewed scientific publications from Bionics Institute scientists and engineers in top tier scientific journals. We also had major success in achieving prestigious grants from the National Heath and Medical Research Council (NHMRC), (40% success rate versus 10% across the sector), Australian Research Council, plus international funding from US Department of Defense and European funding agencies.

Looking Ahead: Building on Our Success

The past year has been a time of exciting breakthroughs, and we are eager to build on this momentum. Beyond our Alzheimer's and Crohn's disease trials, our researchers are working tirelessly on a range of other research projects into other difficult to treat conditions including epilepsy, hearing impairment, chronic pain and more.

The value of these projects has been recognised through the awarding of significant funding from government and philanthropic avenues, including:

- Our first Private Ancillary Fund (PAF) loan of $400,000 – a result of an Australian Tax Office ruling we sought to help us secure longer-term funding for highly-translatable areas of research. This unique offering provides high net worth individuals with a tax-effective opportunity to support the development of potentially life-changing med tech
- A $1million NHMRC Grant awarded to our research team, Professor James Fallon, Associate Professor Sophie Payne and Dr Tomoko Hyakumura, which will enable our research team to continue their work developing novel technology to continuously monitor peripheral nerve activity. We are aiming to be able to record and analyse different fibre types of the vagus and sciatic nerves, with limited impact on the nerve itself. This has clinical application for conditions such as inflammatory bowel disease
- The Passe & Williams Foundation continued their longstanding support of Bionics Institute hearing researchers with the awarding of two prestigious Fellowships. This funding allows Dr Anu Sabu and Dr Demi Gao to continue developing innovative solutions for common hearing issues.

We are also proud of our impactful educational and thought leadership initiatives including:

- Regular research seminars, enabling sector colleagues and the general public to join us in-person or virtually to learn from both Bionics Institute and industry research leaders
- The Bionics Institute Innovation lecture, held in May 2024, which brought together more than 300 guests from universities, research institutes, investment firms, start-ups, government and med tech incubators for an evening of insights and networking
- Our Open House event, which saw 70 members of the public tour our facilities, take part in hands on activities, and ask questions of engineers and scientists during National Science Week 2023
- The Bionics Institute Girls in STEM Mentoring Program, which in 2024 has more than 70 students from 15 schools participating. The Celebration Event for the 2023 Program (held in October 2023) provided opportunity for 100 students, teachers, mentors and staff to gather and hear from Prof Moira O'Bryan from the University of Melbourne, and Julie Rynski from National Australia Bank (NAB).

Inspiring the next generation of researchers is integral to our mission and we look forward to welcoming even more of the community to the Bionics Institute in the future.

Message from our CEO cont.

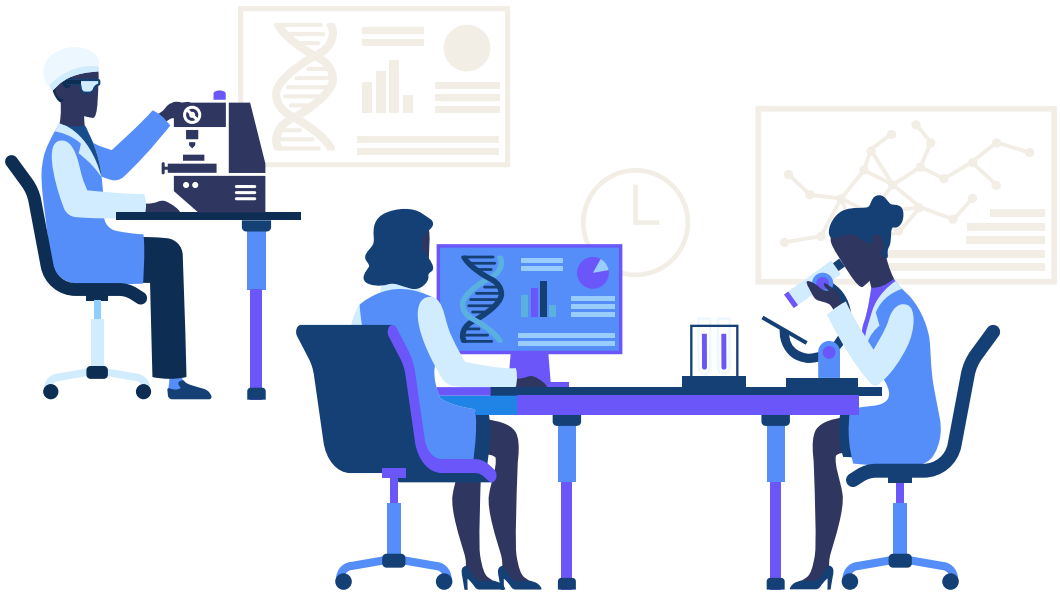
A Heartfelt Thank You

The success of our projects and initiatives depends on ongoing funding from various sources, including philanthropic donations, government grants, and industry partnerships. We are deeply grateful to our individual donors, foundations, and government supporters who believe in our mission. Without your support, our much-needed work would not be possible. Together, we are not just advancing science; we are changing lives.

I invite you to explore this year's Annual Report to learn more about our achievements and the remarkable impact we are making. We remain committed to translating groundbreaking research into real-world solutions that improve the health and well-being of people across the globe.

> *"As we continue to push the boundaries of medical research and device development, our focus remains on making a tangible impact on patients' lives."*

Robert Klupacs
Bionics Institute CEO



Our Board

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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 Malcolm Horne, Professor Kate Hoy, Professor Colette McKay, Associate Professor Rachael Richardson, Associate Professor Mehrnaz Shoushtarian, Associate Professor David Szmulewicz and Associate Professor Andrew Wise.

These teams are supported by our excellent capability providers led by Dr Sheridan Laing: clinical research support (led by Dr Sally Herring), pre-clinical research (led by Associate Professor 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) and electrode design and fabrication (led by Jenny Zhou).

Report from our Chief Technology Officer and Head of Research Operations

Like researchers at every medical research institute, and many universities, our researchers face growing challenges to produce quality research that truly impacts people's lives. Fortunately, for those of us privileged enough to work at the Bionics Institute, we have an incredible 'family' to support and enable us, without whom we would be unable to achieve the amazing successes detailed throughout this Annual Report.

One of the unique features of the Bionics Institute is our focus on translational research, underpinned by our Research and Development process, a critical aspect of our ISO 9001 certification.

A year of impact

In the past twelve months we had the highest annual number of peer reviewed scientific publications from Bionics Institute scientists and engineers (forty-eight) in top tier scientific journals. We also had major success in achieving prestigious grants from the NHMRC, (40% success rate versus 10% across the sector), ARC, Victorian Government and international funding from US Department of Defense and European funding agencies. Our individual researchers were also recognised for their impact by research.com with Associate Professor Andrew Wise, Professor Kate Hoy and Professor Rob Shepherd being named in the 2024 Best Neuroscience Scientists in the World rankings; and Professor Colette McKay being named in the Best Engineering and Technology Scientists rankings. With an eye to the future, we also grew our ranks of more junior researchers including an increase in our number of PhD students (8) and had success with our early-career (Dr Anu Sabu) and mid-career (Dr Demi Gao) researchers receiving prestigious fellowships from the Passe & Williams Foundation.

Teamwork is key to innovation

These measures of success are gratifying and worthy of celebration, but our focus remains on transforming people's lives via our current-edge research. Therefore, I have taken most pleasure in seeing our vagus nerve stimulation program, championed by Associate Professor Sophie Payne, enrol its first participant in a trial of technology to treat inflammatory bowel disease being run with Associate Professor Peter de Cruz at the Austin Hospital (the ElectRx study NCT05469607).

The journey from bench to clinic is rarely linear or easy, as demonstrated by manufacturing and COVID related delays in for this project, but our successes are a testament to the strength and creativity of our teams, who continue to navigate the complexities of med tech research with resilience and vision. Our study participants, and their carers, are also a critical part of these teams as well. Whether volunteering to be the first person in the world to receive our vagus nerve device, bringing their young child in to help us develop a hearing test, or sharing with us their lived experience, we could not achieve the great success we have, without their valuable contributions.

Positioning ourselves for the future

As a leader in med tech innovation, the Bionics Institute has always been committed to advancing promising research through every stage of development, from concept to clinical trial and, ultimately, commercialisation. As we have seen the Aikenhead Centre for Medical Discovery Centre slowly rise from the ground in the middle of our precinct, and had many discussion with partners of the centre, it has reinforced the unique position the Bionics Institute occupies in the med tech space.

With our focus on med tech based translational research and transforming people's lives, rather than an individual disease or technology, our capabilities model of technical experts enabling our research leaders to focus on their ideas and innovations, and our location and deep expertise in truly cross-disciplinary research allowing rapid and meaningful engagement on clinical problems, the Bionics Institute is truly one of a kind.

It is the people, and our extended 'family', that make the Bionics Institute unique.

"To our dedicated researchers, staff, donors and partners, I extend my deepest gratitude. Your hard work and unwavering belief in the mission of the Bionics Institute have made our successes possible.

Thank you for your continued support as we look toward another year of innovation, collaboration, and life-changing progress."

Professor James Fallon
Chief Technology Officer and
Head of Research Operations

BIF Bionics Incubator Fund projects

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 to learn more about our BIF projects.

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.

Our team of global scientists, engineers and clinicians need world-class facilities to carry out their groundbreaking research into Alzheimer's disease, rheumatoid arthritis, hearing loss, tinnitus and chronic pain.

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

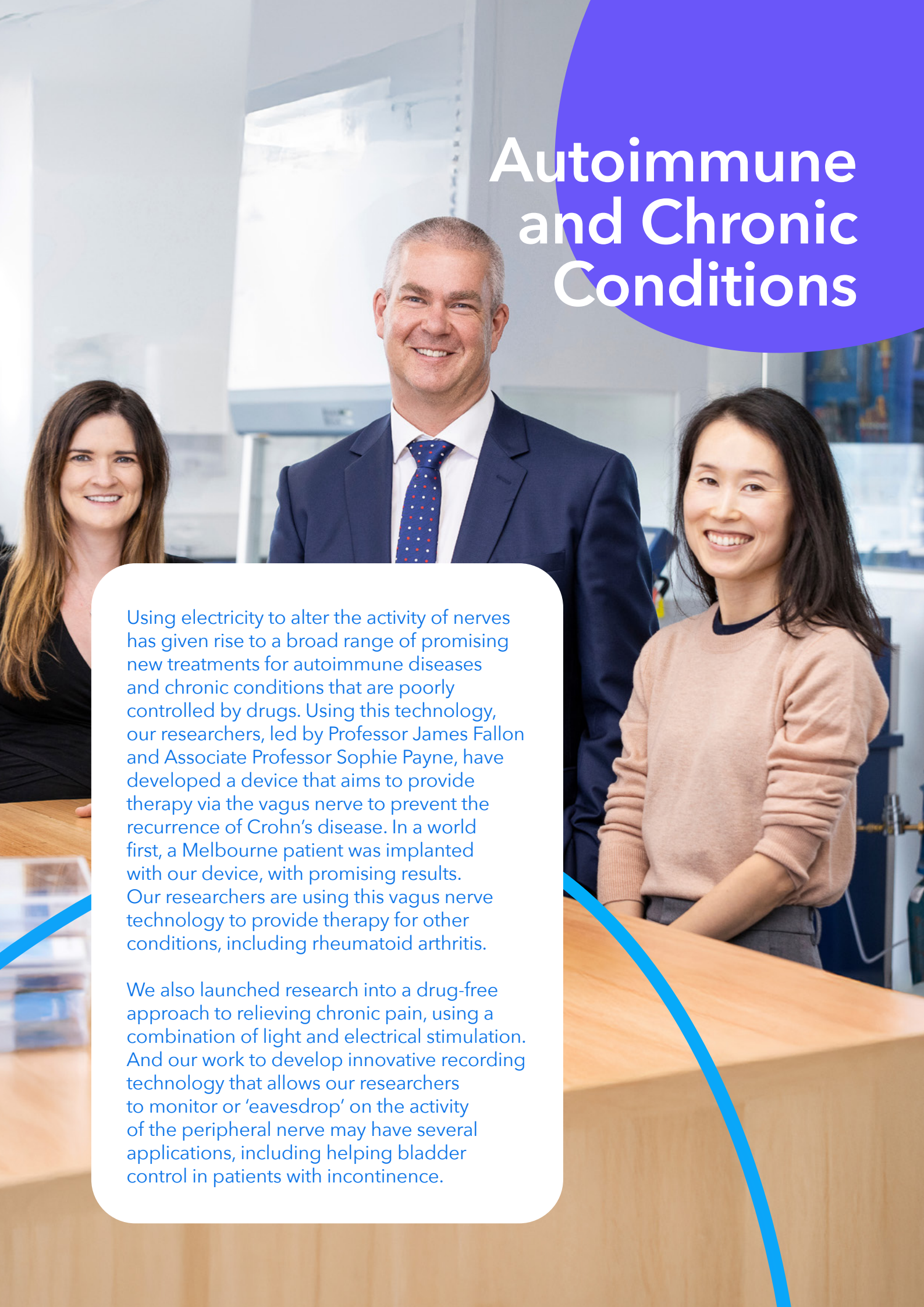
Benefits of being an independent partner in ACMD

Collaboration lies at the heart of 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 also 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.

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.



Autoimmune and Chronic Conditions

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 and Associate Professor Sophie Payne, have developed a device that aims to provide therapy via the vagus nerve to prevent the recurrence of Crohn's disease. In a world first, a Melbourne patient was implanted with our device, with promising results. Our researchers are using this vagus nerve technology to provide therapy for other conditions, including rheumatoid arthritis.

We also launched research into a drug-free approach to relieving chronic pain, using a combination of light and electrical stimulation. And our work to develop innovative recording technology that allows our researchers to monitor or 'eavesdrop' on the activity of the peripheral nerve may have several applications, including helping bladder control in patients with incontinence.

Research report

Preventing recurrence of Crohn's disease

A type of inflammatory bowel disease (IBD), Crohn's disease is a debilitating condition where the body attacks its own tissues causing excessive inflammation in the gut. Around 80% of people with Crohn's disease eventually need surgery to remove sections of the bowel if drug treatments stop working. The benefits of surgery are often temporary.

The Bionics Institute's world-leading research project, which started in 2015, aims to provide an alternative drug-free therapy to prevent recurrence and reduce the effects of Crohn's disease. Within just 4 years, the research team – including Professor James Fallon, Professor Rob Shepherd, Professor John Furness and Associate Professor Sophie Payne – designed, tested and validated a prototype device ready for a first-in-human clinical trial. The trial, called the ElectRx Study (NCT05469607), is active and currently recruiting participants and our first patient has had the device successfully implanted.

Our 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.

Research highlights

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 started recruiting participants. Our first patient had the device implanted in November 2023 and was doing very well at the 6 month review. He has made a full recovery from surgery, has not experienced a return of inflammatory symptoms, and the device has been working well.

Funding and research communication acknowledgement

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

Meet the team

Professor James Fallon, Associate Professor Sophie Payne, Owen Burns, Michelle Bravo and Dr Sally Herring.

External collaborator: Professor Rob Shepherd (University of Melbourne), Professor John Furness (University of Melbourne), Professor David Grayden (University of Melbourne), 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).

Case study

The crippling impact of Crohn's disease

Living with Crohn's disease is a constant struggle for Sara. She first suspected something wasn't quite right after giving birth to her second child back in 2017.

'I was constantly sick with colds and flus,' she remembers. 'Then in 2018, I developed a cough that wouldn't go away and I was always feeling out of breath.'

Crohn's causes her body to attack its own tissues, which creates inflammation of the digestive tract.

There is currently no cure for Crohn's and the symptoms can be excruciating - severe abdominal pain, diarrhoea, fatigue, weight loss and malnutrition. At its worst, the condition can be life-threatening.

'By 2019 I had debilitating stomach pains all the time. I was going to the toilet 10 times a day, and each time I did, it felt like I was passing glass,' Sara says.

Bionics Institute researchers are working on a cutting-edge device that has the potential to reduce the impact of Crohn's.

The device attaches to the vagus nerve in the abdomen and provides electrical stimulation to kick start the body's natural mechanisms, with the aim of reducing activity of inflammatory cells in the gut.

A drug free treatment could be a life-changing option for people like Sara.

Current drug therapies, while providing some relief, often cause side effects or have a reduced impact over time. Around 80% of people with Crohn's end up needing invasive surgery to remove diseased parts of their bowel.

Sara explains, 'As things stand, there's very little doctors can do to ease my symptoms. They put me straight on steroids, then tried a range of different drug treatments, but none of them really worked. And my symptoms always came back. I was worried that would mean I'd have to have major surgery, which would only ever be a temporary solution. I was afraid I'd have to live the rest of my life knowing that the terrible symptoms could come back at any time, and I'd need further surgeries.'

Our device, currently in clinical trial at the Austin Hospital (NCT05469607), is an important step towards the development of therapies that aim to provide patients with the chance to have better quality of life.

"The Bionics Institute's research into innovative new treatments give people like me hope of a better future."

Sara,
Crohn's disease sufferer

BIF

Research report

Reducing inflammation in rheumatoid arthritis

Associate Professor Sophie Payne's team is working on a revolutionary new treatment for rheumatoid arthritis (RA). Although a range of drug treatments are available for RA, they can cause unpleasant side-effects and nearly half of patients with RA don't respond to treatment.

Using the technology developed for Crohn's disease, our device also aims to provide drug-free therapy for RA by stimulating the vagus nerve to kick-start the body's natural anti-inflammatory response. This in turn dampens the inflammation causing joint pain and stiffness, allowing people with RA 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 the neck level, which is in contrast to vagus nerve treatments for RA 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. This new device aims to provide a drug-free treatment and give people with RA 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 early 2025.

Research highlights

We secured significant funding from the Victorian Government in this financial year, which supported activities to prepare our technology for clinical trial. We have also formed a clinical team to support the translation of our vagus nerve stimulation (VNS) technology into a trial for patients with RA and are now in the late stages of acquiring approval from the human ethics research committee.

Funding and research communication acknowledgement

This project was seeded by the Bionics Incubator Fund and is now supported by a generous donor and the Victorian Government. Associate Professor Sophie Payne is also supported by the Lions Clubs Australia.

Meet the team

Associate Professor Sophie Payne, Professor James Fallon, Dr Tomoko Hyakumura, Mr Patrick Lam and Dr Sally Herring.

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

BIF

Research report

Eavesdropping on the peripheral nerve

Bionics Institute researchers 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 to control the bladder in patients with incontinence.

Research highlights

The extension of the project has led to data generated indicating that we can record key signals in the vagus nerve that correlate to the level of inflammation experienced in the gut. This could be essential in developing new adaptive treatment technology for inflammatory bowel disease (IBD). PhD student Thomas Cahir has also developed a new device that will pick up eavesdropping activity in the sciatic (leg) nerve, with application to bionic limbs.

Funding and research communication acknowledgement

The original project, focused on the bladder, is supported by the National Institutes of Health Stimulating Peripheral Activity to Relieve Conditions (NIH-SPARC) fund. In 2023, we published the original study in *APL Bioengineering*.

Our original sensory pain and vagus nerve investigations were supported by the Bionics Incubator Fund (BIF).

We have since secured significant funding through a National Health and Medical Research Council (NHMRC) Ideas Grant.

Meet the team

Professor James Fallon, Associate Professor Sophie Payne, Jerico Matarazzo, Dr Tomoko Hyakumura, Dr Alex Thompson, Thomas Cahir and Jenny Zhou.

External collaborator: Janet Keast (University of Melbourne).

BIF

Research report

A drug-free approach to chronic pain

It is often difficult for those with chronic pain to feel adequate relief using existing pharmaceutical treatments, which also pose serious risks of side-effects, addiction and death.

Implantable nerve stimulators are a drug-free alternative for managing chronic pain, delivering electrical pulses to nerves to mask or block pain signals. However in their current form, they are only suitable for a subset of pain conditions and it is extremely difficult to deliver electrical stimulation to relieve chronic pain without causing unwanted activation of other nerve fibres.

Optogenetics is a technique in which a genetic modification is applied to selective nerve fibres to make them fire when pulses of light are directly applied via an implanted device. This technique overcomes the limitations of electrical stimulation by providing high selectivity. Selective activation or inhibition of sensory fibres may both have a role in suppressing chronic pain without the need for drugs. Yet, the application of optogenetics to treat chronic conditions has been hampered by issues of tissue heating during prolonged light stimulation and responses reducing over time. Using recent innovations in optogenetics and electrical stimulation to address these challenges, our team aims to suppress pain with low intensity optical excitation or inhibition, comparing outcomes with existing electrical stimulation technologies for clinically relevant pain conditions.

Research highlights

Our team has developed a world-first innovation that uses combined optical and electrical (hybrid) stimulation to dramatically lower the light intensity required for optogenetic techniques. By applying low-intensity light to the sciatic nerve (commonly affected by the painful condition sciatica), electrical current could be used at below-threshold levels to exclusively activate genetically modified touch sensory fibres, leaving neighbouring motor and pain-related sensory fibres unaffected. The improved selectivity of hybrid stimulation greatly improves the range of the therapy and avoids off-target effects. Critically, hybrid stimulation selectively increased the synchronised response of touch fibres at much lower electrical currents – expanding the range of the therapy and avoiding off-target effects.

The team has also been examining targeted inhibition of pain-related nerve fibres. We developed a reliable intra-sciatic surgical injection technique that selectively modified the relevant nerve fibres. We then demonstrated light-mediated inhibition of evoked activity in these fibres, while neighbouring touch sensory fibres were unaffected by the light stimulus. These findings are particularly relevant for pain related to arthritis, and lower back pain which are currently not well managed by existing med tech or drug approaches.

Funding and research communication acknowledgement

This work is supported by the Victorian Government and the Bionics Incubator Fund (BIF) and received support from the CASS Foundation.

Meet the team

Associate Professor Rachael Richardson, Dr Mary Ardren, Associate Professor Sophie Payne, Jerico Matarazzo, Elise Ajay, Ethan Duff, Associate Professor Andrew Wise, Professor James Fallon, Jenny Zhou, Ella Trang, Flip Kammerer, Dr David Hill, Owen Burns and Dr Alex Thompson

Brain Research

Professor Kate Hoy and her team launched 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.

Our researchers are also investigating peripheral stimulation for gait impairments in Parkinson's disease, and vagus nerve stimulation in the abdomen is being studied as a means of improving seizure control for patients with drug-resistant epilepsy.

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.

Our researchers are investigating transcranial magnetic stimulation (TMS), as a novel treatment approach for Alzheimer's. TMS uses magnetic pulses 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.

The world-first 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 we have commenced recruitment into our clinical trial. We have consented 12 participants into the trial to date and continue to enrol new participants every month.

We also recruited additional key research members Jacqueline Noonan (PhD candidate) and Eunice Ng (Clinical Research Assistant). Our first cohort of eight participants completed their full treatment course, and we commenced preparation of a provisional patent related to the novel aspects of our research.

Meet the team

Professor Kate Hoy, Dr Oscar Murphy, Danielle Holland, Eunice Ng and Jacqueline Noonan.

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).

BIF

Research report

Investigating the effect of abdominal vagus nerve stimulation on the brain

Our researchers are working to expand the application of abdominal vagus nerve stimulation (aVNS) for treatment of brain disorders. We are particularly interested in the area of the brain responsible for the therapeutic effects of cervical VNS (cVNS) for treatment of epilepsy and depression.

The advantage of aVNS developed at the Bionics Institute is that it is free from respiratory and cardiac side effects associated with conventional cVNS in the neck. If aVNS can activate the therapeutic brain region similarly to cVNS, it has a potential to be used as a more effective alternative to cVNS for a range of brain disorders.

Research highlights

Preliminary findings indicate that aVNS can activate the brain region essential for the therapeutic effect of neck-level vagus nerve stimulation for treatment of epilepsy and depression, without side-effects on the larynx, lungs and heart. Our next aim for this work is to investigate the efficacy of aVNS for the treatment of epilepsy.

We are also interested in exploring what other effects aVNS has on the brain. Master of Biotechnology student Dianne Caresosa has been working with our Histology and In-Vitro Team (HIT) to identify other regions of the brain that are activated through aVNS using immunohistochemistry techniques. This work may lead to identification of other potential applications of aVNS.

Funding and research communication acknowledgement

This work is supported by the Bionics Institute Incubator Fund.

Meet the team

Bionics Institute researchers: Dr Tomoko Hyakumura, Associate Professor Sophie Payne, Jerico Matarazzo, Dianne Caresosa, Dr Wendy Adams, David Nguyen, Ella Trang and Professor James Fallon.

Research report

Peripheral stimulation for gait impairments

Parkinson's disease (PD) 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 PD. Other symptoms 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 PD. Despite the prominence of gait disorders in PD, 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.

Research highlights

PD is characterised by abnormal brain activity; for example, unusually large numbers of neurons simultaneously active. As a first step in this project, we conducted a study on healthy controls to investigate whether application of stimulation to the feet generated responses in the brain. Our results demonstrated that cortical activity is generated in response to stimulation in the form of vibration applied to the feet. In collaboration with Monash Health, we have now submitted an ethics application to conduct a study on people with PD to assess whether stimulation improves gait symptoms. In August 2023, Niamh Hennessy began a PhD on this project.

Funding and research communication acknowledgement

Our findings were presented by Michelle Bravo at the 45th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (24-27 July 2023, Sydney) and later published. This research is supported by funding from the Promobilia Foundation in Sweden.

Meet the team

Associate Professor Mehrnaz Shoushtarian, Professor James Fallon, Niamh Hennessy and Michelle Bravo.
External collaborators: Professor Robert Iansek and Dr Anna Murphy (Monash University).

Developing rigidity measurement technology for Parkinson's disease

A common symptom of Parkinson's is rigidity of the muscles – something which is difficult for clinicians to measure and treat. To address this, the Bionics Institute engineering team are working to develop wearable technology that gives doctors precise information on the level of rigidity of the muscles in a patient's hand. Thanks to funding from the Promobilia Foundation, we are working to miniaturise our current prototype, reduce the weight and optimise the form of the device, with the aim of improving the technology's usability.

Movement and Balance Disorders

Associate Professor David Szmulewicz and Professor Malcolm Horne joined us to lead research into new technology that utilises wearable sensors and artificial intelligence (AI) to measure abnormal movement and incoordination caused by brain conditions.

This work aims to aid with clinical decision making, as well as support those in regional and remote parts of Australia, particularly those with limited access to health services.

Research report

Measuring neurological disorders of movement

Our NeuroMovement Laboratory looks at the many diseases that interfere with balance and our ability to carry out movements. Cerebellar ataxias, for instance, are a group of brain conditions that cause abnormal movement or, more specifically, incoordination. Additionally, vestibular disorders (impairment of the inner ear balance mechanism) are a very common causes of imbalance.

These diseases may cause falls, reduced arm and hand dexterity, impaired vision, loss of speech clarity and communication challenges, plus disturbed swallowing with the risk of choking and pneumonia.

There is currently no accurate way to measure ataxia, and clinicians depend on bedside clinical examination.

Led by Associate Professor David Szmulewicz, our researchers are developing new technologies that utilise wearable sensors and AI to produce accurate measurements of ataxia and imbalance.

One such suite of devices is called the Ataxia Instrumented Measures system (AIMs). Using these and other devices, the team have shown they can accurately measure ataxia whilst a patient is eating, drinking, speaking, sitting and walking.

Being able to accurately measure ataxia will help develop our understanding of these conditions and assist clinicians to monitor the effect of therapies. It is also very important in the development of new treatments.

A project developing virtual reality assessment of abnormal eye movements is also under way and has potential application in disease diagnosis, safety in operating heavy machinery and remote patient assessment.

Research highlights

Associate Professor David Szmulewicz and his team visited remote Aboriginal communities with limited access to specialist care, providing residents with an accurate measure of their disease progression and current treatment effectiveness.

We have identified that the AIM technology has the potential to be used to test gene therapy treatments for ataxia. The devices are also finding usefulness in other diseases that affect movement.

Meet the team

Associate Professor David Szmulewicz, Professor Malcolm Horne, Jemimah Harding and Associate Professor Hamish MacDougall (Honorary).

External collaborators: Professor Pubudu Pathirana (Deakin University), Associate Professor Ian Harding (QMIR Beghofer Medical Research Institute), Libby Massey (Machado-Joseph Disease Foundation), Professor Melanie Baylor (WEHI), Professor Paul Lockhart (MCRI), Professor Alex Tarnutzer (Kantonsspital Baden, Switzerland) and Dr Orit Samuel (Otoneurology Unit, Lin Medical Center, Israel).

BIF

Research report

Measuring essential tremor

Essential tremor (ET) is a progressive, disabling condition that causes involuntary and rhythmic shaking. Sometimes, another neurological condition called dystonia occurs in conjunction with ET, causing a person's muscles to contract. ET commonly affects a person's upper limbs or head but can also be present in the lower limbs and voice.

Due to the complex nature of ET, doctors who are not specialised in tremor assessment may have difficulty assessing the severity of these conditions. Once diagnosed, there are some surgical and pharmaceutical treatments available for ET, but they are not always effective or only help some people for a period of time. Finding a way to measure ET more easily within a primary care setting would help doctors decide on an appropriate treatment for a person's tremor, assess if a treatment has had benefits, or determine if a neurologist referral is required.

The use of objective measurement tools may also help to develop new treatments through use in clinical trials. Our research team are working to develop an easy-to-use system for the measurement of ET using virtual reality (VR). Sensors already available within VR technologies will be used to build an algorithm that accurately measures the severity of ET. We aim to use this data to build a simple device that can be used in clinical trials of new therapies and by non-specialists who are not experienced in assessing ET.

Research highlights

Our study consists of multiple stages, performed serially. The initial stages involved the 'build' of the VR testing environment where the participant could perform the tremor assessments. This virtual environment allows data to be collected from the VR's sensors to measure the frequency and amplitude of the tremor in the relevant body part.

We then collected data from 10 control participants and 10 participants with moderate-to-severe ET. These participants had their tremor assessed by a neurologist's assessment according to The Essential Tremor Rating Assessment Scale (TETRAS). This analysis demonstrated a correlation between the upper limb(s) tremor with the mean spectral power and peak spectral power. The analysis also demonstrated that it is possible to identify the presence of ET and quantify its severity with high concordance with TETRAS. This preliminary information led us to confirm the possibility of using the VR data to stage severity of ET. Currently, we are near completion of our target of obtaining data from a further 20 participants with varying mild-to-severe ET with or without dystonia.

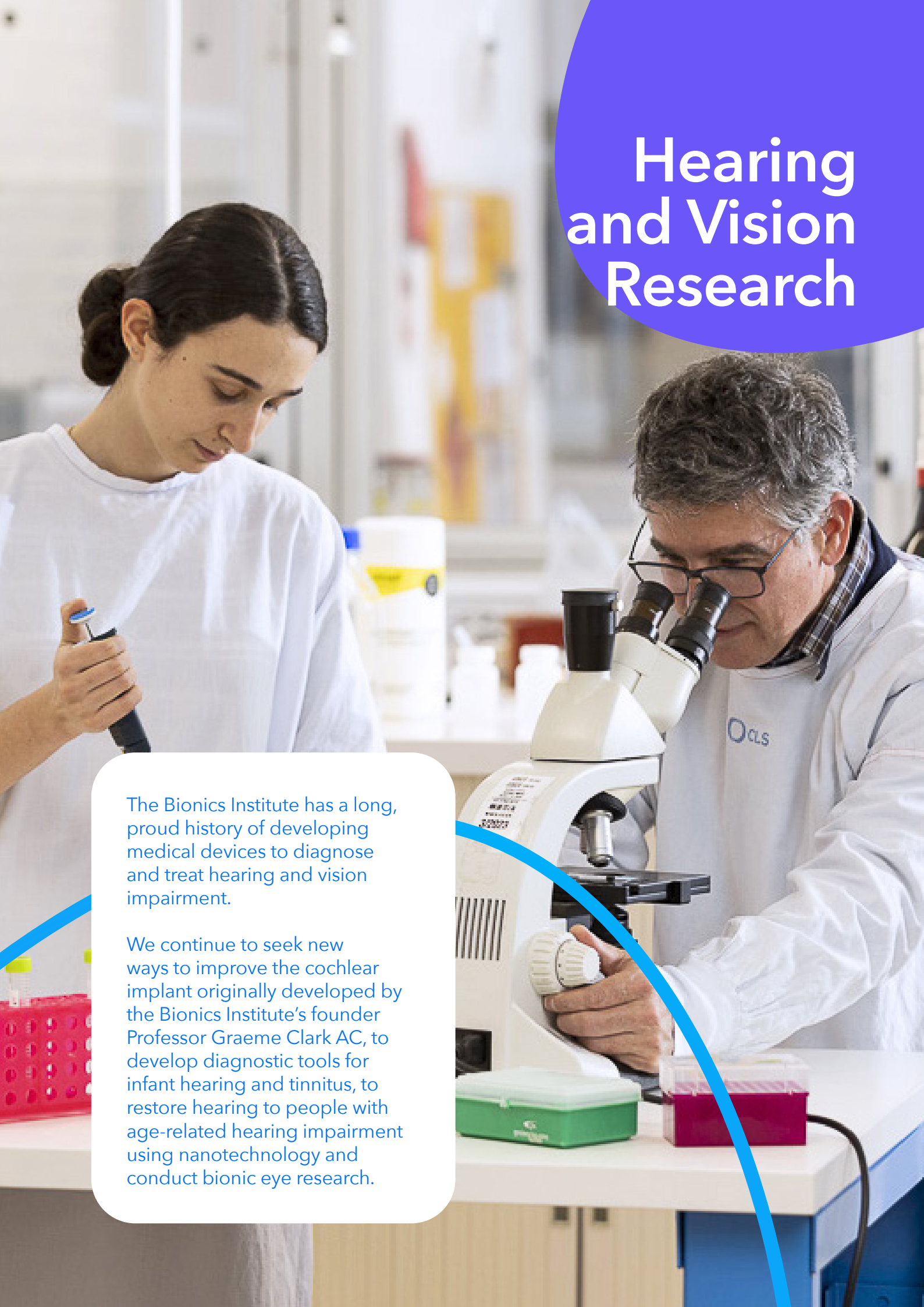
Funding and research communication acknowledgement

This work is supported by the Bionics Institute Incubator Fund (BIF).

Meet the team

Bionics Institute researchers: Professor Malcolm Horne, Sarah Osborn, Associate Professor David Szmulewicz and Dr Hamish MacDougall (Honorary)

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, to restore hearing to people with age-related hearing impairment using nanotechnology and conduct bionic eye research.

Research report

Helping hearing-impaired infants to thrive

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 aims to offer vital insights into a baby's hearing during the crucial early months.

This early stage is pivotal for effective intervention as untreated hearing issues can lead to persistent communication difficulties. EarGenie employs light-based imaging (functional near-infrared spectroscopy or fNIRS) to track changes in brain oxygen levels, indicating a baby's response to a sound or a change in sound. This technology has the potential to assess the effectiveness of hearing aids or cochlear implants for hearing and speech success. Additionally, it could aid babies who have auditory neuropathy, a condition where current testing methods fail, by measuring the severity of the hearing condition and enabling early intervention.

Research highlights

This year, the EarGenie team achieved significant milestones with the completion of our first trial with the EarGenie minimal viable product (MVP) prototype, which was made in partnership with commercial medical device design company Design + Industry. 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 made available to local and international clinical research labs to refine the final design for manufacture and regulatory approval.

Our two PhD students have both successfully graduated this year. Ishara Paranawithana showed that fNIRS could track the development of an infant's hearing brain over the first 2 years of life. Onn Wah (Steven) Lee showed how the infant's brain responds in two different ways when an infant hears a sound or distinguishes between sounds. Their work will significantly contribute to the future success of EarGenie.

Funding and research communication acknowledgement

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

Dr Demi Gao is supported by a Passe & Williams Foundation Mid-Career Fellowship.

Meet the team

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

Research report

Individual optimisation for cochlear implant users

Our researchers are investigating why some cochlear implant recipients do not understand speech as well as others. Led by Dr Tommy Peng and Professor 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 cochlear; difficulty processing information in the auditory brain pathways; and detrimental brain changes because of deafness.

We have recruited 44 study participants and published four 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 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. We are currently combining this patient-specific information with state-of-the art machine learning models to guide how devices are programmed and tailor clinical rehabilitation techniques to improve speech perception for cochlear implant recipients.

Funding and research communication acknowledgement

We presented our research at the 2023 Conference on Implantable Auditory Protheses in California (USA) and the 2024 MidWinter Meeting for the Association for Research in Otolaryngology in Florida (USA). This research is funded by a Project Grant awarded to Professor Colette McKay from the National Health and Medical Research Council (NHMRC) and a conjoint grant from the Passe & Williams Foundation. Dr Tommy Peng is supported by a Passe & Williams Foundation Junior Fellowship. Jamal Esmaelpoor is supported by a University of Melbourne PhD scholarship.

Meet the team

Dr Tommy Peng, Professor Colette McKay, Katherine Henshall 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

A hybrid approach using light and electricity

Electrical pulses from implanted devices can be used to restore nerve function or treat diseases. Unfortunately, with electrical stimulation it is hard to selectively activate just one type of neuron in mixed nerve bundles.

Furthermore, the electrical current spreads out making it hard to achieve a precise area of activation. For devices like the cochlear implant and the bionic eye, this leads to poor resolution of sound or vision.

Our Optogenetics team, led by Associate Professor Rachael Richardson, has been exploring a way to precisely target the stimulation to individual types of nerve fibres or to confined areas of the neural tissue.

Optogenetics is a technique in which selective nerve fibres are genetically modified so that they respond to pulses of light. When applied to nerve bundles that contain multiple types of neurons, this paradigm-changing technology allows us to control activity in just the modified nerve types, leaving the others unaffected. Light is also very easily focused and is less prone to spread compared to electrical stimulation, providing a means to achieve precise neural activation.

Our researchers have been investigating light-based stimulation strategies for hearing restoration, vision restoration and chronic pain relief.

Research highlights

Spatially precise stimulation is essential for applications like vision and hearing restoration. Light is ideal for this purpose, since it can be more easily spatially confined compared to an electrical current. Using optogenetic techniques in the cochlea and the retina, our research findings showed that the area of neural tissue activated by light is much more confined compared to electrical stimulation.

Precise timing between the stimulus and the neural response is also crucial for high resolution visual or auditory experiences. We demonstrated that the fidelity of neural responses to light is much higher when adopting a hybrid approach that uses both light and electrical stimulation. Developing and testing a world-first hybrid cochlear array consisting of alternating electrodes and micro-scale light-emitting diodes was a crucial part of this research.

We also extended our hybrid stimulation strategy to the peripheral nervous system, and showed how optogenetics can provide additional benefits in the form of selectivity. Targeting the stimulation to nerve fibres that are involved in transmitting pain to the brain has the potential to treat chronic pain more effectively than current electrical stimulation techniques.

Funding and research communication acknowledgement

The Optogenetics team's peripheral nervous system research is supported by the Victorian Government, the CASS Foundation, and the Bionics Incubator Fund (BIF).

Our research into hybrid stimulation techniques in the cochlear and retina is supported by an Ideas Grant from the National Health and Medical Research Council (NHMRC).

The team has published in *Nanomaterials, Hearing Research*, and *Journal of Controlled Release*, and has presented their work at the Australian Neuroscience Society (December 2024), 45th Annual International Conference of the IEEE Engineering in Medicine and Biology Conference (EMBC) in Sydney (July 2023), Conference on Implantable Auditory Prostheses in California (July 2023), Association for Research in Otolaryngology in California (February 2024), Photonics West in California (February 2024) and Federation of European Neuroscience Societies in Vienna (June 2024)

Meet the team

Associate Professor Rachael Richardson, Professor James Fallon, Associate Professor Andrew Wise, Associate Professor Sophie Payne, Dr Mary Ardren, Dr Alex Thompson, Dr Niliksha Gunewardene, Jerico Matarazzo, Jenny Zhou, Sarah Kiloni, Ethan Duff, Elise Ajay and Ajmal Azees.

External collaborators: Dr Patrick Ruther (University of Freiburg), 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) and Professor David Grayden (University of Melbourne).

Research report

Pre-clinical bionic eye research

Our current retinal implant has restored vision to a small group of patients blinded by the retinal disease retinitis pigmentosa.

However, the resolution of the restored vision is relatively low. This project aims to develop a prototype retinal implant that dramatically improves the level of vision provided.

Research highlights

Our next generation bionic eye will incorporate a multichannel stimulation strategy to improve visual acuity. We have performed proof-of-concept studies in cat retina as we confirm the efficacy of the new stimulation strategy.

Funding and research communication acknowledgement

This work is supported by a National Health and Medical Research Council (NHMRC) Development Grant.

Meet the team

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

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).

Research report

Treating hearing loss with nanotechnology

Hearing impairment not only impacts our ability to communicate with loved ones, it is also associated with cognitive decline, social isolation and depression.

Hearing loss is commonly caused by exposure to loud sounds and as a consequence of ageing, the most common complaint from patients seeking treatment is difficulty in understanding a conversation in a noisy setting.

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 novel form of high potency growth factors and a new way of delivering these therapeutic drugs to the inner ear using nanotechnology. Growth factors are highly important for the sensory cells within the inner ear. Once delivered into the inner ear, the growth factors can act to restore lost connections between the nerve fibres and sensory hair cells.

This technology aims to overcome some of the significant barriers (safety and efficacy) that have prevented the development of successful drug therapies for hearing loss.

Using this approach in pre-clinical models, we have been successful in repairing damage that has occurred to the delicate inner ear sensory cells that are critical for the perception of sound.

Research highlights

We are readying this highly promising therapeutic technology for a first-in-human clinical trial in patients with hearing loss. Key to our progress is the development of clinical grade manufacturing of our drug and delivery therapy, and establishing the regulatory pathway to enable commercial rollout of this technology to people in desperate need of treatment for hearing impairment.

Funding and research communication acknowledgement

Associate Professor Andrew Wise's research is supported by a Senior Fellowship from the Passe & Williams Foundation, a Development Grant from the National Health and Medical Research Council (NHMRC) and grants from the H & L Hecht Trust and the Robert Bulley Charitable Trust.

Meet the team

Associate Professor Andrew Wise, Dr Yingjie Hu, Catherine Mathew, Yao Zhou, Mardi Gammon, Professor James Fallon, Associate Professor Rachael Richardson, Dr Erol Harvey, Robert Klupacs, James Firth, Associate Professor Peta Grigsby, Dr Trung Nguyen, Joshua McLaughlin, Amy Morley, Ella Trang, Patrick Lam and Dr David Hill.

Research report

Investigating combination treatments for hearing loss to improve speech understanding

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 not all patients 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 2023–24, our team continued to record neural activity 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 have begun quantifying the differences in this discrimination that occur with deafness. We are working to test our hypothesis that the benefits of electro acoustic stimulation derive from the temporal part of the brain and hope our data from a pre-clinical model will indicate causes of residual hearing loss in cochlear implant users.

Funding and research communication acknowledgement

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

Dr Anu Sabu is supported by a Passe & Williams Foundation Junior Fellowship.

Meet the team

Professor James Fallon, Professor Dexter Irvine, Associate Professor Andrew Wise, Dr Alex Thompson, Dr Anu Sabu, James Firth, Dr Trung Nguyen, Josh McLaughlin, Ella Trang and Daniel Williams-Wynn.

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

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 Associate Professor 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 200 individuals, further improving accuracy of our algorithms. We also completed a study where we recorded heart rate, in addition to fNIRS, from individuals with tinnitus and controls. Heart rate was recorded as an indicator of stress, often seen in individuals with tinnitus. Our results showed the addition of heart rate further improved detection of tinnitus severity. We also completed a study demonstrating our ability to measure changes in tinnitus severity using fNIRS, in the same person, which is critical for monitoring treatments. The study was in a group of cochlear implant users who experience tinnitus and whose perception of tinnitus changes with use of their implant. We found a strong relationship between changes in tinnitus perception rated subjectively and changes in our fNIRS objective measure.

Thanks to generous philanthropic support, we are developing a prototype fNIRS device for tinnitus measurement, to enable large multi-site clinical trials of our objective measure with potential tinnitus treatments.

Funding and research communication acknowledgement

Associate Professor Mehrnaz Shoushtarian's work is supported by funding from Hearts and Minds Investments and The William Angliss Charitable Fund. The team's findings were published in the *International Journal of Audiology* (January 2024). Research was shared via poster presentations at the 45th Annual International Conference of the IEEE Engineering in Medicine and Biology Society in Sydney (July 2023) and the Military Health System Research Symposium in Florida (August 2023). Associate Professor Shoushtarian was also interviewed on 3RRR's Einstein A Go-Go radio show, discussing our work developing an objective measure of tinnitus.

Meet the team

Associate Professor Mehrnaz Shoushtarian, Michelle Bravo, Jamal Esmaelpoor, Professor James Fallon, Owen Burns, Mark Harrison, Daniel Williams-Wynn, Asif Mohammed, Claire Hartmann and Dr Alex Thompson.

External collaborator: Dr Nandakishor Desai (University of Melbourne).

Case study

Living with the torment of tinnitus

Like anyone, Kevin wants to have a normal life, doing the things he loves, with people he loves.

But 46 years of high-pitched, jarring sounds in his head caused by severe tinnitus is making it a daily struggle.

'This thing is in your head. It drives you crazy,' Kevin explains.

Therapies, hearing aids, diet changes and medications – Kevin has tried countless ways to try and ease the torment, without success.

He says: 'Seeking help felt worthless. The bottom line is that I got nowhere. No doctor could hear what I was hearing. No one knew how to treat it.'

Tinnitus affects his sleep, relationships and mental health, so it's hard to stay motivated to do normal activities. At dinner parties, Kevin says he often feels isolated as tinnitus makes it very hard to follow his friends' conversations.

'Sometimes I just tune out, as I'm missing too much.'

There's currently no cure for tinnitus, and it is difficult for doctors to diagnose and monitor tinnitus because they can only rely on self-reported symptoms.

Bionics Institute researchers are working to change that. Associate Professor Mehrnaz Shoushtarian and her team have developed a revolutionary new test that could bring people like Kevin extraordinary hope and relief.

Results of early research studies are promising – measuring changes in blood oxygen levels in the brain to measure the brain's response to sound.

Using this approach, we have been able to show differences in brain activity between people with and without tinnitus, as well as individuals experiencing tinnitus at different severity levels. The tinnitus research team are now validating their data in a bigger clinical study and developing portable prototypes of the system for use in a larger multi-site clinical trial.

By gathering further research data, we aim to develop a definitive test of the presence and severity of tinnitus. Such a test might aid in development and monitoring of potential treatments by objectively showing which treatments are effective.

New tests and treatments could have a profound impact on those like Kevin.

"This potential test gives me hope that soon my tinnitus might be better managed. I'll be able to enjoy a concert, a conversation at a dinner party and especially the quiet calm and solitude of a walk in the park."

Kevin,
Tinnitus sufferer

Research report

Objective assessment of a surgical technique for pulsatile tinnitus

Pulsatile tinnitus involves hearing a constant beating or whooshing sound, often in synchrony with one's heartbeat. It can be caused by compression of an artery on the hearing nerve inside the skull.

This randomised clinical trial aims to investigate whether a form of surgery called microvascular decompression, which is used to move the artery away from the nerve, can be used to treat pulsatile tinnitus.

At the Bionics Institute, we will record our fNIRS-based objective measure of tinnitus before and after surgery. By performing fNIRS measurements, we aim to provide objective evidence of the effectiveness of the surgical intervention.

Use of our objective test along with surgery has the potential to personalise this treatment for people living with pulsatile tinnitus.

Research highlights

We currently have two participants enrolled in the trial with further recruitment underway.

Funding and research communication acknowledgement

This research is supported by Monash Health, as a collaboration between the Bionics Institute and Monash Health.

Meet the team

Associate Professor Mehrnaz Shoushtarian, Michelle Bravo, and Professor James Fallon.

External collaborator: Associate Professor Leon Lai (Monash Health).

Research report

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

The Bionics Institute has developed an objective test of tinnitus in humans using 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.

Part of our tinnitus test in humans involves recording brain responses to sound or visual patterns. In our preclinical study, initial findings showed we could record similar responses in animals. The next step is to perform recordings in a preclinical model of tinnitus. We paused this project in December 2023 to focus on our planned human trials.

Meet the team

Associate Professor Mehrnaz Shoushtarian, Professor James Fallon, Michelle Bravo.

Fellowship report

Passe & Williams Foundation

Dr Demi Gao: Improving cochlear implant programming

A senior research scientist at the Bionics Institute, Dr Demi Gao is leading research to improve cochlear implant programming for infants.

Currently, there is no reliable objective test available for clinicians to measure the range of sound and volume that babies can hear. This can mean infants with severe to profound hearing loss are not fitted with a correctly programmed cochlear implant early in life and miss out on important stimulation needed to develop full language and speech skills – with lifelong effects.

Thanks to a Mid-Career Fellowship from the Passe & Williams Foundation, Dr Gao and our researchers are developing an innovative test using functional near-infrared spectroscopy (fNIRS), to measures how the brain responds to sounds.

Our test aims to support clinicians to make appropriate decisions on setting up the cochlear implants correctly for infants early in life – leading to better outcomes for those with hearing impairments.

Research highlights

We've conducted an fNIRS study for hearing level assessment in sleeping infants and undertaken data analysis and interpretation to better understand auditory evoked fNIRS responses. An fNIRS-based speech detection algorithm is now in development.

"With the support of a Passe & Williams Foundation Mid-Career Fellowship, my work at the Bionics Institute provides me with the opportunity to conduct cutting-edge research that improves speech and language outcomes for children with hearing impairments."

Dr Demi Gao

Fellowship report
Passe & Williams Foundation *cont.*

Dr Anu Sabu: Investigating how combined stimulation improves hearing outcomes for the partially deaf

With an interest in biomedical devices, electrophysical recordings and data analysis, Research Fellow Dr Anu Sabu is working to understand how information is encoded by the auditory system.

For some people, having a cochlear implant as well as hearing aids provides enhanced sound quality and speech comprehension (particularly in noisy environments), compared to only having electrical stimulation from a cochlear implant. Yet, little is understood about why these benefits occur or why not all patients experience the same benefits.

With the support of a Passe & Williams Foundation Junior Fellowship, Dr Sabu and Bionics Institute researchers aim to address this knowledge gap by measuring the brain's response to sound using recordings from the inferior colliculus, and then investigating how this data relates to the person's ability to discriminate between different speech sounds.

This research aims to provide clinicians with the information they need to optimally program a patient's cochlear implant and hearing aids (in combination) so that, with better sound quality, the patient can participate in situations where background noise is a problem.

Research highlights

We've developed a software algorithm to process the brain signals recorded from the inferior colliculus, and have analysed the recordings to measure how different speech tokens can be discriminated in different noise/background settings in subjects with normal hearing or some extent of hearing loss

"I'm deeply grateful to the Passe & Williams Foundation for their generous Junior Fellowship award. This invaluable support empowers me to conduct groundbreaking fundamental research in auditory neuroscience, under the guidance of leading experts in the field."

Dr Anu Sabu

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 learning opportunities for high school students, and short-term student research projects and internships, as well as major graduate research projects for PhD and Masters by Research degrees.

Open House 2023: Showcasing our innovators during National Science Week

The Bionics Institute 2023 Open House event was a resounding success, with over 100 people visiting on Wednesday 16 August to take part in tours of our laboratory and hear from our researchers, engineers and scientists about their work.

We ran six tours throughout the day, providing an opportunity for students, supporters, industry connections and fellow med tech innovators to learn more about the impact of our research.

We were thrilled to be able to offer hands-on experiences under the guidance of our lab team, and showcase projects including our Alzheimer's research, hearing therapeutics and vagus nerve research as well as provide insight into our engineering capabilities.

Held as part of National Science Week, we're proud that this 'Inspiring Australia' initiative was supported by a National Science Week grant from the Australian Government.

Girls in STEM Mentoring Program 2024

The Bionics Institute is passionate about inspiring young women to pursue a career in science, technology, engineering and mathematics (STEM). In 2024, the Girls in STEM Mentoring Program provides unique learning experiences for 70 students from 15 Victorian and interstate schools.

Over a 6-month period, students gain science communication skills and insights into study pathways through monthly online meetings with leading female researchers. Program mentors are from across the STEM sector – academia and industry – including the Bionics Institute, the University of Melbourne, Trajan Scientific and Medical, and Orygen.

The program also supports students to meet with their mentor in person, gain hands on experience in a laboratory via a tour of the Bionics Institute and present learnings from the program to their peers at a school assembly.

In October, program participants, teachers, principals and mentors come together for a celebration event to acknowledge the achievements of the students.

Case study

Griffin Swann Scholarship supports early-career researcher success

Jacqueline Noonan's love of science and innovation has led her to contribute to developing more effective treatments for those with Alzheimer's disease.

With a strong passion for neuroscience, Jacqueline is currently completing her PhD investigating dysfunctional connectivity in cognitive decline associated with Alzheimer's disease.

Jacqueline is working in the Bionics Institute's Cognitive Therapeutics team and says she hopes to become a Research Fellow and progress to the next stage of her career. 'I've got so many questions, and I hope to be a part of finding those answers – for myself and for others,' she says. For her PhD, Jacqueline is analysing data from the Bionics Institute's TRAM trial, which is exploring transcranial magnetic stimulation (TMS) of the brain as a way of improving memory in those with mild to moderate Alzheimer's. TMS is a safe and painless electrical stimulation technique, which uses magnetic pulses to alter brain activity.

Under the guidance of Professor Kate Hoy, Jacqueline's sub-study examines brain connectivity in individuals with mild cognitive impairment and healthy older adults to further explore cognitive decline. Jacqueline says that the expertise of researchers and engineers at the Bionics Institute have developed her knowledge and set her up for professional success.

'I've been very fortunate and impressed by a lot of the people that I've been working with, particularly Kate. I think she's incredible.'

To help support her during her studies, Jacqueline received the inaugural Griffin Swann PhD Scholarship – awarded to a young researcher interested in improving the lives of those with Alzheimer's. For Bionics Institute supporters Peter Griffin AM and Terry Swann, the decision to set up a scholarship fund to support a PhD student over 4 years was very straightforward.

'We see our role as assisting research institutes to fund bright young people to advance knowledge into a range of problems still facing society today,' Peter explains.

Jacqueline is determined to continue research that aims to help slow or even prevent cognitive decline in individuals with Alzheimer's, and the scholarship plays a significant part in this.

'Improving the quality of life of those with Alzheimer's is something I'm passionate about – giving hope to both patients and their families.'

"I'm so grateful for the support of Terry Swann and Peter Griffin. Their scholarship means that I can continue to work towards that goal."

Jacqueline Noonan
PhD student

PhD Student Focus

Ajmal Azees (RMIT University)

Ajmal Azees presented his research on optogenetic stimulation for spatially precise stimulation of cochlear neurons at the SPIE Photonics West Optogenetics and Optical Manipulation Conference held in San Francisco in early 2024. Ajmal says:

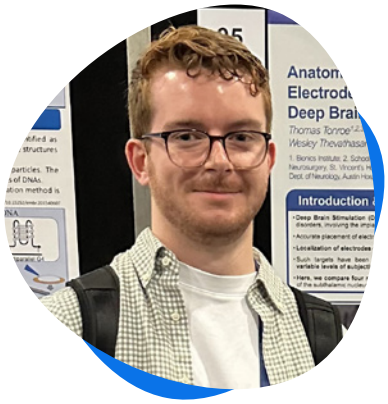
> *"I was thrilled to have the incredible opportunity to present our research findings and have engaging discussions at this event. Thank you to my supervisors for their support and thank you to the Bionics Institute's McManamny Family Travel Grant and RMIT University Travel Grant for making this journey possible!"*

Ishara Paranawithana (Monash University)

Ishara was selected as the geographic finalist for the Asia-Pacific region in the student paper competition organised as a part of the 2023 IEEE International Conference on Engineering in Medicine and Biology (EMBC 2023) held in Sydney. Ishara says:

> *"I had the pleasure and privilege of representing Australia as the Asia-Pacific finalist. The opportunity to meet other student paper finalists and listen to their very impressive work has really been the highlight of the conference for me!"*

His work, focused on understanding how connectivity of hearing and language areas in the brain develop over time during infancy, also featured in The Age in November 2023.



Tom Tonroe (RMIT University)

Tom was part of the Bionics Institute representatives at the 2023 IEEE International Conference on Engineering in Medicine and Biology in Sydney, where he presented research findings on anatomical targeting for electrode placement in deep brain stimulation. Tom says:

> *"I was grateful to be afforded the opportunity through the Harold Mitchell Travel Fellowship to present the first research output of my PhD at EMBC 2023. It was also great to attend several talks around current and future neuromodulation techniques, and the translation of early-stage research towards improved patient outcomes."*

Jacqui Noonan (University of Melbourne)

Jacqui attended the Australian Dementia Research forum held in Surfers Paradise (QLD) in June 2024. Through a competitive internal application process, Jacqui was awarded the first round McManamny Family Scholarship Travel Grant available to PhD students at any stage throughout their candidature. Jacqui says:

> *"The experience was incredibly valuable for my PhD journey, as it provided me with the opportunity to deepen my understanding of the latest advancements in dementia research. With the help of the McManamny Family Scholarship, I could attend the forum which allowed me to refine my research questions, gain new insights and connect with leading experts and other researchers in the field."*

Jacqui who is in the first year of her PhD, was also awarded the Griffin Swann PhD scholarship upon application to commence a PhD with the Medical Bionics Department at the University of Melbourne and the Bionics Institute.

Jamal Esmaelpoor (University of Melbourne)

Jamal was one of our representatives at fNIRS 2024 in Brimingham, having received the Harold Mitchell Travel Grant – funding awarded to a senior PhD student within the Institute to present their work at a major overseas meeting. The event brought together over 500 attendees from around the world to learn about advancements in fNIRS technology and research findings. Jamal had the opportunity to speak to his work 'Cross-modal Functional Plasticity after Cochlear-implantation' during a poster session. Jamal says:

> *"I would like to express my gratitude for the support I received from the Harold Mitchell Travel Fellowship, which enabled my participation in the recent fNIRS conference. Attending the conference was exceptionally beneficial for my PhD project. I had the opportunity to engage with experts from around the world, discussing their work and experiences with fNIRS data, which broadened my understanding of current methodologies."*

Bionics Institute Leadership and Impact Awards

We were delighted to welcome Professor Field Rickards, Professor Dexter Irvine, Professor Peter Seligman and Associate Professor Graeme Rathbone to our final staff meeting of 2023 to present our annual awards for leadership and impact.

All four researchers made a substantial contribution to the Bionics Institute during their careers and have held a number of prestigious roles in industry and academia. We are honoured to recognise their service and legacy through accolades to staff.

In 2023, our recipients were:

Field Rickards Award for Best Researcher

Professor Kate Hoy

Field Rickards Award for Best Team

Finance Team

Field Rickards Award for Best Student

Ajmal Azees

Dexter Irvine Award for Best Auditory Scientist/ Engineer

Dr Gautam Balasubramanian

Peter Seligman Award for Best Engineer

Jerico Matarazzo

Graeme Rathbone Award for Best Early Career Researcher

Dr Oscar Murphy

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

This year we got the opportunity to speak to you personally by phone, on tours of the Institute, or at one of our events. It was a joy to hear that you love the Bionics Institute as much as we do.

We know you care passionately about contributing to the medical breakthroughs of the future and feel it's vital to invest in medical research that isn't happening elsewhere.

Many of you have been affected by the conditions we research, including hearing loss, Parkinson's, Alzheimer's, Crohn's disease, epilepsy and arthritis, and you want to help our researchers find new treatments.

The Bionics Institute is very different to most medical research institutes where the focus is on discovery. Our researchers and engineers focus on fast translation of our research into clinical reality and the milestones highlighted in this report, including several clinical trials, show how we are making an impact.

Impact made possible by you

Our ability to make an impact and improve the lives of people with challenging conditions is made possible by you, and people like you. We would like to take this opportunity to thank everyone who has and continues to support our researchers. In the next few pages, you can read the stories of these wonderful donors:

- The Gillespie Family Foundation who donated towards our first ever Giving Day for Hearing Research
- Steritech who donated in memory of our long-standing Board Director, Brian Jamieson
- The Gaudry Foundation who donated to 52 charities in 52 weeks to inspire others to give
- Joe and Dot Hernandez from Precision Electronic Technologies who give every month
- Cooper Investors who joined with Hearts and Minds Investments to support our tinnitus research.

Leaving a legacy

We were deeply honoured to be remembered in the Estate of the late Lorraine Phillips. Lorraine was a loyal supporter during her lifetime and her legacy lives on in our research.

Many of you let us know about your intention to leave a gift in your Will to the Bionics Institute and joined our Catalyst Community this year. Thank you, your choice will ensure we can continue our pioneering research and improve the lives of people for generations to come.

Gifts of time, talent and treasure

The word philanthropy comes from the Greek word meaning 'love of humanity' and is now often defined as giving gifts of time, talent and treasure to help make life better for other people. We are very grateful to our Fundraising Committee and the newly formed Young Bionics Committee for their incredible support – we couldn't do what we do without their dedication to the Bionics Institute.

Thank you

We are very grateful to everyone who supports our mission to research and innovate cutting-edge medical devices to solve medical challenges and transform lives, and we look forward to working in partnership with you for many years to come. Thank you.

The global impact that grew out of philanthropy

‘It’s been an exciting journey, being on the Board of the Bionics Institute and supporting its endeavours. It’s a 40-year-old institute with a young, start-up mentality and I’ve really enjoyed watching it grow and flourish.’

Entrepreneur and philanthropist Roger Gillespie OAM was a Bionics Institute Board member from 2014 until 2023 and knows the Institute well. He has lived with hearing loss for many years and was initially interested because the institute was renowned for the cochlear implant and hearing research.

However, he says he soon realised that the Bionics Institute was very different to other medical research organisations due to the fact that it’s small and agile, and very focused on commercialising medical devices to ensure they reach patients.

> *‘I’ve met many researchers at the Bionics Institute who have arrived with brilliant ideas and developed amazing new treatments and diagnostic tools. It has been mentally stimulating and very fulfilling.’*

Roger co-founded Bakers Delight with his wife Lesley in 1980 and together they built the business into the largest chain of bakeries in Australia, now run by their daughter Elise Gillespie and her husband David Christie. The business in North America trading as COBS Bread is run by their son Aaron.

For everyone in the family, Roger, Lesley, Elise, David and Aaron as well as Aaron’s wife Meghan, running a business goes hand in hand with giving back to the community.

Lesley says it’s all about the people and the family give to the Bionics Institute through the Gillespie Family Foundation because they see the long-term benefit.

‘We back great people doing great things, and there are some very special people working at the Bionics Institute,’ she says.

Roger agrees and says it’s been a joy to see the evolution of an epilepsy monitoring device, developed at the Bionics Institute with neurologist Professor Mark Cook AO, into a thriving start-up company.

“The global impact of a new device to monitor epilepsy would be huge for the millions of people suffering with the condition – that grew out of philanthropy,’ he says. ‘We’re now involved as impact investors – it appeals to us as entrepreneurs, but what really matters is that we’re doing our bit to help humankind live a better life.”

Roger and Lesley Gillepsie

Give52: The joy of regular giving

When Melbourne couple, Anton and Jenny Gaudry sold their business in 2018, they wanted to give back to the community. They were inspired by Tristan Miller, author of *Run Like Crazy*, who wrote about the challenge of running 52 marathons in 52 weeks.

Instead of running, the Gaudrys decided to 'give like crazy', visiting and donating $10,000 to 52 charities in the 52 weeks of 2020 under the banner of Give52.

Anton says he and his wife saw an opportunity, not only to give financial support to charities in need, but also inspire other people to think about giving to charity on a regular basis.

'The aim of Give 52 was to capture people's imagination – especially the younger generation. Donating the cost of one coffee per week will not make a dent in your budget, but over time it will make a big difference to the charity you support and make your community a better place to live,' Anton says.

Jenny says that giving regularly, not only helps other people, it's also incredibly rewarding.

> *'The fun aspect of philanthropy wasn't something we'd considered so it's been a pleasant surprise. We've met some incredible people, and we get so much joy from seeing the impact of our donations,' Jenny says.*

The Gaudrys have a strong interest in education and are very appreciative of the medical treatment they and their family have received that just wouldn't be available without medical research.

Giving to medical research at the Bionics Institute was therefore an easy decision.

Anton says: 'We love hearing about the incredible research at the Bionics Institute. They're working on solutions to some of the world's most challenging conditions, and it's great to know we're helping them get new treatments into the clinic to help people with diseases like Alzheimer's and Crohn's disease.'

"The best outcome for charities like the Bionics Institute is to set up a giving plan – make a regular commitment and feel the joy of regular giving."

Anton & Jenny Gaudry

Engineering a solution for the torment of tinnitus

Senior Research Engineer Owen Burns and his team are working with lead researcher Associate Professor Mehrnaz Shoushtarian to develop a new prototype to test tinnitus using functional near-infrared spectroscopy (fNIRS).

Supported by generous donations from Hearts and Minds Investments (as nominated by Cooper Investors), and the Lucas' Papaw Foundation, the team will produce a portable prototype in 2024 for use in a multi-site clinical trial.

Peter Cooper founded Cooper Investors in 2001 and combines his role of Chief Investment Officer with advocating for more and better philanthropy in Australia.

> *'Medical research provides an excellent return on investment, and I look forward to seeing the progress of this research program towards new treatments for tinnitus,' Peter says.*

With further support from the Lucas' Papaw Foundation, our expert engineers are able to purchase essential equipment needed to develop a clinical-grade, portable version of the brain imaging cap and associated software which can be trialled in sites around Australia.

Tinnitus, hearing sounds not present externally, affects 15% of the population and can severely impact quality of life. Currently there are no reliable treatments for tinnitus, and also no objective test to determine if potential treatments are working.

Associate Professor Shoushtarian says: 'We have developed an objective test of tinnitus using fNIRS and machine learning to detect tinnitus-related changes in the brain, which is an important step in developing reliable treatments'.

Using a general-purpose fNIRS system, Associate Professor Shoushtarian and her research team have established a technique that detects tinnitus with 87% accuracy. However, to meet clinical usability requirements, a specialised prototype is under development.

The Bionics Institute's test aims, for the first time, to clinically show the presence of tinnitus, so that clinicians can assess if a treatment is working and to pave the way for the development of new treatments.

"We are deeply grateful to Hearts and Minds Investments and the Lucas' Papaw Foundation for helping us silence the torment of tinnitus."

Owen Burns & Associate Professor Mehrnaz Shoushtarian

Corporate giving boosts research

Support for the Bionics Institute through corporate philanthropy has provided our research efforts a timely boost this financial year. Joe and Dot Hernandez from Precision Electronic Technologies have chosen to support the Bionics Institute's work via regular corporate giving, joining a growing number of companies focused on giving back to the community through charities.

Precision Electronic Technologies is renowned for excellence in electronic manufacturing and has a legacy of innovation – it was one of the first Australian companies to manufacture printed circuit boards in the 1950s. Today, Precision Electronic Technologies services customers from Australia and around the world, some of which are med tech companies.

'We feel that it is very important for companies to give to charitable causes such as the Bionics Institute,' says Joe and Dot.

Another example of workplace giving is matching schemes, where employee gifts are matched by the employer, doubling the impact of an employee donation.

The Bionics Institute thanks Agilent Technologies, Macquarie Group Foundation and Westpac Group for matching gifts from employees to the Bionics Institute. Former Macquarie Group and Macquarie Bank non-executive director and Bionics Institute Board Member Michael Coleman FAICD*Life* says that corporate matching is a great example of an incentive to get employees to support charitable causes close to their heart and doubling their impact.

Michael says: 'Workplace matching, such as the scheme in place at Macquarie Group Foundation, is a fantastic tool for companies to support causes that are meaningful to their employees and to make an impact in the charitable sector'.

"I'm proud to be a supporter of the Bionics Institute and a catalyst for Macquarie Capital Group supporting the Bionic Institute," he adds.

The Bionics Institute also received support from Right Lane Consulting, a for-purpose management consulting firm, who gave a generous corporate gift on behalf of a member of their advisory group. A one-off corporate gift is a meaningful and powerful way to support a cause, and the Bionics Institute is very grateful to Right Lane Consulting.

There are multiple ways to take part in corporate giving, including corporate partnerships through cash and in-kind sponsorship, donation matching to multiply impact, or companies can support employees through workplace giving.

"The positive outcomes for companies, such as team building, employee morale and goodwill makes supporting the Bionics Institute all the more worthwhile."

Joe and Dot Hernandez
Precision Technologies

Bionics Institute's first Giving Day for hearing research

On 5 March 2024, during World Hearing Week, we invited all our supporters to join us in helping our researchers give everyone the joy of hearing. Excitingly, the Bionics Institute raised over $146,000 on our first ever Giving Day!

With the generosity of our supporters, we raised significant funds towards groundbreaking hearing research at the Bionics Institute to speed up new tests and treatments including:

- An objective test for tinnitus
- A new hearing test for babies
- Improved performance for cochlear implant users.

Those who donated on Giving Day saw their donation doubled, thanks to a group of wonderful supporters. We would especially like to thank the Gillespie Family Foundation for their cornerstone gift to the campaign.

All donations, no matter what size, help us to research new tests and treatments. The Bionics Institute is grateful to all those who contributed towards Giving Day and share our vision to give everyone the joy of hearing.

Garden party Fundraiser

Long-time ambassador Cynthia McLarty kindly hosted a garden party fundraiser and raised an incredible $10,000 to help speed up groundbreaking research.

The fun-filled day included a raffle, BBQ, cream teas, wine tastings and much more; with the support of friends, family and local businesses, the day was a huge success.

Cynthia's son Sam was born profoundly deaf and at 9 months old became one of the youngest children in Victoria to receive a cochlear implant.

Whether it's a garden party, coffee morning or sponsored fitness event, we are so grateful for the time and effort our supporters so generously give to help us progress our research and give hope to those living with debilitating medical conditions.

"I have been forever grateful to the Bionics Institute from that miracle day, 24 years ago, when my son Sam heard sound for the first time. A moment I will never forget. Hosting the garden party was a small way of giving back to an organisation that has changed so many lives around the world, and will continue to do so."

Cynthia McLarty
Long-time ambassador

Getting in-quiz-itive with our supporters

The 2024 Trivia and Auction Night took place in June 2024 and was a resounding success, with over $14,000 raised for life-changing medical research at the Bionics Institute.

Hosted at Richmond Town Hall, this annual fixture saw 150 people attend for a night of fun and frivolity, trivia and a live auction where all items were sold.

The Bionics Institute would like to give a special thank you to Bio101 and the City of Yarra for being Gold Partner Sponsors, and John Cottrell for kindly giving his time to be the Trivia Master and DJ for the night.

This event was organised by the Young Bionics Committee, with thanks to: Jed Bertalli, Kaitlin Beattie, Ned Gill, William Anderson, Stephanie Vipond, Tim Luscombe, Hamish George, Ed Phillips and Emily Jarman.

We would also like to thank the following organisations and individuals for providing in-kind gifts to auction off as part of the live and silent auctions: RACV Club, Concept Logistics, Intrepid, Dan Murphy's, Mackenzie Arnold, Donna Demaio, Cynthia McLarty, Robert Klupacs and Gift a Break.

Thank you to WHITEFOX Real Estate for generously donating their time to be auctioneers.

Fundraising Committee

Our Fundraising Committee provides valuable assistance in driving engagement and events with our supporters.

Michael Stilwell
Chair

Pamela Batrouney

Caroline Chernov

Jim Hayman

Sean Moore

Kunal Rastogi

Donating to honour a lifetime of giving back

For over 21 years, Brian Jamieson was dedicated to supporting research at the Bionics Institute as a longstanding Board member.

With 30 years of experience in the advisory and audit services industry as CEO of Minter Ellison and KPMG, and extensive experience as a company director and chair, the Institute benefited immensely from Brian's expertise in financial management.

Everyone who worked with him at the Bionics Institute remembers his warmth, keen sense of humour and wide circle of friends and work colleagues, many of whom he introduced to the Board.

In August 2023, Brian sadly lost his battle with cancer.

Despite his long illness, he made sure the Bionics Institute continued to receive sage advice by asking family friend and former colleague, Jen Dicker to join the Board.

Jen is Chair of the Board of Steritech, a family business providing services to the food, packaging, medical and agricultural industries.

To honour Brian's memory, Jen, her father Ian Dicker and the Steritech board decided to make a donation to the Bionics Institute.

> *"We made this donation in memory of our dear friend Brian, who served on our advisory board for over 30 years. We miss him dearly. His humility, quiet generosity, and sharp business acumen were unmatched. Brian was passionate about the future of the Bionics Institute, and we are honoured to carry forward his legacy."*
>
> ***Jen Dicker***

Vale Brian Jamieson

02/03/1944 - 07/08/2023

Thank you for your generous support!

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

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Ms Ana Ago
Ms Laura Ahto
Ms Elise Ajay
Mr Mazin Albassit
Mr Luis Alexander
Ms Tracey Allen
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Thank you for your generous support! *cont.*

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Thank you for your generous support! *cont.*

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

Thank you

All gifts, no matter what size, have a meaningful impact. Your donation ensures we can continue our pioneering research and improve the lives of people for generations to come.

Financial Statement

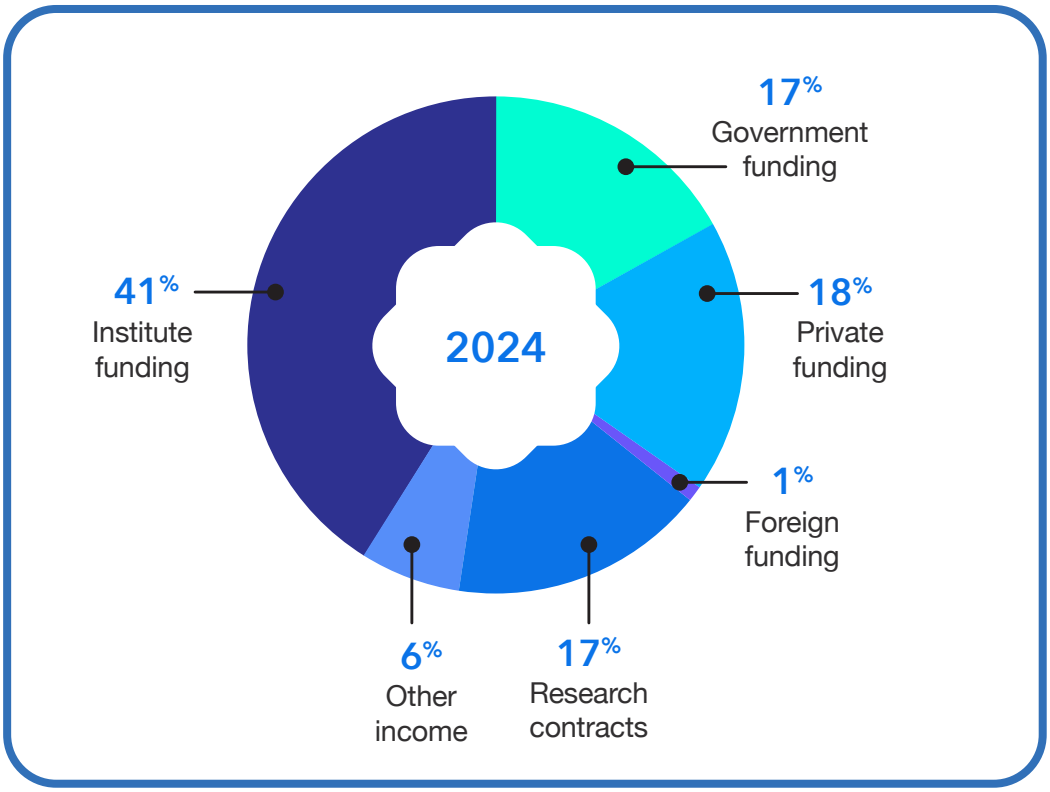
Abridged financial statement
for the year ended 30 June 2024

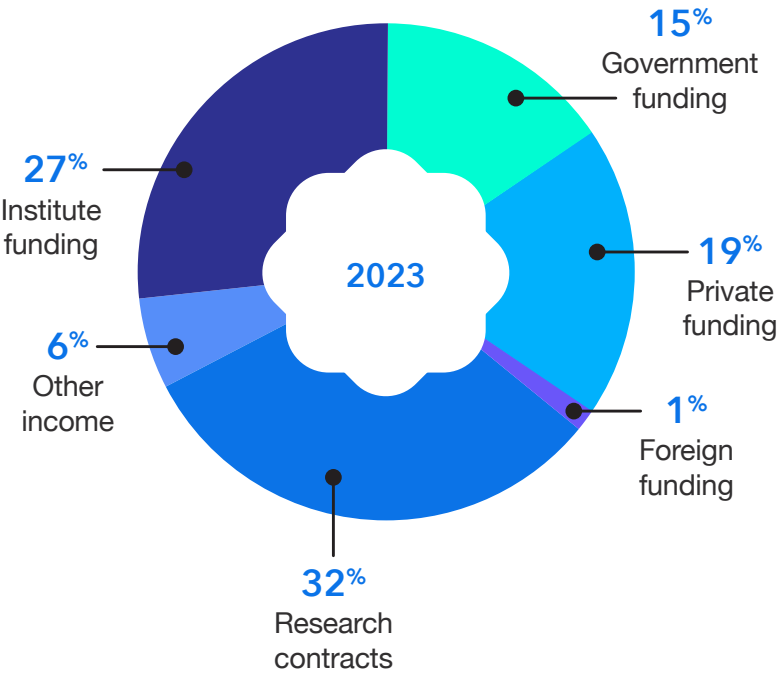
CONSOLIDATED INCOME STATEMENT	2024 $	2023 $
REVENUES FROM ORDINARY ACTIVITIES		
Federal Government grants	1,794,161	1,615,188
State Government grants	884,732	733,105
Foreign grants	179,981	174,425
Trusts & foundations	1,126,676	1,179,530
Public fundraising	1,692,101	1,741,565
Research contracts	2,685,938	4,954,679
Investment & interest income	1,106,843	1,118,065
Other income	1,033,676	906,875
TOTAL REVENUE FROM ORDINARY ACTIVITIES	10,504,108	12,423,432
less Expenditure on ordinary activities	(15,917,861)	(15,478,466)
DEFICIT ON ORDINARY ACTIVITIES	(5,413,753)	(3,055,034)
Loss on sale of property and fixed assets	(52,292)	(343)
Gain on available-for-sale financial assets	553,702	1,013,881
Share of loss in associates	(373,241)	(1,034,564)
NET DEFICIT	(5,285,584)	(3,076,060)

CONSOLIDATED STATEMENT OF FINANCIAL POSITION	2024 $	2023 $
Current Assets	12,269,997	7,064,586
Non-Current Assets	8,264,899	18,603,768
TOTAL ASSETS	20,534,896	25,668,354
Current Liabilities	5,712,788	5,712,612
Non-Current Liabilities	1,645,184	1,493,234
TOTAL LIABILITIES	7,357,972	7,205,846
NET ASSETS	13,176,924	18,462,508
TOTAL INSTITUTE FUNDS	13,176,924	18,462,508

Financial Statement *cont.*

Funding of our research





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

“It’s really fulfilling to work somewhere that focuses on taking new ideas and bringing expertise together, to translate them into something effective and useful that will have a positive impact on someone’s life.”

Dr Gautam Balasubramanian
Senior Data Scientist

Bionics
Institute

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