EXCHANGE

NeuRA Profile 2014

Discoveries that change the world are not made by a single scientist working alone.

Discoveries are made via the exchange of ideas, insights and knowledge between scientists, and through the give and take of time, generosity and goodwill from patients and the broader community. These exchanges occur everyday at NeuRA.

We invite you to read about them in the following pages and see how essential they are for driving neuroscience research forward.

NeuRA

Discover. Conquer. Cure.

EXCHANGING KNOWLEDGE – CHANGING LIVES

NeuRA's capacity to tackle society's health challenges is the greatest it has ever been. The size and scope of our new research facility are indicative of the burden brain diseases will have on humanity into the future – unless we can bring together the best minds in science and medicine. With this new facility, we are doing exactly that.

Through the opening of the Margarete Ainsworth Building, we continue to engage in front-line research to tackle the many neurological, psychiatric and psychological diseases and disorders affecting our community.

Our clinical facilities and interview rooms, research laboratories, shared equipment and collaboration zones allow for synergies in thinking, methodology and problem-solving. Through this strategic development, new discoveries and new knowledge will provide an investment in the future that will have far-reaching benefits for society as a whole. Our strategic aims will drive progress by building on our strengths and achievements and securing new scientific opportunities.

Of significance to NeuRA's research strategy is our resolve to advance diagnostic techniques such as imaging, genetic testing and the identification of biological markers so that we can more accurately define groups of patients and use this knowledge to improve the development of new treatments.

We are also entering a new era of partnership to support exceptional science and promote translation of research to the community, accelerate the pace of improvement in health, and stimulate growth. This is not just symbolic but provides a framework for engagement with other research institutes, hospitals, universities, and other agencies, both national and international. It will speed up the exchange of the best ideas in medical science, from fundamental discovery to innovative, preventative and therapeutic interventions.

The exchange will strengthen Australia's research base and empower the scientific community to respond effectively to current and future challenges.

Paul V Brassil **Prof Peter R Schofield, *PhD DSc***

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External partnerships to leverage resources
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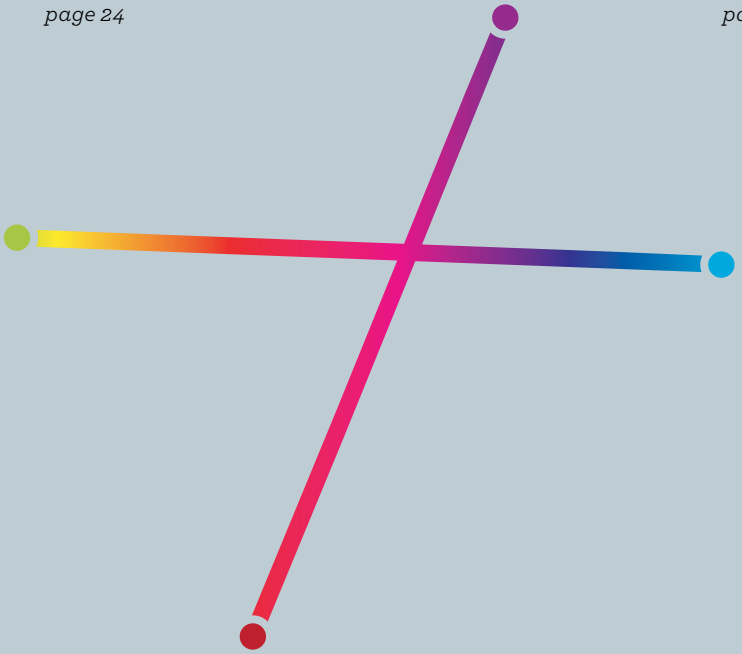

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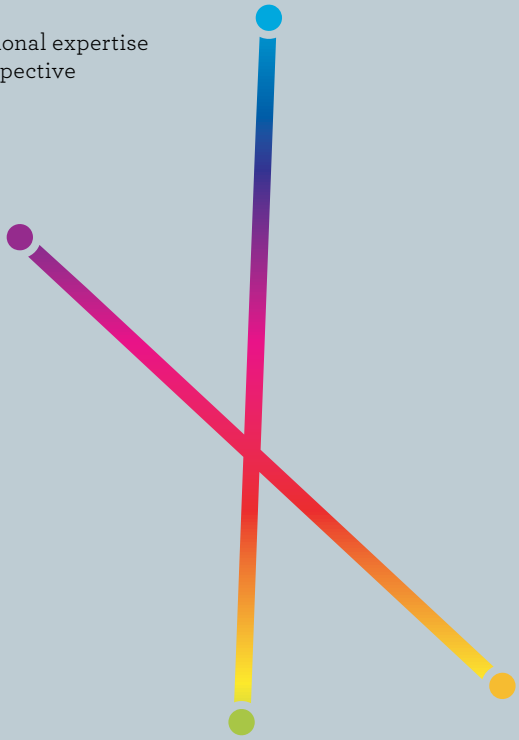

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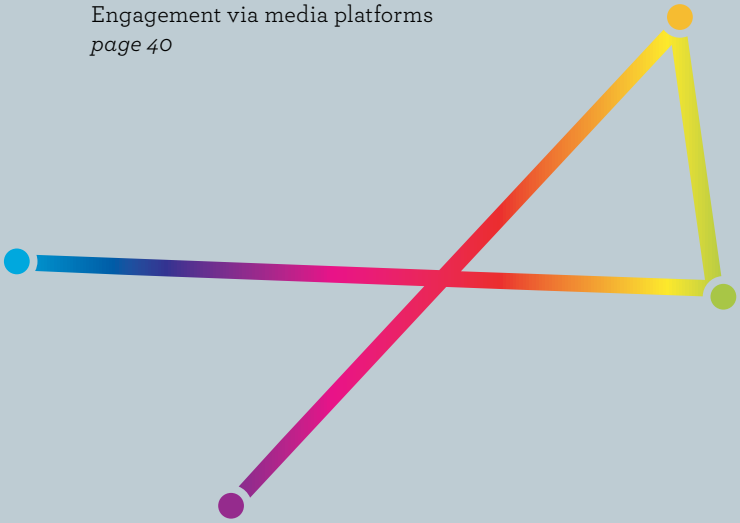


PHILANTHROPY

Philanthropic partnerships spark research that is innovative, collaborative and efficient by providing financial support and expertise. Private philanthropy can hasten the process of turning ideas into cures by helping researchers clear funding hurdles. In exchange, a donor receives the benefit of participation in the research they are funding and gains a direct understanding of the real problems and potential solutions, which makes them a more informed giver.

The Hon Jillian Skinner MP, State Minister for Health and Medical Research; Mrs Margarete Ainsworth; The Hon Tanya Plibersek MP, Federal Minister for Health and Minister for Medical Research.

> NeuRA's scientists are now working within the most innovative medical and clinical research environment, allowing them to push the frontiers of their science.

The Margarete Ainsworth Building.

Leveraging support and convening high-level partnerships for NeuRA's research initiatives create an environment that will deliver the greatest impact on the most urgent medical research challenges we face today.

One such partnership, developed through an exchange of ideas with NeuRA's Chairman, Paul Brassil, and Executive Director, Prof Peter Schofield, resulted in businesswoman, Margarete Ainsworth, making one of the largest single gifts given by a female philanthropist in Australian history. Her exceptionally generous donation of $10 million represents a milestone for NeuRA. The NeuRA Board offered to recognise this gift by naming the new building the Margarete Ainsworth Building. We were delighted when Mrs Ainsworth accepted our proposal to make her gift public.

In exchange for her generosity, Mrs Ainsworth will see the results of her philanthropy develop into tangible research opportunities. Life-saving research will happen as a result of her gift, and significant new discoveries will be made.

A long-time supporter of mental health research, she says she is motivated by two simple factors: "A desperate need for research, and a confidence in NeuRA."

"I have always felt for those families living with mental illness," Mrs Ainsworth says. "Compassion for people who have not been as lucky as I have been has given me the inspiration to give."

NeuRA is fortunate to have Margarete Ainsworth as a friend. Her gift is a template for 'private philanthropy' – philanthropy that is personal, antibureaucratic and inspirational. Even though resources of the public and for-profit sectors dwarf those of the philanthropic sector, private philanthropy still has one crucial advantage. Private donors do not answer to voters or shareholders, and they are not constrained by the peer-review protocols that dominate our government funding. They are free to find their own niche.

Another powerful contribution that philanthropists make to medical research is in raising awareness. Mrs Ainsworth's gift provided a conduit to exposure across many audiences, increasing the profile of our research.

Mrs Ainsworth's philanthropic philosophy is simple: give to what you really feel passionate about. "I find it very rewarding," she says.

The rewards obviously flow both ways as this substantial gift allowed NeuRA to continue the fitout of the new building. NeuRA's scientists are now working within the most innovative medical and clinical research environment, allowing them to push the frontiers of their scientific endeavours.

This special gift reflects the power of philanthropy to transform research capacity, speed up the continual search for more breakthroughs that will benefit patients in Australia and globally, and further endorses NeuRA's position as a leading centre of excellence in the neurosciences.

SHARED GOALS

Medical research is no longer a solo activity; it takes place via cooperation and exchange within teams of like-minded individuals – scientists, research assistants, PhD students and technical and operational staff. Teams at NeuRA work together as partners towards their shared goals.

E-health environment is essential

Dr Kim Delbaere (seated) with software engineer Tom Davies and research assistant Ashley Woodbury.

In any given year, around one third of people aged over 65 will experience a fall.

Falls and fractures account for more than half of all injury-related health care costs, estimated at over 500 million dollars per year in Australia. While the fear of falling may not sound like a major health problem, it can have serious implications for the elderly, some of whom live in constant fear they might trip and fall. As a result, they stop exercising and stay home which actually contributes to a greater chance of having a fall. This can also lead to depression and loss of vital contact with friends, family and the extended community.

Working with their previously established research methodology, a group of NeuRA researchers is investigating the various reasons people fall. Dr Kim Delbaere is a scientist and physiotherapist, and Tom Davies is a software engineer. An unlikely pair? Not really. In a landscape opening its horizons to an e-health future, their information exchange and cross-referencing of research data are essential.

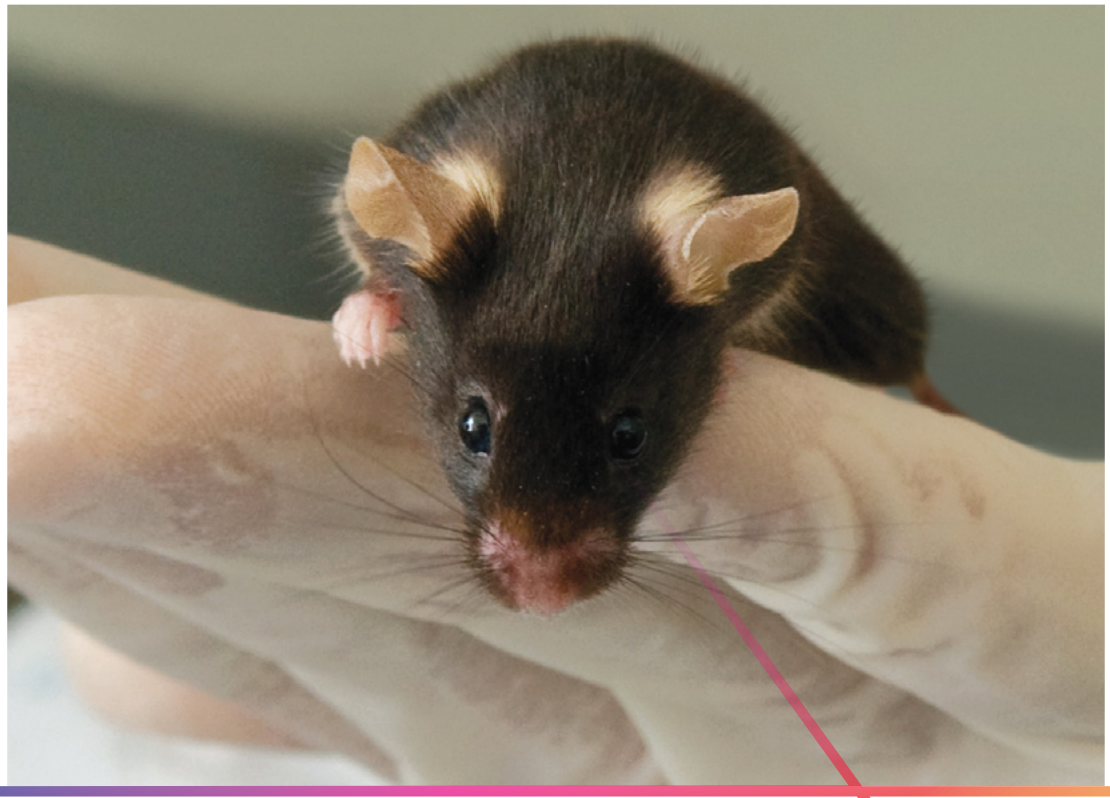
The pair merges their disparate qualifications and unique skill sets to create apps and online tools that place the onus on an individual to manage his or her own care at home. App-based questionnaires and balance tests designed by the team are now on the market and are being used by clinicians, health professionals and individuals to reduce the risk of falls at home.

The merging of technology and science is an exciting frontier that has seen NeuRA become a front-runner in fall-related app technology.

The self-management of falls risk is just one of the ways NeuRA is embracing an e-health solution.

Capturing motor neurons

> This research may help to develop treatments that slow or even halt the progression of motor neurone disease.



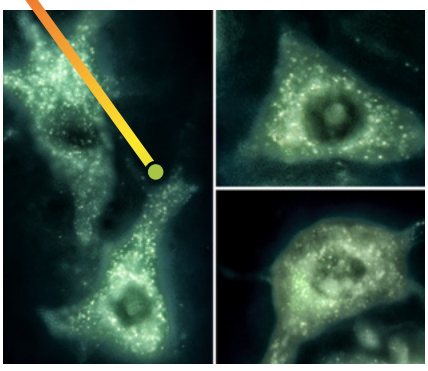
Motor neurone disease is an invariably fatal condition that progressively affects the function of the motor neurons in the spinal cord, impacting a person's ability to move, breathe and swallow.

While clinicians can track the progression of the disease via changes in patients' behaviour and movement, this method is inexact. An objective measure of disease progression – by measuring changes in the number and distribution of motor neurons in the spinal cord – would help researchers better understand how the disease progresses on a microscopic level.

This research may help to develop treatments that slow or even halt the progression of motor neurone disease.

Scientists in the team led by Prof George Paxinos worked together on a two-year project to map the number and distribution of motor neurons in the mouse spinal cord. The image featured here are cell bodies of motor neurons; the points of light are dye particles that have accumulated in the cell during the labelling process and the dark regions are the cell nuclei.

The maps will assist researchers to pinpoint changes in the number of motor neurons that occur during the onset and progression of the disease.



Cell bodies of motor neurons.

Reducing the impact of kidney disease

A new study will examine whether restriction of dietary potassium intake will alleviate complications of kidney disease.

People with diabetes and chronic kidney disease frequently experience peripheral neuropathy. This type of nerve damage starts as tingling, numbness and pain in the feet or legs and can progress to irreversible nerve injury, leading to foot infection, ulceration and amputation. Dr Ria Arnold and collaborators from UNSW and POWH aim to identify treatments that reduce the impact of such neurological complications.

By using cutting-edge research techniques that stimulate patients' nerves with small electrical pulses, the team measures nerve responses, which can detect abnormal nerve function prior to the onset of clinically diagnosed neuropathy.

Using these techniques together with clinical neurological assessments, the team has shown that high potassium levels in the blood are responsible for abnormal nerve function in kidney disease patients. Now, they have secured funding from the National Health and Medical Research Council to investigate whether controlling potassium levels via restriction of dietary potassium intake can improve neuropathy outcomes.

The results of the study may lead to changes in clinical care that will significantly improve quality of life for patients by identifying further opportunities for treatment and providing objective measures of treatment efficacy.

Dr Ria Arnold is undertaking a nerve conduction study to help determine the severity of peripheral neuropathy in a participant in the chronic kidney disease trial.

Grasping the artificial finger induces a sensation in some subjects that their hands are level with one another, despite being 12 cm apart.

Is this my finger?

How do you convince someone that a finger they can't see or feel is actually part of their body?

Researchers have revealed a new class of illusions with the realisation that humans may be more attuned to their own bodies than previously thought.

The findings provide fundamental information into how the brain makes maps of the body so that it can then make accurate movements. The results expand the current understanding of proprioception, or sense of self, and body representations. These results will provide new insight into clinical conditions where proprioception is disrupted.

Prof Simon Gandevia and colleagues tricked the brain into believing it owns a fake finger using only sensory inputs from the muscles. The ground-breaking study highlights that sensing which parts of your body are yours and their positions in the world do not require vision, nor touch. It can be achieved by muscle receptors alone.

These discoveries are relevant to any disorder where there is an abnormality in proprioceptive representation of the body and its position and the forces generated such as stroke, schizophrenia or phantom limb syndrome.

Perspective shift to change pain

Developing new treatment approaches to manage chronic low back pain.

> Our approach aims to prevent people from developing chronic back pain.

Most people will experience at least one episode of back pain in their lifetime.

Back pain is often very painful and debilitating but usually settles down within a few days or weeks.

Unfortunately for a significant proportion of people, recovery is much slower. About 40% of sufferers go on to develop chronic back pain. For these people, treatment options are limited and most produce only minimal relief from pain.

Prof Lorimer Moseley and Dr James McAuley's work is directed towards developing new treatment approaches to manage chronic low back pain. One approach showing considerable promise aims to prevent people from developing this chronic condition.

The researchers, working in collaboration, are conducting a 3-year, National Health and Medical Research Council funded, randomised controlled trial that aims to change the way people with low back pain think about their pain. It is hoped that by changing their perception, they will recover earlier and be prevented from developing a chronic condition.

The trial compares the team's psycho-educative intervention to an inactive control intervention. Patient recruitment has started and the trial will recruit 250 participants in the Sydney area who have experienced a new episode of low back pain.

If successful, this game-changing approach is likely to result in massive cost savings and productivity gains for the Australian community.

Improving muscle performance after spinal cord injury

People who have experienced spinal cord injury or stroke often lose the ability to activate their muscles, as a result of damage to neural pathways involved in motor control.

Siobhan Fitzpatrick and Jim Nuzzo, in Assoc Prof Janet Taylor's lab, are testing methods that may have the potential to improve existing connections between motor neurons within the spinal cord in people with neurological injury.

Their methods are designed to enhance plasticity, or changes in the way neurons communicate, such that the message the neurons send to the muscles will become stronger.

Siobhan induces this plasticity by stimulating a person's brain and motor neurons to the arm with carefully timed pairs of magnetic and electrical current, which are designed to increase the output of the motor neurons. In contrast, Jim uses physical training to induce plasticity, asking people to bend their arm as fast as possible, with the idea that this vigorous exercise induces just the right nerve-firing pattern to increase motor neuron output. Both researchers measure changes in biceps muscle responses to direct spinal cord stimulation before and after a period of stimulation or exercise.

By exchanging technical expertise and knowledge of the scientific literature, Siobhan and Jim are shedding light on how the activity of spinal motor pathways can be manipulated to improve muscle performance.

An experimental setup using magnetic stimulation to induce changes in the neural pathways supplying muscles.

Fitting a device used to measure the brain's electrical response to sound.

Clinical trial for Down syndrome

Difficulties with cognitive functions such as learning and memory in Down syndrome may be due to an imbalance of excitatory and inhibitory communication in the brain.

Prof Rhoshel Lenroot and Dr Jason Bruggemann are trialling a medication that modifies the way that brain cells communicate with each other.

Assessing the effectiveness of this medication in three different ways, they will measure memory and language skills, which are often problematic for people with Down syndrome. They will also look for improvement in managing daily life activities such as grocery shopping. Finally, the research team will measure the brain's electrical response to sound, providing a more direct index of the effect of medication on brain function.

By working with both adolescents and adults with Down syndrome, the research team will be able to see whether treating individuals at a younger age can reduce the severity of illness in later life.

One of the very first trials for a medication to combat Down syndrome, this type of translational research could make a big difference to the quality of life for people who have this genetic neurodevelopmental condition.

How emotion imprints your memory

Dr Fiona Kumfor presents emotional pictures to individuals with dementia and measures how this influences their memory.

“

These discoveries are bridging the gaps in our knowledge of dementia.

The idea that emotional memories are uniquely stored in the brain is not new.

As early as 1890, the philosopher and psychologist William James suggested that emotional events leave ‘a scar upon the cerebral tissues’. The brain regions underpinning this emotional boost, however, are not well understood. Dr Fiona Kumfor and Assoc Prof Olivier Piguet increased this understanding, taking a step forward in the mapping of the brain by revealing that the orbitofrontal cortex, located in the frontal lobe of the brain in the region above the eyes, plays a pivotal role in emotional memory.

They discovered that difficulty in remembering emotional events was related to shrinkage in the brain. The findings provide new information revealing that the amygdala is not the only important brain structure involved in emotional memory formation, as previously thought.

Assoc Prof Piguet says that up until now we knew that emotional memories were supported by the amygdala, a brain region also involved with emotion regulation. This study is the first to demonstrate the involvement of the orbitofrontal cortex in this process. This is an important development in understanding the relations between emotions and memory and the disturbance of the emotional system in this type of dementia.

In order to investigate emotional memories, patients with frontotemporal dementia, a rare form that affects people in their 50s and 60s, were examined. Unfortunately, no treatment or cure exists, but discoveries like these are bridging the gaps in our knowledge of dementia. This new information could help create diagnostic tools and change how we diagnose types of dementias and differentiate between them.

A blood test for types of dementia

NeuRA researchers are developing a blood test to diagnose different types of dementia that cannot be diagnosed, with certainty, in life.

What if a simple blood test could reveal what is happening inside your brain?

Led by Prof Glenda Halliday, a team of researchers is investigating whether it is possible to develop a blood test for different types of dementia. The proposed test will screen for particular proteins in the blood, such as Tau and TDP-43, that are responsible for causing the brain changes that lead to different types of dementia, and that cannot be diagnosed with certainty in life.

The goal is to provide clinicians with a way of discriminating between the different proteins involved in frontotemporal dementia.

At the moment, these different types cannot be diagnosed based purely on the clinical presentation of symptoms and neuroimaging, and therefore cannot be treated effectively.
The team has already collected blood samples from over 500 dementia-affected participants and controls.

The hope is that this test could direct people suffering from dementia to effective curative treatments and reveal important information about the effectiveness of those medications in halting the progress of the disease and reducing symptoms.

Lauren Bartley collects blood samples from dementia-affected participants and controls.

Dr Matthew Brodie adjusts a head piece containing miniature sensors for researcher Milou Coopens. The sensors measure subtle changes in balance control mechanisms which contribute to fall injuries in older people.

Monitoring gait to predict falls

NeuRA falls experts are investigating whether changes in walking style can predict the likelihood of a fall.

Up to a third of people over 65 have a fall each year, often resulting in disability and loss of independence. One of the most effective ways of preventing falls is to accurately predict them and intervene before they occur. Dr Matthew Brodie is investigating whether changes in gait – specifically, how the head and body move while walking – are a useful predictor of an impending fall.

By attaching accelerometers - devices that sense minute changes in direction - to the heads and waists of participants, Dr Brodie found that those displaying erratic movement patterns were more likely to suffer falls. With accelerometers now included in everyday products such as mobile phones, there is potential for high-risk people to be monitored remotely and alerted of the potential of an impending fall.

Falls, however, are by nature highly complex and difficult to predict with certainty. The multidisciplinary falls research team at NeuRA, led by Prof Stephen Lord, seeks to unravel the interplay between unstable head movements while walking and a fear of falling, reduced physical capacity, medication use and exposure to every day trip hazards.

Clinical trial for schizophrenia

Dr Tom Weickert and Prof Cyndi Shannon Weickert.

> The research teams conducted the first clinical trial of a hormone-based treatment for both men and women with schizophrenia.

Prof Cyndi Shannon Weickert and Dr Tom Weickert have recently completed a clinical trial to test if a new treatment aimed at estrogen receptors can improve brain function for people with the illness.

Estrogen modifies brain cells and impacts human emotion and cognition. It also impacts symptoms of schizophrenia.

This is of particular interest to Prof Shannon Weickert, who was curious as to why schizophrenia often appeared in adolescence.

By examining the neurobiology of sex hormones, she found that they control neuronal gene expression and impact cognitive and social development in adolescence. She also found that receptors for the sex hormone estrogen are abnormal, or mutated, in people with schizophrenia. Her research team has studied cells in the lab, using a drug to overcome this mutation.

They then partnered with Dr Weickert's team to trial this drug in patients with schizophrenia, translating findings from the molecular and cellular neurodevelopment of schizophrenia into meaningful help for people living with this illness. They conducted the first clinical trial of a hormone-based treatment for both men and women with schizophrenia. This medication, already in use for other conditions, has been shown to be beneficial for thinking abilities such as memory during ageing.

Now, these NeuRA partners have found that this same estrogen-based medication improves memory and attention in people with schizophrenia.

Prof Cyndi Shannon Weickert is the Macquarie Group Foundation Chair of Schizophrenia Research, a joint venture of NeuRA, UNSW, SRI and Macquarie Group Foundation.

COLLABORATION

At NeuRA, scientists work on a daily basis with colleagues undertaking similar research. However, the most innovative medical and clinical research often takes place when scientists from different backgrounds cross paths and formulate new insights through information exchange and scientific networking.

Unique sleep centre opens at NeuRA

Research volunteer is set-up for a detailed overnight sleep study to investigate the effects of common sleeping pills on the upper airway and breathing during sleep.

Almost one in 10 Australian adults suffer from sleep disorders, costing the nation more than $5 billion a year in healthcare and indirect costs.

Recently, NeuRA opened a new sleep research centre to study the causes of disrupted sleep. The centre is unique in that it combines basic science in sleep and breathing physiology with research into improving treatments.

This centre will combine the expertise of several different research groups across NeuRA, including those led by Dr Danny Eckert, Prof Lynne Bilston, Assoc Prof Jane Butler, Prof Caroline Rae and Prof Simon Gandevia. This multi-disciplinary team has a broad range of approaches to understanding sleep physiology and the causes of disrupted sleep, from research into the neural control of respiratory and upper airway muscles to new techniques to develop personalised treatments for obstructive sleep apnoea.

> “This multi-disciplinary team has a broad range of approaches to understanding sleep physiology and the causes of disrupted sleep.

Disrupted sleep is also common in many neurological disorders in which NeuRA has expertise, including dementia, motor neurone disease, multiple sclerosis, Parkinson’s disease, schizophrenia and spinal cord injury. The cause of sleep disorders in these patients is poorly understood and difficult to treat; research requires a strong interdisciplinary approach.

One of the goals of the sleep centre is to establish how these neurological conditions disrupt sleep and how disrupted sleep may worsen the condition, and to develop tailored therapies to improve health outcomes. Disrupted sleep is common in schizophrenia, for example, but research into effective treatments has been minimal. The sleep centre plans to collaborate with the Schizophrenia Research Laboratory to investigate tailored treatments to improve sleep disruption in these patients. This combination of expertise is unique in the world.

Safe standards: child restraints in cars

A direct result of our research is increased safety standards of child restraints through improvements to design and labelling.

Last year, 50 Australian children died in car crashes and thousands more were seriously injured. Improving the performance and correct use of child restraints play a major role in preventing these injuries. Collaborative research from two NeuRA research groups is helping to drive these improvements by addressing the standards that govern restraint design, manufacturing and labelling.

Prof Lynne Bilston contributes engineering, biomechanical and technical expertise to new restraint designs, while Dr Julie Brown's policy and public health experience helps identify limitations parents face in using restraints in real life situations.

One of the major updates to the standards in 2013 was the introduction of a new category of booster seats to the Australian market, designed for children up to 10 years of age. Even though it's legal for children 7 years and older to use just the car's lap sash seatbelt on its own, Prof Bilston's research has shown that children should use a booster seat until they are tall enough - approximately 145-150cm - to fit properly into the car's seatbelt. Most children won't reach this height until they are 10 to 12 years old.

The need for this new type of restraint was identified in part through Dr Brown's behavioural and consumer research, which found that parents weren't putting their older children in booster seats – even though it was safer to do so – because they felt they'd outgrown them.

Prof Bilston's work in biomechanics, ergonomics and crash testing helped to define the size and requirements of a booster seat suitable for older children, something that was not previously available to parents. Having this new type of restraint available is crucial to Australian parents in keeping their children safe in cars.

Researcher Bianca Albanese shows Sylvie Sweatman how an integrated booster seat pops up out of the back seat of a test car.

Preventing nerve damage after cancer treatment

NeuRA researchers are working towards preventing nerve damage caused by chemotherapy.

Thanks to advances in cancer treatment, more people are surviving cancer today than ever before. As a direct result, however, more people are having to live with a significant long-term side effect of chemotherapy: nerve damage. Nerve damage appears in the hands and feet as tingling and numbness and can become such a problem that those affected have trouble buttoning clothes, holding a pen or even walking.

As there is currently no way of reversing nerve damage, the research team at NeuRA focuses on prevention. Prof Matthew Kiernan and colleagues have recently developed a technique to detect early signs of nerve damage, enabling clinicians to identify at-risk patients before too much damage has occurred.

Assoc Prof John Kwok and his fellow researchers are working alongside the Kiernan team to help identify at-risk patients, providing expertise on genetic risk factors for chemotherapy-induced nerve damage. Assoc Prof Kwok is investigating natural variations in genes that make certain people more susceptible to this damage.

As the focus of research has only recently turned to improving quality of life after cancer, the impact of nerve damage on patient function and daily life has been largely underestimated. Dr Susanna Park is determining exactly how nerve damage affects the everyday lives of patients to better identify and measure nerve damage, hopefully leading to improved outcomes for cancer survivors following chemotherapy treatment in the future.

Dr Susanna Park and Assoc Prof John Kwok.

Trek of hope for a dementia cure
by Aboriginal artist, Mary-Jane Page
from the La Perouse community.

Dementia and Aboriginal Australians

Why is dementia prevalent in Aboriginal Australians?

The landmark Koori Growing Old Well Study (KGOWS), commenced by Prof Tony Broe and his team in 2008, found the prevalence of dementia in older Aboriginal Australians to be three times higher than in non-Indigenous Australians of the same age. Before this study, little was known about the rates of dementia in older Aboriginal Australians.

In a longitudinal follow-up study, NeuRA researchers are revisiting study participants to build a more accurate picture of why this community is disproportionately affected by dementia. The aim is to identify the risk factors and find ways of preventing dementia and promoting healthy brain ageing.

The team will be looking at the significance of risk factors such as cardiovascular disease, depression and anxiety in developing dementia in this group of people. Working with geneticist Assoc Prof John Kwok, the team will also be looking at genetic risk factors for dementia common to all populations.

This collaborative study marks the first investigation of predictors, risk factors and biomarkers for dementia in Aboriginal Australians and is an essential step to developing treatments and interventions in the future.

Preventing falls in people with multiple sclerosis

Dr Phu Hoang is working to prevent falls in people living with multiple sclerosis.

People with multiple sclerosis are at a high risk of falling, yet there is currently little evidence on what treatment programs are most effective to prevent falls.

As part of a new and exciting multidisciplinary collaboration, the National Health and Medical Research Council Program on 'Motor Impairment' now in place at NeuRA, several senior scientists are together designing and testing a falls intervention program for people with multiple sclerosis.

Multiple sclerosis is a chronic, typically progressive disease involving damage to the sheaths of nerve cells in the brain and spinal cord. The symptoms may include numbness, impairment of speech and of muscular coordination, blurred vision, and severe fatigue.

Experts in falls prevention, Prof Stephen Lord, and in multiple sclerosis, Dr Phu Hoang, together with clinical trial specialist Prof Rob Herbert, have designed the interventions to target the underlying causes of susceptibility to poor balance and falling. Proprioception expert Prof Simon Gandevia will assess whether the interventions affect the participant's awareness of where their ankle and foot are in space, while Assoc Prof Janet Taylor will look at changes to the strength and susceptibility of the leg muscles to fatigue.

These physiological factors play a role in increasing the falls risk in people with multiple sclerosis. The aim of the collaborative project is to modify contributing factors through the interventions to assess their direct impact and thereby decrease the incidence of falls in people with multiple sclerosis.

> The aim of the collaborative program is to modify contributing factors thereby decreasing the incidence of falls.

Impact of abnormal eating behaviour on disease progression

Dr Rebekah Ahmed and Assoc Prof Olivier Piguet discuss the results of their study examining eating behaviors in patients with frontotemporal dementia. This experiment involves new approaches in measuring patient's behaviours and intake using a test meal approach for breakfast.

Scientists are examining the causes of excessive eating in frontotemporal dementia (FTD) and motor neurone disease (MND).

FTD and MND are a group of disorders identified by distinct clinical signs and symptoms, or specific brain pathologies. These disorders are generally rapidly progressing, cause behavioural, language or motor deficits, often in combination, and together are a leading cause of dementia, particularly in people under 65 years of age.

In a project that combines their knowledge and experience, several research groups - Halliday, Piguet, Hodges and Kiernan - are exchanging crucial research information to tackle the problem of excessive eating in these neurological diseases.

Rebekah Ahmed, a PhD candidate is investigating changes in eating behaviour, such as bingeing and excessive consumption of sugary or fatty foods, which are commonly found in FTD patients. Despite its different clinical presentation, MND is thought to represent another facet of the same condition. What is not known is whether abnormal eating behaviour is also present in MND and what effect it has on the metabolic health, including weight, body mass index, cholesterol and hormonal levels, in FTD and MND, and its potential impact on prognosis and disease progression.

This research project is investigating the underlying causes of excessive eating, such as shrinkage in a region of the brain known as the hypothalamus, as well as the occurrence of sexual and autonomic disturbance in FTD and MND. The aim is to develop interventions to improve quality of life for patients and carers. Through this collaboration, it is hoped the outcomes can determine the systemic effects of these neurodegenerative diseases.

Epigenetics signal the way forward

Exercise affects your brain on a deep level in positive ways.

To better understand the role of genes in dementia, Assoc Prof John Kwok is focussing on questions such as why it is that if you keep an active mental life by playing complicated board games, learning a language or keep physically fit, you are less likely to succumb to dementia.

He is interested in the burgeoning field of epigenetics that seeks to answer such questions. All the genes in the human body have to be switched on or off in a tightly regulated manner to function correctly. Epigenetics acts as a dimmer switch that can slowly turn down or up the brightness of a light. We can't change our genes but we can turn down the brightness of our 'bad genes' by improving certain protective lifestyle factors.

Understanding the mechanisms behind how healthy lifestyle factors affect brain health informs many areas of NeuRA's work. The study of epigenetics is geared to establishing comprehensive new possibilities into future treatments and health care advice.

Keeping physically fit helps prevent dementia.

A new mouse model for schizophrenia

Specialised behavioural phenotyping equipment helps researchers measure behaviours in mice with genetic abnormalities that are relevant to symptoms of human mental illness, and to identify mechanisms of disease.

> An important clue about the causes of schizophrenia is that genes alone are not enough to explain who becomes ill and who does not.

The purpose of developing new animal models is to mimic disease as closely as possible and to provide new investigative tools to explore pathophysiology and new treatments.

One of the clues we have about the causes of schizophrenia is that inheritance of certain forms of genes can increase the risk of developing the disease.

Previous research carried out at NeuRA shows that variation in the neuregulin gene, a gene important for brain development, increases risk for schizophrenia by over-synthesising the neuregulin gene in the brain. Animal model expert Dr Tim Karl, together with Prof Cyndi Shannon Weickert, who studies the role of the neuregulin gene in human brain development and in the brains of schizophrenia patients, have become the first in the world to produce and study an animal model that mimics this change caused by the genetic risk.

Together with postdoctoral researcher Dr Leonora Long, the researchers have collaborated with a pharmaceutical company in the USA to make a mouse that overexpresses the neuregulin gene in the brain, and hope to unlock the secrets of why NRG1 variation causes risk for schizophrenia.

Another important clue about the causes of schizophrenia is that genes alone are not enough to explain who becomes ill and who does not. Certain environmental factors, such as exposure to cannabis, can also increase risk for developing schizophrenia. Earlier research by Dr Karl and Dr Long suggests that the neuregulin gene also impacts on an individual's susceptibility to the detrimental effects of cannabis. The research team is currently looking at whether the new neuregulin gene mouse model displays behaviours relevant to schizophrenia, such as cognitive and social deficits, and whether these behaviours worsen with cannabis consumption.

PARTNERSHIPS

Ongoing exchanges between partners in the neuroscience community are an essential component of successful research. Whether it's by sharing tissue samples, access to patients, or expertise in an emerging area of neuroscience with a hospital, a university or a fellow medical research institute, NeuRA's researchers are leveraging their resources and expertise through collaboration.

Harnessing Australia's expertise

Launch of the Mindgardens Neurosciences Project: Prof Peter Smith, Dean of Medicine, UNSW; Peter Joseph AM, Chairman, The Health-Science Alliance; Paul V Brassil, Chairman, NeuRA; Prof Peter R Schofield, Executive Director, NeuRA; Terry Clout, Chief Executive, South Eastern Sydney Local Health District.

Maximising health outcomes for patients through collaboration and expansion.

A wealth of the Southern Hemisphere's pre-eminent neuroscience and mental health research and clinical service entities currently operate adjacent to NeuRA, on the UNSW and Prince of Wales Hospital campuses.

So how can our biggest neurosciences community help transform Australia into a global research and clinical force for translational medicine?

With the opening of our new building, we have created a gateway to The Mindgardens Neurosciences Project – a proposed, strategically placed research hub that will provide the opportunity for scientists and clinicians to work together. This integrated precinct will stimulate the exchange of research experience and advances, thereby cementing Australia's reputation as a world leader in neuroscience. The research hub will be of a scale to facilitate Australia's collaboration with global developments in neurosciences.

Accelerated understanding of neurosciences and mental health disorders and diseases, with better care and cure outcomes through world-class translational research strategies, will be a key element of the proposed research landscape. Emphasising a comprehensive, high quality 'one-stop shop' for patients and referring clinicians, the hub will have no parallel in the Southern Hemisphere.

This neurosciences development will facilitate and foster global collaborations and strong industry links that will deliver enormous benefits to the Australian community.

> "This precinct will stimulate the exchange of research, cementing Australia's reputation as a world leader in neuroscience.

Closing the gap in hip fracture health care

The development of the first ever national standard of care for hip fracture is underway.

Prof Jacqui Close is advocating major changes in the standards of care for hip fracture patients.

Monitoring performance and driving change to ensure improvements to the system are on their way.

Hip fracture is the most serious and costly fall-related injury sustained by older people. There are approximately 17,000 hip fractures per year among Australians aged over 40 and that number is set to increase with an ageing population.

We are working in partnership with other organisations such as the NSW Agency for Clinical Innovation on hip fracture care, investigating prevention in the first instance, and to bring about a high standard of care in all hospitals when a hip fracture does occur.

More hospitals are recognising the importance of a shared responsibility with geriatricians who have expertise in the medical and rehabilitative care of these patients. Recent NeuRA research into mortality rates in hospitals after hip fracture showed that, where care is shared between surgeons and geriatricians whilst in hospital, a better outcome is realised.

Driving the changes is Prof Jacqui Close who combines her research at NeuRA with clinical practice as a consultant in orthogeriatrics at Prince of Wales Hospital. The development of the first ever national standard of care for hip fracture is underway. The data and ensuing results could not be formulated without exchanges between patients, academics, clinicians and carers.

Prof Close provides leadership and advocacy on government strategy in order to ensure that this research is translated into policy and, in turn, practice.

Identifying children at risk of schizophrenia

NeuRA researchers, in collaboration with Kings College London, are investigating developmental trajectories in children at risk of developing schizophrenia.

Because early diagnosis and treatment of schizophrenia can help minimise the damaging effects of the disease, our current research is focused on finding what brain differences are present in children at risk.

Together with colleagues from Kings College London, Prof Rhoshel Lenroot and Dr Jason Bruggemann are evaluating whether changes in the brain's electrical response to sound - a measure called the mismatch negativity or MMN - are different in at-risk children before onset of the disorder.

The team's results showed that some children with certain risk factors, such as a first-degree relative with schizophrenia, have an MMN unlike that of their typically developing peers, which could indicate abnormal brain development. Interestingly, the MMN is larger in these at-risk children, whereas in adults with schizophrenia it is smaller, suggesting that deviations in the MMN change with development and the stage of illness.

Long-term follow-up of these at-risk children by the team from Kings College London will reveal who will go on to develop schizophrenia and hence whether an increased MMN during childhood is associated with an increased risk of developing schizophrenia. If we can better understand how brain development is different in children at greater risk of developing schizophrenia, then perhaps with appropriate early treatment we can reduce the burden of schizophrenia for future generations.

Prof Rhoshel Lenroot.

Designing a new app to detect dementia

NeuRA's Prof John Hodges, in partnership with colleagues in the UK, has developed an app to screen for dementia.

The ACE mobile app is based on the Addenbrooke's Cognitive Examination, or ACE, which was developed by Prof Hodges. Originally a pen and paper test, the ACE has become a gold standard test for screening patients for dementia. The app has been designed for use on iPads and is self-scoring – very little training is required to use and administer the test.

Prof Hodges and team have revised and refined the original ACE test, but it was a collaboration with colleagues from Plymouth University that led the computerisation of the device.

The app will be used primarily by psychologists, nurses and other health professionals to provide a report to clinicians that is easy to interpret and allows comparison with what is considered a normal score in healthy older people. The benefit of this app is that health professionals working in the community can detect dementia early and accurately, which will help reduce the long waiting periods many people face to see a specialist.

Going forward, early diagnosis will become increasingly important as treatments for dementia improve.

A future that harnesses technology for health outcomes in which accessibility to good quality health care is now essential. It makes use of developments in computer technology and telecommunications to deliver health information and services more effectively and efficiently.

Binge drinking and brain development

Prof Caroline Rae.

> Alcohol use patterns in young people are becoming more extreme.

We know what binge drinking can do to our culture, but what does it do to a developing brain?

The effect underage drinking has on a developing brain is a question Prof Caroline Rae is seeking to answer.

An alarming 19-23% of adolescents have binge-drunk in the last week and this proportion is increasing in young females. 13% of all deaths in young Australians are a direct result of alcohol use, with alcohol use patterns in the young becoming more extreme.

At this age, the frontal lobes of teenagers are still developing. This progresses into our early 30s, but most occurs in the teenage years.

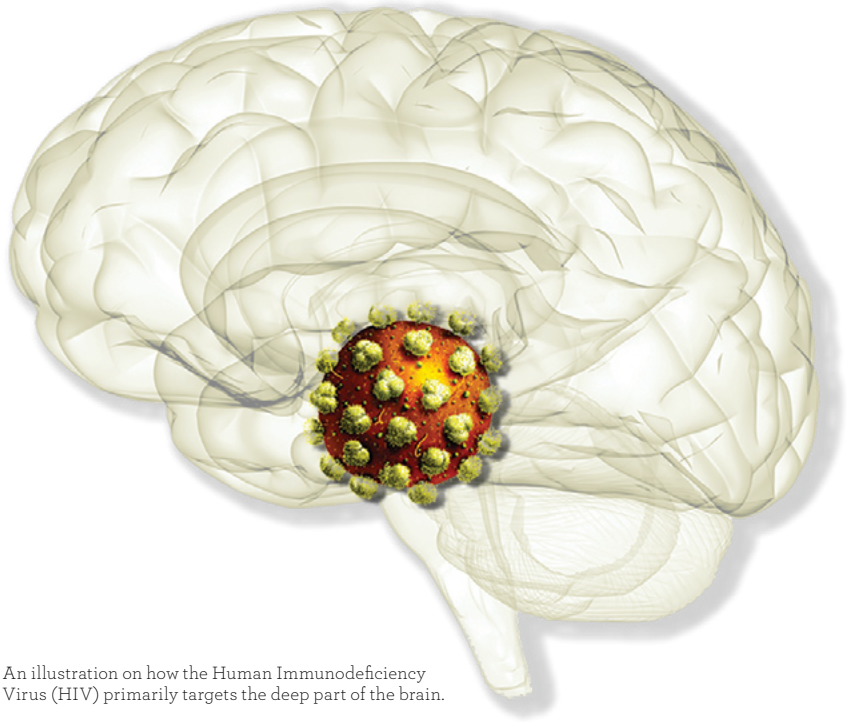
Alcohol is very likely to be affecting the development of the brain and the connections that are being built. The recent trend to mix high-caffeine drinks with alcohol could be exacerbating the problem. Currently, there is very little scientific evidence on the effects of early binge drinking.

Prof Rae collaborates with Prof Maree Teesson at the National Drug and Alcohol Research Center (NDARC). Together they seek to uncover what is happening in a teenager's brain when binge drinking occurs - they will then assess the possible consequences.

The team aims to uncover the neurocognitive effects of binge drinking, such as whether it affects people's memory, people's ability to recognise emotions on other people's faces, or the ability to inhibit impulses.

The structural and functional effects of binge drinking on the brain are also under examination.

Targetting the impact of HAND



An illustration on how the Human Immunodeficiency Virus (HIV) primarily targets the deep part of the brain.

HIV Associated Neurocognitive Disorders (HAND) can occur when HIV enters the nervous system and impacts the health of nerve cells.

HAND is a major neurological complication in HIV+ persons. It impairs cognitive activity, including memory, learning, attention, problem solving, and decision making. Symptoms can vary from confusion to forgetfulness, behavioural changes, nerve pain and sometimes apathy.

The widespread use of combined antiretroviral treatment has reduced the incidence of the most severe form of the disorder, HIV-associated dementia from 8% to 2%. However, the prevalence of mild to moderate degrees of neurocognitive deficits persists in up to 50% of sufferers with phases of relapse and remission. Symptoms are not severe enough to be referred to as dementia, yet they impact on quality of life and independence.

Questions being asked include: To what extent HAND regresses with antiretroviral treatment or cognitive training? Can early treatment reduce HAND incidence? Are HIV+ persons more likely to have HAND as they age and could this accelerate common neurodegenerative diseases? Do alcohol and substance use disorders facilitate HAND? How can we improve HAND early detection using improved neuropsychological and/or neuroimaging methods?

To answer those questions, Dr Lucette Cysique leads and co-leads several studies in Australia working with partners including the UNSW, St Vincent's Hospital, The Alfred Hospital in Melbourne and HIV clinics in NSW. Internationally, the University of California, San Diego and McGill University in Canada are also part of the research program. NeuRA's research is pivotal to this exchange network.

Measuring tRNS success for depression

Assoc Prof Janet Taylor's expertise in the human motor system adds an extra dimension to a clinical trial for depression treatment.

The trial, in conjunction with the Black Dog Institute, will test whether a new type of brain stimulation called transcranial random noise (tRNS) improves depressed mood and other symptoms.

Assoc Prof Taylor and colleagues conducted a preliminary study that found that the motor area of the brain of people with depression shows reduced plasticity, or adaptation, compared with healthy people.

Now, they plan to build on this suggestion that depressive illness might be related to a change in the brain's adaptive ability, by testing whether tRNS improves motor cortex plasticity in depressed people.

The research team will measure the adaptive ability of the motor system before and after several weeks of tRNS treatment. This measurement will allow a more extensive interpretation of the effectiveness of the brain stimulation therapy, and possibly even help researchers form ideas about what might go wrong in the brain of depression sufferers.

Solving the Parkinson's puzzle – it's a world wide challenge

Dr Nic Dzamko and Prof Glenda Halliday are leading an international study on Parkinson's disease.

The brain of every patient suffering from Parkinson's disease is a mystery - why do some cells die but others survive?

Prof Glenda Halliday, an internationally recognised authority on Parkinson's disease and neuroscientist Dr Nicolas Dzamko are working with two key organisations to find a cure.

Parkinson's disease is a progressively degenerative neurological disorder that affects the control of body movements. It will affect the individual for the remainder of their life, with increasing severity as the illness progresses. Unfortunately, it does not just affect the person living with it – it affects the entire family and sometimes an extended community.

Two new projects have commenced with the help of funds from the Michael J. Fox Foundation and Shake It Up Australia Foundation. These studies aim to address the gap in knowledge of the neurodegenerative mechanisms that lead to Parkinson's disease.

Prof Halliday and Dr Dzamko are leading an international study of brain samples from Parkinson's disease sufferers with a range of genetic backgrounds, which will provide new information on how changes in a protein called LRRK2 might lead to the symptoms and progression of the illness.

A second project involves the shipment to NeuRA of blood samples from Parkinson's disease patients and relatives from around the world. The researchers will measure signs of inflammation in the blood and will then link these with abnormalities in the gene for LRRK2.

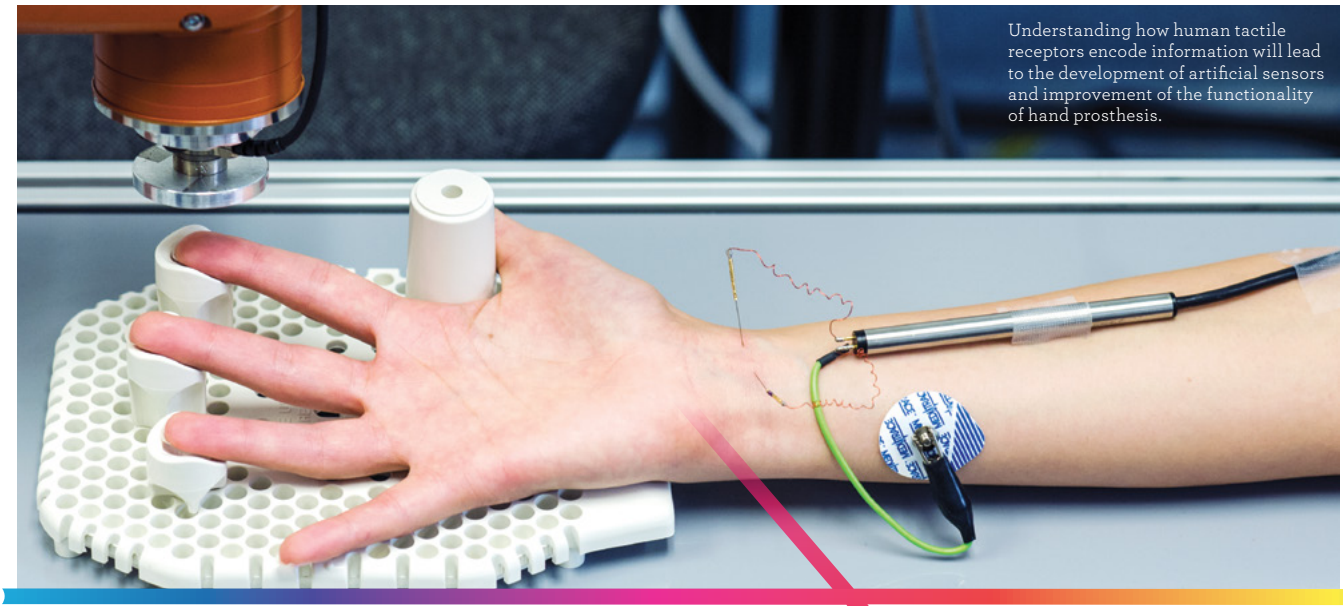
An ultimate goal of these projects is to find a biomarker for Parkinson's disease. That is, something that can be easily and reliably measured in the clinic since no such way of testing for this relentless disease currently exists.

> “Funds from the Michael J. Fox Foundation and Shake It Up Australia Foundation support two new projects.

GLOBALISATION

NeuRA's reputation in the global research community is such that many scientists visit the institute to gain experience in specialist fields. While 'international exchange scientists' come to NeuRA to learn, our researchers also benefit enormously from the exchange of expertise and perspectives that takes place.

Can we make artificial limbs 'feel'?



Understanding how human tactile receptors encode information will lead to the development of artificial sensors and improvement of the functionality of hand prosthesis.

A science magazine article, submitted by the Riga Technical University in Latvia, was the catalyst for an exchange of crucial information.

Amputation of a hand and loss of ability to handle and feel objects have devastating consequences, impacting the patients' quality of life.

Functionality of artificial limbs and robotic devices is currently limited by lack of artificial tactile sensors resembling those in human fingertips. Imagine how clumsy you would be performing everyday tasks if you didn't have any sensation in your hands. The main challenge designing artificial sensors is to make them soft while maintaining high sensitivity and spatial resolution.

This has become possible as a result of collaboration between Dr Ingvars Birznieks' sensory neuroscience group at NeuRA, and Dr Stephen Redmond's biomedical engineering team at UNSW. Together they have designed a new type of tactile sensor based on unique information processing algorithms which enable the creation of a tactile sensor which is soft and compressible, and has no hard electronic components on the sensing surface.

The greatest challenge to building the sensor prototype was the unavailability of suitable materials. After an extensive international search, the breakthrough came unexpectedly after Dr Birznieks read a small note in the Science Illustrated magazine. It appeared that the team of Prof Maris Knite at the Riga Technical University in Latvia had developed the required unique materials – exactly what was needed.

A very successful global collaboration was established and, thanks to NeuRA postdoctoral research fellow, Dr Heba Khamis, the first 'proof of concept' prototype has been built. Such new advanced sensors will improve control of smart prosthetic devices and may restore lost sense of touch in amputees.

Scientia Prof George Paxinos AO.

Creating a more complete picture of the brain

Prof George Paxinos is collaborating with visiting scientists from Duke University in North Carolina, USA to create the world's first MRI atlas of the rat brain.

First published in 1982, Prof George Paxinos and Prof Charles Watson's ground-breaking anatomical brain atlas, The Rat Brain in Stereotaxic Coordinates, has become the most cited publication in neuroscience. Comprising stained histological sections of post-mortem brain tissue demarcated into anatomical regions, this atlas is used by researchers all over the world to navigate through the brain.

With the advent of new technologies, such as magnetic resonance imaging (MRI), we are now able to see into the living brain; these technologies offer new and exciting possibilities for studying and diagnosing brain disease.

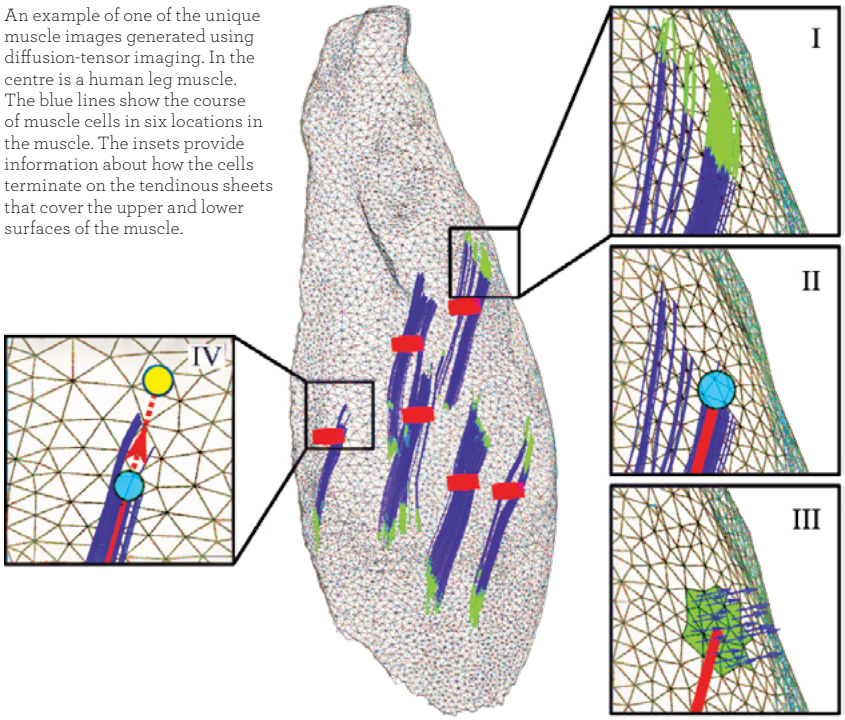
The ability to accurately navigate through the brain remains fundamental to this research. Prof Paxinos is working with Duke University's Evan Calabrese to synthesise images of the brain captured through MRI technology with existing histological maps to create a new type of brain atlas to guide this emerging field of research.

Evan Calabrese, an MD/PhD candidate at the Duke Center for In Vivo Microscopy, has captured MRI images of the rat brain that have the highest contrast and resolution of any images internationally.

He came to NeuRA to gain expert knowledge from Prof Paxinos in histology and locating markers within the brain - stereotaxic coordinates - as well as to validate a new method called Diffusion Tensor Imaging that allows researchers to see nerve fibre pathways in the brain's white matter.

With the participation of Prof Charles Watson, Paxinos and Calabrese have delineated brain regions in MR images to make the world's first MRI atlas of the rat brain. Together with histological atlases, these new atlases offer a more complete picture of the brain, opening up fresh possibilities for advances in neuroscience research.

Understanding how muscles change their lengths



An example of one of the unique muscle images generated using diffusion-tensor imaging. In the centre is a human leg muscle. The blue lines show the course of muscle cells in six locations in the muscle. The insets provide information about how the cells terminate on the tendinous sheets that cover the upper and lower surfaces of the muscle.

Prof Rob Herbert is collaborating with researchers from Delft University in the Netherlands to understand how the architecture of muscles influences muscle function.

Prof Herbert studies contracture, the stiffening of muscles that occurs in people who have had a stroke or other neurological condition. Contractures cause deformity and prevent normal movement. They are a major cause of disability in stroke patients.

Bart Bolsterlee, a PhD student who has come to NeuRA from Delft University, Netherlands, is working with Prof Herbert and other colleagues from Delft, studying muscles using magnetic resonance imaging (MRI) methods originally developed for investigating the brain. The methods, called diffusion tensor imaging, generate exquisitely detailed images of the internal architecture of living humans' muscles.

During his research exchange at NeuRA, Bart has developed new methods for quantifying the length and orientation of muscle fibres in leg muscles and has used these methods to investigate the validity of measurements made with ultrasound imaging. The application of diffusion tensor imaging to muscles opens up the possibility of answering questions that could not be answered even just a few years ago.

A future project will use diffusion tensor imaging to compare architecture of muscles in people who have ankle contractures after stroke with muscles from people who do not have contractures. This will provide important insights into the mechanisms that cause contracture.

Reflex connection

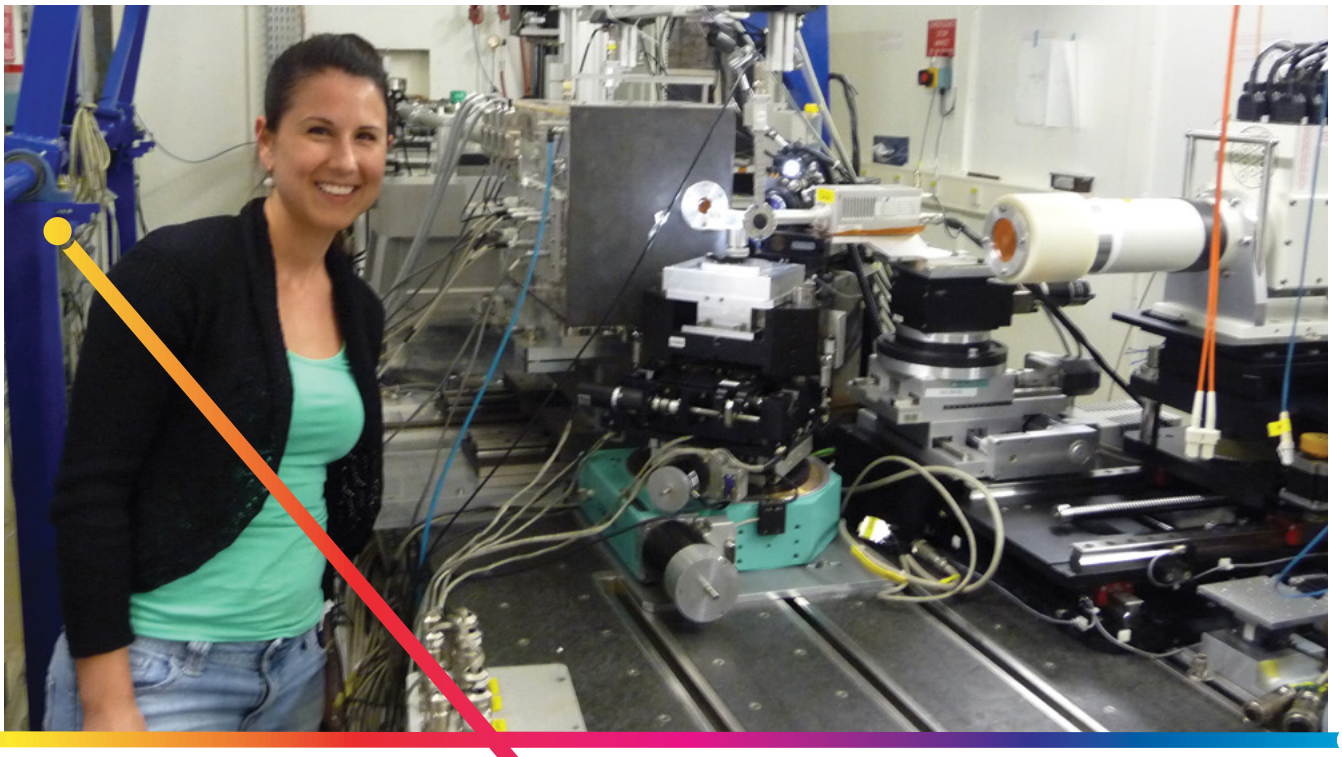
Knowledge gained overseas enabled the establishment of one of the few laboratories in the world investigating methods to restore balance reflex function.

Dr Americo Migliaccio co-founded a laboratory at Johns Hopkins University in the USA and was part of the fast-track academic program. On returning to Australia, NeuRA offered an excellent opportunity to continue this research. He now applies his skills to his translational research program connecting studies in basic physiology to clinical studies in patients - research identified by the NHMRC as a priority and valued contribution in Australia.

Dr Migliaccio studies the vestibulo-ocular reflex that helps to stabilise vision during rapid head movement, which would otherwise appear to bounce every time we walk or move. The reflex involves a direct nerve connection from the balance organ in the inner ear to the eye muscles. Injuries to the balance organ through illness or ageing also lead to problems with balance, especially in the dark, and walking. Some people recover from this type of injury but most continue to have poor quality of life.

Dr Migliaccio has identified a neural pathway that may be crucial for recovery after injury or ageing and is working towards the development of treatments targeting this pathway.

Dr Migliaccio adjusting the eye movement measurement camera that is part of his rotary chair system.



NeuRA researcher Dr Katherine Davies inside the European Synchrotron Radiation Facility, Grenoble, France.

Has the Parkinson brain lost its shine?

NeuRA's connection with Grenoble and Bordeaux provides an integral exchange network for Parkinson's study.

French physicists are collaborating with Assoc Prof Kay Double and her team to investigate changes in metals in the Parkinson's disease brain. It has been known for a long time that iron levels are increased in the brain in Parkinson's disease, but using cutting-edge imaging technologies, the Double researchers demonstrated that copper is reduced in the brain in Parkinson's disease.

This finding, published in the prestigious journal Neurobiology of Aging, has important implications for developing new treatments for Parkinson's disease. Copper is vital for the function of the healthy brain and other neurological disorders in which brain copper levels are altered and are successfully treated by restoring brain copper levels to normal. The belief is that a similar approach may also be beneficial in Parkinson's disease.

To make this finding, the team used brain tissues sourced from the Sydney Brain Bank at NeuRA and collaborated with Dr Sylvain Bohic at the European Synchrotron Radiation Facility in Grenoble and Dr Richard Ortega at the University of Bordeaux in France.

> This finding has important implications for developing new treatments for Parkinson's disease.

Using highly sensitive bioimaging methods the team, including NeuRA PhD student Katherine Davies, who twice visited France to participate in the research with Drs Bohic and Ortega, was able to show that copper levels are reduced within individual brain cells in early Parkinson's disease.

The team is continuing the collaboration to investigate how copper levels can be restored in Parkinson's disease and if this approach reduces brain cell death.

COMMUNITY

Medical research would not be possible without the participation, cooperation and support of the community, from research volunteers who give their time and goodwill, to our Sydney Brain Bank donors and our financial supporters. Although medical research benefits the community in due course, sometimes we are able to give back in more immediate ways, such as through the work of the Koori Dementia Care Project. Whether the exchange happens over the long or short-term, the relationship between NeuRA and the community is at the heart of our research.

Sharing a common goal: donating to the Sydney Brain Bank

Tissue Resource Manager, Heather McCann, chats with Lucille Bloch.

The generosity of brain donors is essential to the work of the Sydney Brain Bank.

The Sydney Brain Bank is a tissue facility based at NeuRA and used by neuroscientists in Australia and around the world. By studying brain tissue donated after death, researchers are able to build a comprehensive picture of what is occurring at a cellular level. It relies on donors registered through several established research programs, both healthy people and those with specific neurodegenerative diseases, who share a common goal with neuroscience researchers: to uncover the causes of and find cures for neurodegenerative diseases.

> “Lucille decided to become a donor because she believes in the power of research to find answers to devastating diseases of the brain.

Lucille Bloch has been registered as a brain donor for many years. She became a donor through her husband Keith, also a donor, who had frontotemporal dementia and was a research participant at NeuRA. She says she decided to become a donor because she believes in the power of research to find answers to devastating diseases of the brain – and to give hope to those people who will unfortunately follow her husband down the same path of dementia.

Research at NeuRA and around the world would not be possible without those in the community like Lucille and Keith who make the thoughtful and generous decision to donate.

“I was dizzy for years”

Frenzel goggles are uses as a diagnostic tool to evaluate patients with vestibular disorders to observe involuntary eye movements.

Long-term dizziness patient found that participating in a NeuRA study turned her life around in just a few short minutes.

In 2002, Lydia had a sudden onset of dizziness and was told she would never get better.

After learning to live with it for over a decade, Lydia came across Dr Jasmine Menant’s study to treat dizziness at NeuRA. The aim of the study is to better understand the causes of dizziness, and assess the effectiveness of individually tailored treatment plans that include one or more therapies, such as rehabilitation of inner ear conditions, balance exercises and cognitive behavioural therapy.

Currently, many patients are offered only one therapy and continue to experience symptoms because their dizziness has not been completely treated.

Lydia assisted the NeuRA study by participating; the study needs many people to take part in order to determine any clear conclusions. Lydia benefited by receiving treatment that brought her decade-long dizzy spells to an end.

Dr Menant and her team hope that by improving diagnosis and offering an individualised selection of treatments, they can improve the quality of life for the many Australians like Lydia who have been told that they just have to learn to live with the condition.

> Treatment brought decade-long dizzy spells to an end.

Motorcycle community weighs into crash prevention research

Researchers are working with motorcycle riders to tackle the increasing number of injuries from crashes.

As motorcycles and scooters become increasingly popular forms of transport, the numbers of riders injured and killed in motorcycle crashes is also increasing. Dr Julie Brown and her team are looking for ways to help reduce the pain and suffering as well as the healthcare burden associated with these crashes.

The motorcycle riding community in NSW plays a significant role in this research. By talking to over 500 riders across the state, the researchers have begun to build an in-depth profile of the riding population. This will help set priorities for developing strategies to reduce the number of riders injured on our roads. The research team is also investigating specific motorcycle crashes throughout the Greater Sydney, Illawarra and Newcastle region.

The 101 crashes investigated to date have provided invaluable information about the contribution of the road environment, the riders, their bikes and other road users and their vehicles to motorcycle crash risk.

This information will be used to implement better education for road users and road designers.

The team will also explore ways to prevent crashes through enhanced motorcycle technology and ways to prevent injury through improved design of motorcycles and protective equipment.

Dr Julie Brown is working with the motorcycle community to reduce injuries from crashes.

Dr Bill Brooks and DIAN study participant Chontell Johnson.

Reaching out to the familial Alzheimer's community

Communication is important when a family member develops symptoms of Alzheimer's.

The DIAN (Dominantly Inherited Alzheimer Network) study is an international study of familial Alzheimer's disease funded by the US National Institute on Aging. It has already succeeded in identifying biomarkers that predict the development of Alzheimer's disease in people who carry genetic mutations. These biomarkers can be used to monitor drug effectiveness in clinical trials.

Dr Bill Brooks, a DIAN study coordinator, reaches out not only to those who have had a diagnosis of dementia, but also their carers.

He gives talks to community organisations and carer groups providing medical and scientific input. Dr Brooks spends time with the families in our DIAN clinical research, discussing the myriad issues they face particularly when they are concerned about developing symptoms.

Research shows that exchanging information and support can reduce the sense of isolation, distress and depression and increase the self esteem of people with, or caring for, someone with dementia.

PhD student, Terry Trinh and Hons Student, Laura Harris with Dr McNulty in the laboratory working to understand the neurophysiological mechanisms of rehabilitation after stroke.

Improving rehabilitation after stroke

> The largest unmet need of stroke survivors is the lack of ongoing rehabilitation options.

Helping stroke survivors help themselves is an important strategy in this rehabilitation program.

Research by Dr Penelope McNulty and colleagues demonstrates that stroke survivors can continue to regain functional movement regardless of their age, time post-stroke or the level of residual movement after stroke.

The largest unmet need of stroke survivors after discharge from in-and out-patient care is the lack of ongoing rehabilitation options. This research into improving rehabilitation after stroke is centred on the Wii-based Movement Therapy protocol developed at NeuRA by Dr McNulty. Stroke survivors living at home have benefitted through their participation in research trials during the development of this new approach to rehabilitation. All have regained movement that helps them to become more independent in everyday life while helping the research team understand the neurophysiological mechanisms of recovery.

Not only do participants benefit directly, they take great joy in helping the research students in Dr McNulty's group complete their studies. The sense of making a contribution to science or "being useful again" is one component that helps to improve mood and motivation during rehabilitation. Family and carers also benefit through the increased independence of these stroke survivors.

Dr McNulty is extending this study to include therapy delivery via broadband internet connections, to increase the access to rehabilitation of stroke survivors in rural and regional Australia. This will help overcome the isolation after stroke imposed by distance and reduced mobility. Most importantly, participants enjoy the therapy which combines formal therapy with home practice. Many do more home practice than is required and continue long after the formal program ends. In this way Dr McNulty is helping stroke survivors to help themselves.

Focus on dementia care in Aboriginal communities

Dr Holly Mack (left) and Sharon Wall (centre) with Aboriginal Dementia Educators and Health Workers who work with the Koori Dementia Care Project team.

> The pivotal component of the project was engaging and training people from Aboriginal communities.

Translating NeuRA's research into grass-roots education programs for Aboriginal communities.

A community-focused approach to dementia developed to acknowledge the unique community history, cultures and networks of each Aboriginal and Torres Strait Islander partner community, continues to create awareness.

The Koori Dementia Care Project establishes the dementia needs of each community by targeting, training and collaborating with appropriate people within each community to provide information and knowledge. The project translates experience gained from a previous study into meaningful care and practice for Aboriginal communities.

Community leaders were identified within the Aboriginal communities of La Perouse, Campbelltown and Mount Druitt, and the regional areas of Kempsey, Nambucca and Coffs Harbour on the Mid North Coast of NSW.
The pivotal component of the project was engaging and training Aboriginal Dementia Knowledge Holders. Their responsibilities were carried out by highly respected members of each community, who were trained by NeuRA to deliver information regarding dementia into their own communities.

The successful project, implemented by Project Manager, Sharon Wall, was spearheaded by Prof Tony Broe and Dr Holly Mack.

Education and information

A broader understanding of Parkinson's disease through family communication.

Giving back to the community via information sessions and awareness raising seminars, organised by NeuRA and partners such as Parkinson's NSW, play a key role on the research stage.

Prof Glenda Halliday and Assoc Prof Kay Double, international authorities on the pathogenesis of Parkinson's disease, regularly step outside their laboratories to talk to people living with Parkinson's and patient support groups in NSW and around Australia.

Both regularly present to the global scientific community about new developments. Returning home to translate this information to colleagues and local communities completes the circle of information exchange.

Assoc Prof Double is on the Parkinson's NSW board and is committed to translating, through education and information, the progression of her work in the laboratory. The reciprocal benefits of community visits are evident in the outcomes of conversations with patients and family members who generously share valuable insights into how Parkinson's affects their lives.

Prof Halliday says that understanding the advances in NeuRA's Parkinson's initiatives gives people hope and offers another level of information which they may not receive from their GPs or healthcare professionals.

Contributing to discoveries

"When he was diagnosed, George said we had to help research as much as we could to try and find a breakthrough."

"With so many types of dementias, we need discoveries or cures so that other families don't go through what we were experiencing," says Wendy Smith.

George and Wendy Smith, a remarkable couple, have had their lives turned around by the onset of Frontotemporal dementia (FTD). They are true partners with NeuRA in the fight against this disease.

The Smiths first contact with NeuRA came via referral to Prof John Hodges who confirmed George's diagnosis of FTD. This was followed by clinical and other support from the Frontier team. They are thankful to NeuRA for providing guidance and encouragement during this critical period of upheaval.

Being a generous couple, they wished to exchange the support they received from NeuRA for contributions to future breakthroughs and discoveries.

They both chose to sign up to be brain donors, regularly contribute financially, and have indicated that they are leaving a gift to NeuRA in their Will. Wendy also shared their story for a fundraising appeal, which raised almost $30,000.

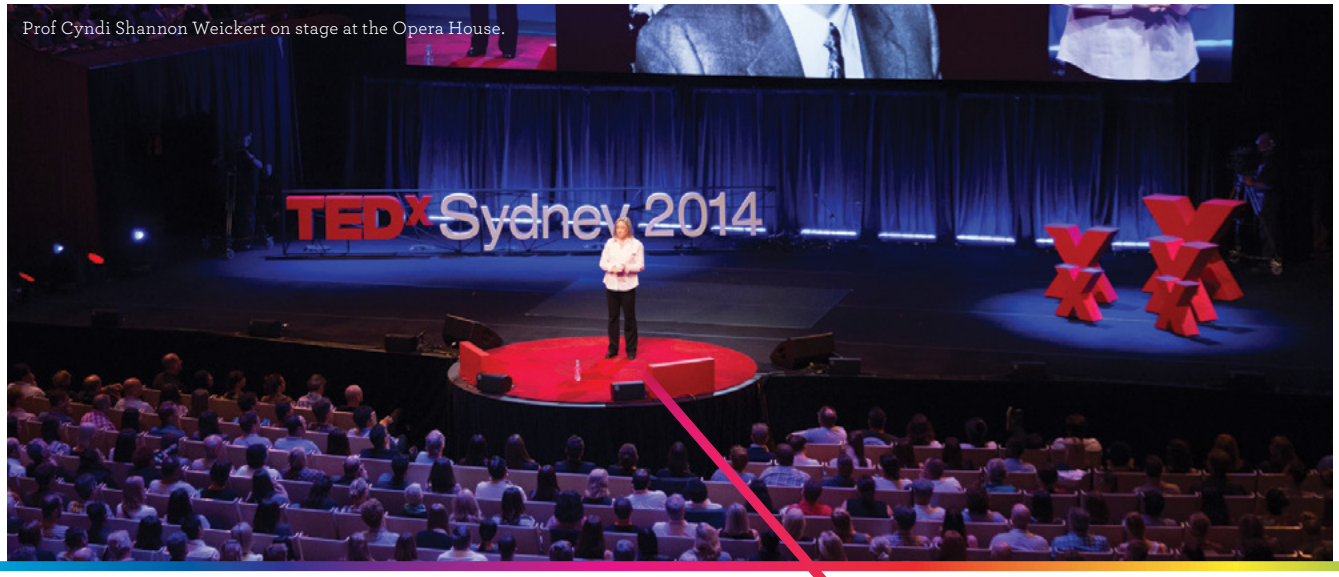
On the eve of their 50th wedding anniversary, life is very different from what George and Wendy had imagined. Yet their drive, vision and financial support mean that one day, with their help, cures for this insidious disease will be found.

Wendy Smith.

COMMUNICATION

Greater access to information means NeuRA's message is spread with immediacy across the globe. Exchanges happen every day. Not only do we deliver stories about our research via traditional media, we use the NeuRA Blog and YouTube channel, and welcome direct engagement on platforms like Facebook and Twitter. Social media's levelling of the playing field allows for this free flow of information and exchange. In science, a shrinking world and the democratisation of information are exciting as our voice to you is now more direct than ever before.

NeuRA takes the stage at TEDx Sydney



Prof Cyndi Shannon Weickert on stage at the Opera House.

NeuRA scientist joins a long list of thinkers, doers and idea-generators.

TED talks are becoming recognised as visual insights into the minds of thought leaders throughout the world.

NeuRA's Prof Cyndi Shannon Weickert recently stood on a stage, previously occupied by innovator Steve Jobs and luminaries such as Bill Clinton and Bono, and talked about her work on schizophrenia.

She knows only too well that there is currently no cure for schizophrenia. Her dream is to turn that fact into fiction as she told a sold-out TEDx Sydney at the Sydney Opera House.

Prof Shannon Weickert and her team of over 20 scientists aim to uncover the underlying biological basis of schizophrenia.

Presenting findings from her research illuminating the path to new and improved treatments - past, present and future - she also reflected on her family's journey with the disease and her experiences as a sister and care giver.

Schizophrenia is a devastating mental illness that ranks among the top 10 causes of disability in developed countries worldwide.

It first manifests during adolescence, causing profound withdrawal from family and friends, a decrease in intellectual abilities, hallucinations and delusions. Prof Shannon Weickert has dedicated her life to helping sufferers. Hers is a story of loss, survival and a strong faith in science.

Join the conversation

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Dr Muireann Irish.

Imagination strikes a chord

Research into imagination resonated with media audiences across the nation.

Dr Muireann Irish was interviewed by ABC Radio National's All in the Mind program hosted by Lynne Malcolm, and numerous other radio stations across the country, about her current research on imagination.

Dr Irish's work in dementia considered the mechanisms behind the ability to envisage the future and reminisce about the past.

The story struck a chord with anyone who has ever daydreamed about the future and made us think more about those who have lost the ability to do so.

Previously, it was thought that imagining the future relied heavily upon the ability to retrieve events from the past. Dr Irish's work, however, reveals the importance of general world knowledge in mentally constructing a picture of the future.

Dr Irish says that this study is important because it sheds light upon the brain regions that are essential for memory and imagination.

The popularity of the piece helped us to highlight that changes in future-oriented thinking are common in dementia, which in turn may affect the capacity of the individual to make important long-term decisions or to appreciate the impact of certain behaviours.

Media minded

Media coverage for NeuRA is important. Here is a snapshot of where our researchers have appeared recently.

- Prof Peter Schofield featured in several Fairfax articles recently including a piece in the SMH's The Good Weekend about 'The anatomy of violence'.
- German TV Science show 'nano' visited Australia and featured Prof Caroline Rae talking about intelligence and how brain stimulation may be able to improve it. The documentary aired on 3Sat TV, the national public broadcaster in Germany aimed at audiences in Germany, Austria and Switzerland.
- Prof Tony Broe joined Jenny Brockie on SBS' Insight to discuss centenarians and an ageing population, particularly indigenous communities. Prof Broe live-tweeted and answered viewer questions during the airing of the program.
- Dr Fiona Kumfor wrote for The Conversation about her work on the colour of emotional memory. The story went viral globally leading to an interview on the ABC's current affairs program, AM and other networks.
- Channel Nine News interviewed Prof Stephen Lord and Dr Matthew Brodie about the use of accelerometers and gait stability. The story offered insight into our emerging technologies.
- Dr Danny Eckert joined Dr Norman Swan on the ABC's Health Report to discuss his research into the causes of sleep apnoea and possible new therapies.
- Dr James McAuley was interviewed on Radio 2UE about his work into chronic back pain. The interview sought to inform the public about what pain really is and focused on a clinical trial currently in recruitment phase at NeuRA.
- Software engineer at NeuRA, Michael Cartwright, ran 9000kms to Queensland to raise money for our Alzheimer's research picking up media interviews along the way including on James O'loghlin's national ABC program.
- Prof John Hodges was interviewed for a feature in CEO magazine about the difficulty in diagnosing neurological diseases and the need for greater research into motor neurone disease.

ADVOCACY

NeuRA's supporters give in so many ways

Ray's introduction to NeuRA was as a volunteer in a Falls Prevention study. He continued to take a keen interest in many aspects of research at NeuRA and, through his association with Clubs NSW, has been a tireless fundraiser, actively encouraging support for our research, particularly into falls.

"I came as a guinea pig, and stayed connected to help make a difference.

Ray Winter, Clubs NSW

Debbie's partner Rino, suffered with frontotemporal dementia (FTD)/corticobasal degeneration for five years until he passed away. Rino and Debbie frequently visited NeuRA's Frontier Group, both participating in our research. Debbie attended the inaugural FTD carers' group and encouraged Rino's family and friends to attend FTD information and support days, to enable a better understanding of his rare condition.

"Rino and I had a great association with NeuRA over the past five years and I couldn't speak highly enough of the Frontier research group. This association ultimately lead to Rino's decision to donate his brain to research knowing that, by donating, it may very well help someone else, especially his own family. After Rino's passing I asked friends and family to give to NeuRA in lieu of flowers at his funeral. I was later told how much was raised and I'm still blown away by their generosity. It shows what an amazing man Rino was and what a worthwhile cause this is.

Debbie Laws

Graham and Kathy sponsor a scholarship for a NeuRA PhD student.

Both Graham and I feel it is important to encourage and support the next generation of aspiring young researchers as they embark on a lifetime of uncovering the potential cures of debilitating disease such as Alzheimer's disease. Having a family member recently pass away from Alzheimer's, we are acutely aware of the burden this disease places on families.

Graham and Kathy Milliken

Howard and Valerie have been NeuRA supporters for the past decade and, two years ago, decided to join our regular giving program supporting our valuable research.

We have made a conscious choice to make regular monthly gifts to NeuRA, knowing that we are helping NeuRA's dedicated researchers continue working on discoveries and allowing them to plan future projects with certainty. We hope that cures will be found for the many diseases of the brain and nervous system that afflict humanity today.

Howard and Valerie Quinlan, ACT

Kim has been a passionate advocate and supporter of NeuRA's Bridge for Brain Research Challenge since its inception 11 years ago.

I love playing bridge and the fact that I can do something I enjoy whilst also supporting a great cause makes me feel really good.

Kim Ellaway, Queensland Bridge Association

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Photo: Cameron Fong

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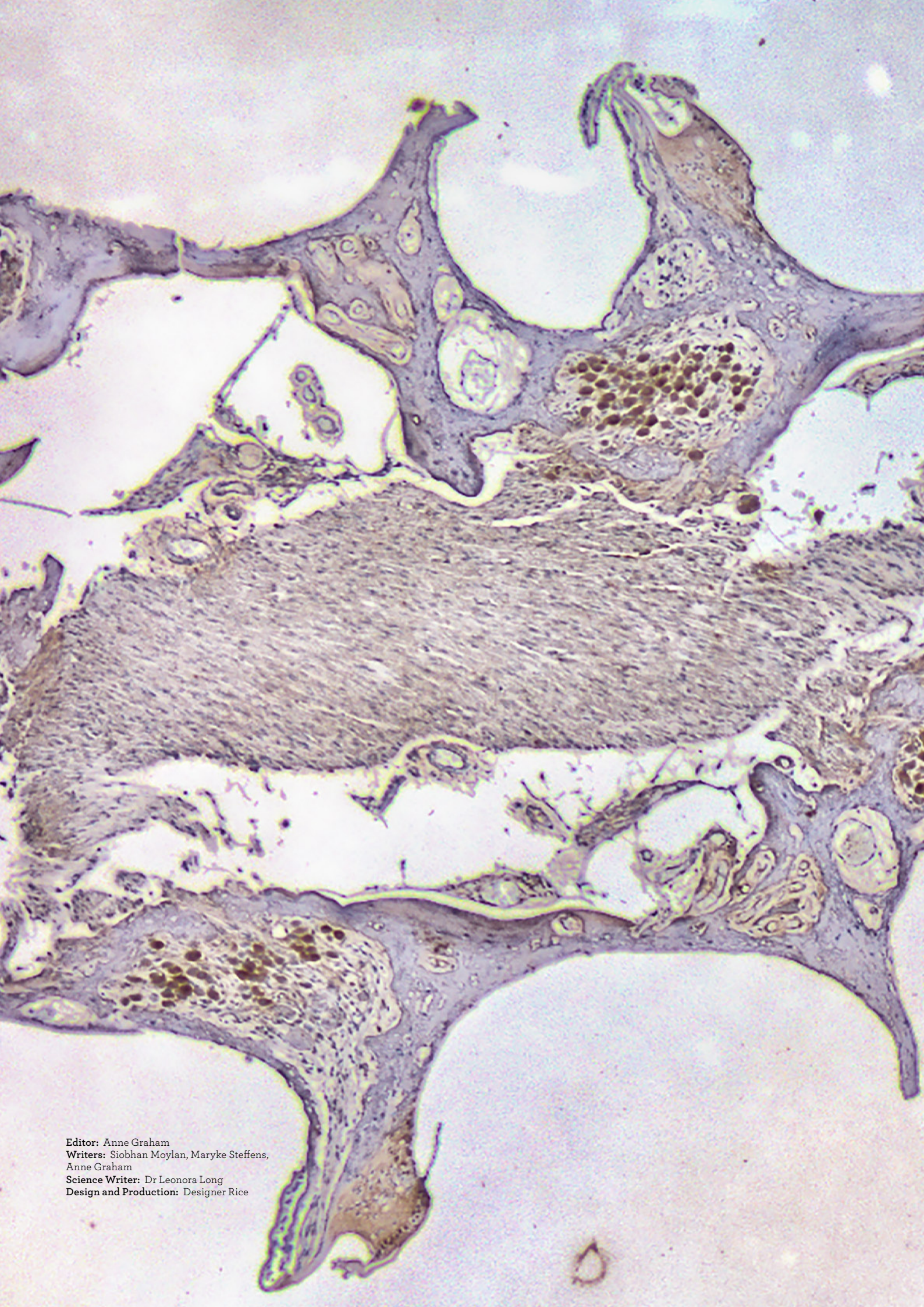

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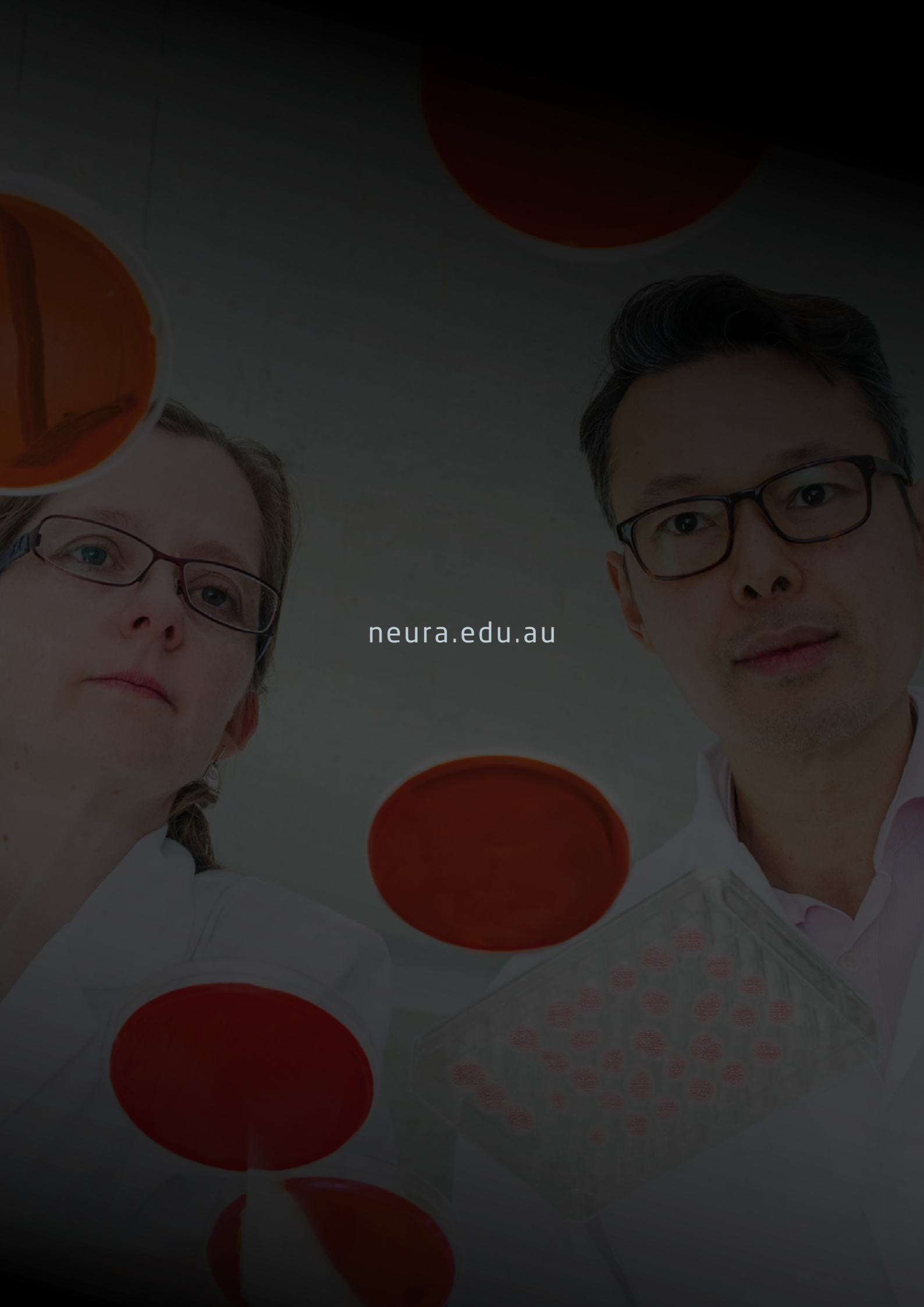
Discover. Conquer. Cure.

Sound stimuli are converted to electrical impulses... the image depicts the bony axis of the snail-like structure, the cochlea, that accommodates the sensory cells of the hearing apparatus. The brown dots which appear to form nests are nerve cells which conduct the sound-evoked electrical impulses to the brain.

Image: Dr Zoltan Rusznak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