Neuroscience Research Australia

Discover. Conquer. Cure.

Profile 2012

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NeuRA Profile 2012

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As a volunteer, Luke is committed to helping Cyndi find answers to schizophrenia through research.

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Inside these pages, we invite you to explore highlights of our research and discoveries.

You will also meet the people who make these discoveries possible: the researchers who give their passion and dedication, and the supporters who give their time as research volunteers and their financial support as donors. All these people are advocates of the same vision: to cure diseases and disorders of the brain and nervous system.

Mervyn Davison
Aboriginal research assistant

Prof Tony Broe AM
Leader in Aboriginal ageing research

Mervyn works with Tony on involving the La Perouse Aboriginal community in our Koori Growing Old Well Study.

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A place of opportunities

Prof Peter Schofield
Executive Director and CEO

Paul Brassil
Chairman

Eight years ago, we started out together at Neuroscience Research Australia; Peter as the new Executive Director and CEO, and Paul as the new Chairman of the Board. In those early days, we hatched a daring plan: to develop a neuroscience 'hub', a precinct with sufficient cachet and presence to act as a magnet to attract great researchers. We wanted people to think, 'NeuRA is definitely where I want to be'.

Our aim has been to send a message that NeuRA is the place for all of us to come together. We want scientists conducting research on neurological and neurodegenerative diseases, as well as mental health and psychiatric illnesses, to have the opportunity to share ideas and collaborate in one place. We want the community to feel that NeuRA is a medical research institute that is welcoming and accessible to everyone.

So here we are, eight years later, standing at the threshold of the new NeuRA building, a place that has occupied our minds for a very long

upper left
Paul Brassil, Governor of NSW
Prof Marie Bashir, Prof Peter Schofield.

upper right
Lollypop ladies, integral
to the redevelopment.

left
Member for Coogee Bruce Notley-Smith,
NSW Minister for Health Jillian Skinner,
NSW Premier Barry O'Farrell,
Prof Peter Schofield.

time. We're nearly there; day-by-day the building takes its final shape.

Our focus now is on the interior of the building, and this is where we need your assistance. We seek your support to help finance the fitout of our new institute, to build the laboratories, interview rooms and research spaces where our neuroscientists can make their important discoveries.

Our new world-class building sits on the corner of Barker and Easy Streets at Randwick, where people turn up the hill to go to the hospital. Our vision is to stop people needing to go there. There is nothing that touches a patient today that did not have its origin somewhere in medical research. The most significant health care issue of our time is the continued existence of diseases for which we do not yet have answers. Let's find a way to cure them. That's what we want our research to achieve... with your help.

Paul Brassil
Chairman

Prof Peter R Schofield
Executive Director and CEO

understanding AGEING

Australia's population is ageing. By 2050, the number of older people aged over 65 years will more than double, and the number of very old people aged over 85 will more than quadruple. Now, more than ever, understanding diseases associated with ageing through research is critical to our ability to grow old well.

PROJECT

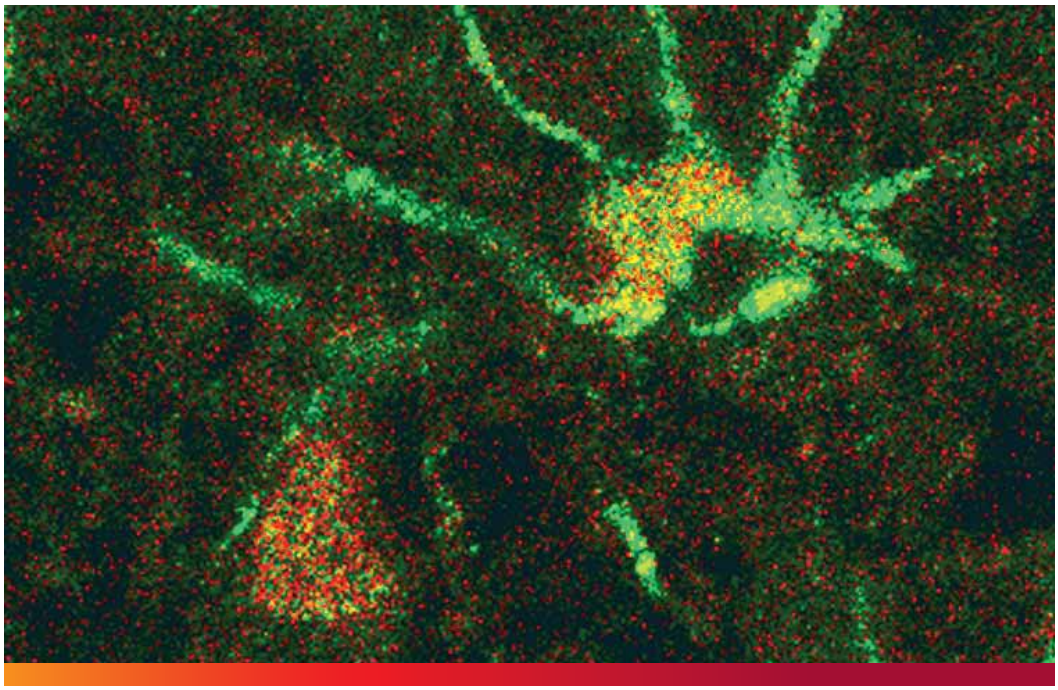
Defence against dementia

An anti-depressant may offer protection against Alzheimer's disease

To date, there are no treatments that prevent or slow the progression of Alzheimer's disease. Current therapies temporarily improve memory and thinking, but they don't stop the death of neurons. High levels of a protein called beta amyloid are thought to cause the damage in Alzheimer's disease. Because this damage starts 15-20 years before the appearance of symptoms, drugs that act on the production of the protein have little effect on people already diagnosed with the disease.

With this in mind, our approach is to look for safe drugs with few side-effects that offer protection against the onset of the disease in healthy older people. We are currently investigating the selective serotonin reuptake inhibitor fluvoxamine, which is used to treat depression and has been taken safely and continuously by many people for over 20 years. We have already shown that fluvoxamine stops the production of the beta amyloid protein in cells and are currently confirming the treatment in transgenic mice. Throughout 2012 we aim to commence a small clinical trial to see whether treatment with fluvoxamine can reduce blood levels of the beta amyloid protein in healthy adults. If successful, it may indicate that this drug is an exciting candidate for the prevention of Alzheimer's disease.

Dr John Kwok looks at beta amyloid deposits in an Alzheimer's disease brain.



“ Stem cell therapy offers the potential to regenerate brain cells damaged by diseases such as Parkinson’s. ”

A newborn neuron in the adult human brain is shown here in green.

PROJECT

The birth of new brain cells in ageing and disease

Understanding how new cells are born in the brain will help us develop new treatments for Parkinson’s disease

The potential to generate new neurons from stem cells in the brain is an exciting area of research; stem cell therapy offers the potential to regenerate brain cells damaged in degenerative brain diseases such as Parkinson’s disease. In order to be able to develop these types of therapies, we first need to understand how the birth of new brain cells (neurogenesis) is controlled and how this process is affected by ageing and by disease.

We have studied proteins that regulate new cell birth in the brain, and found that while levels of several of these proteins change with age, the number of new neurons being born remains essentially unchanged. We have also looked at neurogenesis in people with Parkinson’s disease and found that they have reduced cell birth in the hippocampus, an area of the brain important for memory. This may explain why many people with Parkinson’s disease develop dementia in the later stages of the disease. We also found that the maturation of new cells was changed in another area of the brain in people with Parkinson’s disease. The main medication used in Parkinson’s disease, levodopa, helped increase neurogenesis, but only temporarily.

Building on this research, our ultimate goal is to try and understand how we can manipulate the process of neurogenesis to repair the areas of the brain damaged in Parkinson’s disease.

Dr Kylie Radford and Margaret Anderson are working with Aboriginal communities in NSW.

PROJECT

Early life events and the ageing brain

We are looking at the relationship between early life stress and dementia in older Aboriginal Australians

Emerging evidence suggests that Aboriginal Australians have a higher risk of developing dementia. We already know that traumatic experiences in childhood – separation from family, institutionalisation or abuse – are associated with poor adult health.

We aim to find out whether these early life stresses have an enduring effect on the brain in terms of developing dementia later in life, and whether positive factors, such as education and supportive families, are protective. Our hypothesis is that people with a marked history of early life stress have structural changes in the brain that affect memory, learning and other cognitive and behavioural functions.

Working together with Aboriginal communities in NSW, we completed a pilot study in 2011 and are currently collecting imaging and neuropsychological assessment data for our full study of 120 participants.

This project will help us understand the pathways that lead to the health problems experienced by many Aboriginal Australians, including cognitive decline in older age, so that we can develop appropriate management and prevention strategies. Indeed, one of the aims of this project is to work with Aboriginal communities on strategies to promote early brain development and healthy ageing. The results will have national significance in terms of public health policy for Aboriginal people.

This project is supported by the RW & JG Fellowship in Aboriginal Health and Ageing.

“ We are working with Aboriginal communities on strategies to promote early brain development and healthy ageing. ”

PROJECT

Improving diagnosis of dementia

We are developing new tests to differentiate between Alzheimer's disease and frontotemporal dementia

Although the most widely known symptom of dementia is memory loss, some people with dementia find their main difficulty is not memory at all, but a disintegration of their speech and language skills, known as progressive aphasia. Because this symptom can appear in both Alzheimer's disease and frontotemporal dementia, it can be difficult to diagnose the cause of the aphasia and offer the correct treatment.

We are conducting a study to improve our ability to differentiate between Alzheimer's disease and frontotemporal dementia presenting with progressive aphasia. Using a special type of brain scan, called PiB-PET (positron emission tomography) at Melbourne's Austin Hospital, we are able to see which patients have deposits of a protein called beta amyloid in the brain, which is characteristic of Alzheimer's disease. Normally, this diagnosis is not possible to make until after the patient has passed away.

PiB-PET is an expensive method of diagnosis, so we are also developing a series of diagnostic language tests for progressive aphasia to see if we can predict who has Alzheimer's disease and who has frontotemporal dementia using the results of the PiB-PET as the gold standard. The goal is to use these refined language tests to make diagnosis more accurate, easy and inexpensive, so that patients can be confident they are receiving the correct treatment for their disease.

PhD student Cristian Leyton is part of a team developing more robust diagnostic methods for dementia.

" This new test enables an early diagnosis of MND allowing for earlier treatment and an improved quality of life for the patient. "

Leader in MND research, Prof Matthew Kiernan, with Federal Health Minister, Tanya Plibersek.

PROJECT

Developing a diagnostic test for MND

We have developed a test to diagnose MND with greater accuracy

Motor neurone disease (MND) is a degenerative disease that affects muscles that control our voluntary movements, including moving, speaking and swallowing. MND typically affects people in their mid-50s and is universally fatal. At present, there is no diagnostic test; physicians diagnose MND using clinical signs, but it can take months to satisfy these criteria.

To address this critical deficiency, we have developed a non-invasive test that enables people with MND to be diagnosed with great accuracy, on average eight months earlier than is currently possible. This means we can initiate treatment earlier and improve the patient's quality of life. Our test, called threshold tracking transcranial magnetic stimulation, employs magnetic stimulation to measure increased levels of electrical activity in the brain typical of MND.

In addition to helping us understand the basis of MND, our technique will allow people with MND to participate in drug trials at an earlier stage, which will greatly assist us in finding new treatments for this tragic disease. This technique is currently being validated by us and other clinical research groups prior to more widespread international distribution.

making connections

> **“ We want to give back to the community after they have given so much to us. ”**
>
> *– Prof Tony Broe*

Mervyn Davison – Aboriginal research assistant

When I turned 60, Tony asked me if I wanted a job with his research team. Tony’s a good man. He’s been working in this community for a while, so I know he cares about the La Perouse Aboriginal people. My job is to get older people involved in the study. I think the reason I got the job is because I’ve been here all my life and people know me. I tell them it’s a good thing because maybe we’ll find out how to help young people grow up in a way that will stave off dementia later on. I know it’s going to hit you eventually, but with Aboriginal people, I do think dementia comes earlier than most. The best part of this job is getting the people to become part of the project. Afterwards they say they feel good about doing it and that makes me feel very happy.

Prof Tony Broe – Lead researcher, Koori Growing Old Well Study

Mervyn is our first point of contact with the members of the La Perouse Aboriginal community. Mervyn is just wonderful; he’s reliable and trusted by his community, he knows just about everybody, and if he doesn’t know them, he goes out and finds them. Without him, we wouldn’t have had nearly as much success recruiting people to the study. Aboriginal people are very loyal to their communities and want to see their fellow community members healthy and well. They want to see that our study will lead to something sustainable. We’re currently working with Mervyn and a few others to help them become sources of information for the community on dementia knowledge and accessing local dementia care services. That was part of our promise; we want to give back to the community after they have given so much to us.

RESEARCH ASSISTANT

Mervyn Davison

RESEARCHER

Prof Tony Broe

preventing and RECOVERING from injury

Injury is a leading cause of disability and death in Australia. Car crashes are a major cause of head and spinal injury, falling is a serious issue for the elderly and stroke damages areas of the brain that control movement and speech. Research into how injuries occur, prevention and rehabilitation is essential for reducing the impact injuries have on our community.

PROJECT

Regaining inner balance

We are developing a training device to help people recover from damage to their balance organs

“ We have found that with just 15 minutes of practice a day, people with balance problems begin to recover.”

The extremely unpleasant sensation of vertigo can be symptomatic of damage to the balance organs in the inner ear and loss of an important reflexive eye movement generated by these balance organs, called the vestibulo-ocular reflex. This reflex stabilises vision when you move your head; without it, your whole world appears to bounce, which can produce the dizzy sensations. Unfortunately, people with this type of damage have very few options for rehabilitation and significant recovery.

In collaboration with Johns Hopkins University, we are developing a training device and incremental exercises to help people recover use of this reflex.

Dr Americo Migliaccio and PhD student Patrick Huebner demonstrate their balance training device.

The device projects a green dot on to the wall, and the patient practises following the dot with their eyes while moving their head – a skill that people with damage to their balance organs have lost. Our results are encouraging: we have found that with just 15 minutes of practice a day, people with balance problems due to poor vision stabilisation begin to recover.

“ Improving restraint use is one of the most effective ways to reduce child fatalities. ”

Charity Cheng travels safely in her car seat restraint.

PROJECT

Improving car safety in China

Education is key to improving the safety of children travelling in cars in China

Road trauma is the number one cause of death of children in China. Given that the number of cars in China is rapidly increasing, the number of children suffering road trauma-related injuries is also set to increase. We know that improving restraint use is one of the most effective ways to reduce child fatalities. Unfortunately, however, there are no laws mandating the use of child restraints in China and awareness and implementation by parents of best practices is low. For example, a study we conducted at highway tollgates in Shanghai showed that 9 in 10 children were not restrained at all and almost half the children were seated either in their parents’ laps or in the front seat.

In response to these findings, we recently conducted the first-ever pilot education program in Beijing for 600 parents of children aged 3-6 years. We found that awareness of safe practices and willingness to use child car restraints increased dramatically after attendance. These findings suggest that education programs are crucial for encouraging parents to use rear seat restraints and to improve the safety of children travelling in cars in China. We hope to assist with the roll-out of a larger program based on our pilot in the near future, and develop targeted education programs for Chinese immigrant populations in Australia.

The study was supported by the Australia-China Council.

PROJECT

Spinal cord injuries in children

Children sustain more severe spinal cord injuries in car accidents than adults

Spinal cord injuries can be devastating and lead to permanent disability. Car accidents are the most common cause, and children are particularly vulnerable; they sustain more severe injuries than adults and are more likely to suffer complete loss of function below their injury site or die as a result of their injury. Our aim was to find out why this is the case so that we can improve child injury prevention measures, such as car restraints.

Our findings show that the age of the child and how much their spine moves during impact are important in determining the severity of their injury, while speed of impact was not. We found that children may be more vulnerable to injury than adults when exposed to an equivalent spinal motion, possibly because a child's spinal cord is still developing and has different biomechanical properties. These results, along with data from real accidents and crash test experiments, will be used to develop ways of predicting when children are likely to sustain spinal cord injuries, helping us to better understand how to prevent injuries in the future.

Soon Lau investigates how children sustain spinal cord injuries.

PROJECT

Lessons from China

Why do older Chinese people fall less frequently than older Australians?

Falls in older people will become an increasing problem as our population ages, resulting in a higher rate of serious injuries, such as hip fractures, and loss of independence. We have observed that older Chinese people fall far less frequently than older Australians; understanding why may help us design better fall prevention programs.

" When walking, older Chinese people fall far less, and exercise greater levels of caution, than older Australians. "

We looked at the physical ability, daily activities and attitudes of four groups of older people: Chinese people living in Taiwan and Hong Kong, Chinese Australians and Caucasian Australians. We found that older Chinese people exercised greater levels of caution when it came to exercise, such as being attentive and using a stick when walking outside. They also engaged in structured exercise, such as planned walking and Tai Chi, while Caucasian Australians were more likely to engage in incidental physical activity, such as gardening. Interestingly, we found that these protective behaviours and attitudes were partially lost in Chinese people who had migrated to Australia; their fall rate was significantly higher than that of Chinese people living in Taiwan or Hong Kong.

Marcella Kwan is studying falls prevention for her PhD.

Our plan is to incorporate this information about the importance of structured exercise and avoiding unnecessary risks into fall prevention trials for both Australian Chinese and Caucasian older people.

PROJECT

Regaining fitness after stroke

Dr Penelope McNulty works with stroke patient, Michael Weekes, on arm and hand rehabilitation.

Rehabilitation using video games has the added benefit of improving fitness

Cardiovascular fitness is not always a priority for someone striving to regain movement and speech after a stroke. Physical disability also limits the capacity of stroke patients to retain and regain physical fitness; aerobic capacity often drops to half of what it was pre-stroke. Maintaining cardiovascular health, however, is important: not only does fitness aid recovery, it also reduces the risk of suffering another stroke.

“ Wii-based Movement Therapy maintains cardiovascular health after stroke. ”

Given these difficulties, we investigated whether stroke patients could improve their cardiovascular fitness using Wii-based Movement Therapy that specifically targets use of the hand and arm. After a two-week program, our participants all experienced an increase in peak heart rate (by late therapy, it was 38% higher on average than resting rates), which recovered more rapidly after exercise. Patients also had greater exercise endurance. Their ability to complete everyday tasks, such as picking up objects, also improved. This is clear evidence that something as enjoyable as therapy using the Nintendo Wii Sports not only improves upper limb function, but is also effective at improving cardiovascular fitness.

PhD student, Daniel Schoene, demonstrates the use of the dance mat.

“ Adapted from a video game, the dance mat program improves balance in older people. ”

PROJECT

Keeping you on your toes

Dance mat video games have the potential to reduce the risk of falling

One of our most entertaining approaches to falls prevention in older people has been our dance mat, a game which requires you to coordinate your steps with moving arrows on a screen. Adapted from an off-the-shelf video game and tested in the lab, we are now conducting a randomised controlled trial of a step training program using the dance mat in retirement villages across Sydney. The idea is that having access to the technology in the home will allow older people to practise more often, leading to significant improvements in balance, stepping ability and reaction time, and reducing the risk of falling. We hope to see improvements in cognitive function also.

The system consists of a dance mat and computer that connects to the television, and a training routine specially designed to improve stepping and balance. Participants play approximately 2–3 sessions per week of 15–20 minutes over a period of 8 weeks. This study addresses an urgent health care problem that will affect an increasing number of older people in Australia, and has the potential to significantly enhance quality of life.

PHILANTHROPIST

Clyde Campbell

RESEARCHER

Prof Glenda Halliday

working together

> **“ Research is important because it gives us hope. ”**
>
> *– Clyde Campbell*

Clyde Campbell – Founding director, Shake It Up Australia Foundation

When I was diagnosed almost three years ago at age 44, the first shock was that I had Parkinson’s disease. The second shock was that there was no cure. The journey for me since then has not been about accepting that there is no cure, but about helping to find one through the Shake It Up Australia Foundation. I didn’t have much to do with fundraising and research before my diagnosis; I met Glenda because I wanted to find out who’s who in Parkinson’s research here in Australia, and who I should be supporting. Glenda is very intelligent and passionate, and I feel confident in her ability to help find a cure. Having said that, I know that research is a long journey. We’d all like it to be shorter, but the reality is that unless we start, we’re never going to get to the destination. Research is important because it gives us hope; it helps us know that there’s a better tomorrow if we do the right things today.

Prof Glenda Halliday – Leader in Parkinson’s disease research

I met Clyde at a conference that brought scientists and people with Parkinson’s disease together. Clyde was very enthusiastic about supporting research and finding a cure. All we have at the moment are therapies that treat symptoms; we don’t have anything that will halt the progress of the disease. I believe the immune system plays an important role in triggering the onset of Parkinson’s disease, and Clyde decided to support our research in this area; our project on the LRRK2 gene was the first to receive funding from Clyde’s Shake It Up Australia Foundation. We hope to understand how mutations in the LRRK2 gene affect immune system function, which may help us understand how we can intervene and stop the course of the disease. It’s an exciting time to be in Parkinson’s disease research; I feel we’re on the verge of discovering something important.

understanding and TREATING brain disorders

If we add up all the years of normal, active life lost to disease in Australia, brain disorders (including mental illnesses) are responsible for over 60 per cent of that loss compared, for example, to cancer's 7 per cent. Research into the causes of and treatments for brain disorders is key to improving quality of life for many Australians.

PROJECT

The genetics of bipolar disorder

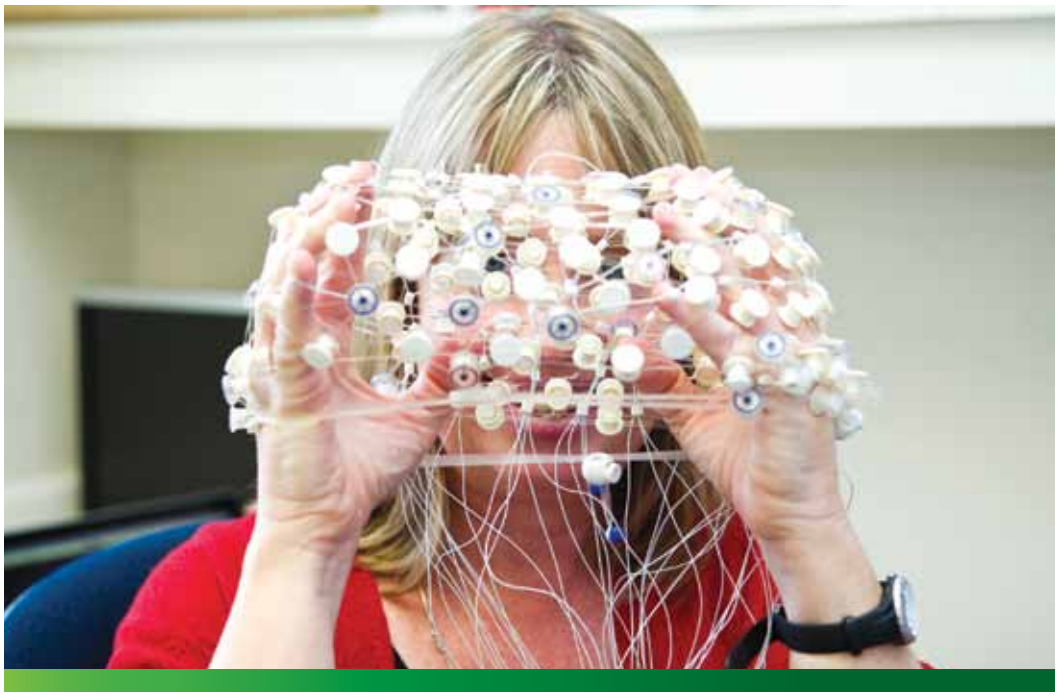
As part of an international team, we have identified several genome regions important in the development of bipolar disorder

Bipolar disorder is a mental illness characterised by extreme swings in mood. We have been recruiting Australian families and individuals with bipolar disorder for over 15 years to identify genes that make us susceptible to this disorder.

Recently, we have been working with a large international consortium of over 250 researchers from more than 20 countries on the largest ever study conducted on bipolar disorder involving 12,000 patients. This collaboration has produced some exciting results: together, the team has identified 11 regions that have a strong association with bipolar disorder, including 6 regions not previously observed. Interestingly, many of these DNA regions are associated with schizophrenia as well, indicating that there is genetic overlap between these two disorders.

By understanding what genes make us susceptible, we are getting closer to understanding the biological causes of bipolar disorder and, perhaps most importantly, identifying new targets for developing treatments for this disabling condition.

Dr Jan Fullerton is part of an international team studying genetic susceptibility in bipolar disorder.



“ Many children with autism spectrum disorders become distressed when exposed to loud noise. ”

Prof Rhoshel Lenroot measures the brain’s electrical activity in children with autism.

PROJECT

Hypersensitivity to sound in autism

We are examining how people with autism process sounds in the brain

Many children and young adults with autism spectrum disorders are hypersensitive to sound, responding to unexpected or loud noise with distressed behaviour, such as fleeing, humming, covering their ears or hyperventilating. In the long-term, individuals can become anxious and withdrawn. Because such people appear to have normal hearing, we believe that this hypersensitivity may be due to peculiarities in the way sounds are processed in the brain.

We are recruiting children and young people with autism spectrum disorders and hypersensitivity to sound and measuring their brain’s electrical activity. We expect to see distinct brainwave responses and hence brain function in relation to sound processing. We will also look at their levels of anxiety and how that contributes to their distressed behaviour. Until now, there have been no studies examining the relative contributions of these factors.

Hypersensitivity to sound can have a profoundly detrimental impact on the lives of a considerable number of children, adolescents and young adults with autism spectrum disorders. Our research will hopefully lead to a better understanding of the psychological and neurophysiological basis of these disorders, as well as better ways of treating and managing hypersensitivity to sound.

PROJECT

Restless legs syndrome and the brain

We are looking for the cause of restless legs syndrome in the brain

Restless legs syndrome is a disorder that causes uncomfortable or painful sensations and a powerful urge to move the legs, particularly at night. It affects up to 1 in 20 people and can cause daytime sleepiness and fatigue, severely affecting quality of life.

Even though this is a common brain disorder, we still don't know very much about it. We are currently conducting the first study to combine ultrasound and magnetic resonance imaging (MRI) to look for changes in the structure and function of the brain in this disorder. The results will help us understand what is happening in the brain to cause these symptoms and may help the development of better treatments for this disorder.

Our data shows that people with restless legs syndrome have up to 80 per cent less function in an area of the brain important for controlling movement. We are continuing to recruit participants for this study to gain a better understanding of these striking changes. If we can understand what is happening in the brain, we will be one step closer to helping the thousands of Australians with restless legs syndrome get a better night's sleep.

Restless legs can cause daytime sleepiness and fatigue.

PROJECT

A new way of treating schizophrenia

Our clinical trial of a new drug for schizophrenia is coming to a close

One of the most exciting projects to take place at NeuRA in recent years is a clinical trial of a novel treatment for schizophrenia. The Cognitive and Affective Symptoms of Schizophrenia Intervention (CASSI) trial is based on our research that suggests that people with schizophrenia are more likely to carry a gene that codes for a faulty oestrogen receptor in the brain. Our clinical trial is looking at whether a drug, raloxifene (already used to treat cancer and osteoporosis), stimulates these faulty oestrogen hormone receptors in the brain and restores their function. Intended to be used as an add-on therapy for people with schizophrenia, we believe that the treatment may improve thinking ability, language, memory, motivation and social skills – all debilitating symptoms of schizophrenia.

So far, 64 volunteers – men and women with schizophrenia aged between 18 and 55 years – have participated in this important clinical study but we are still seeking volunteers. With the study due to finish in the second half of 2012, the team has already published two scientific papers (in *Molecular Psychiatry* and *Journal of Psychiatry and Neuroscience*) on aspects of the study. We are looking forward to analysing all of the data as soon as all participants have completed the clinical trial. If the drug proves to be effective, it has the potential to improve the quality of life of many people with schizophrenia.

Dr Tom Weickert with Reece, a CASSI trial participant.

“ Genetic testing may motivate individuals to engage in protective behaviour. ”

Prof Peter Schofield with PhD student Kirsten Coupland who is investigating gene-environment interactions.

PROJECT

How would you react to genetic testing?

How would you respond to information that you were genetically susceptible to developing depression?

In line with our increasing knowledge of how genes contribute to our mental health, a growing number of genetic tests are being made available direct to the public to test for predisposition to mental illness. But if you had information about your genetic risk, how would that impact on your behaviour?

In conjunction with researchers at the University of NSW, we conducted the first ever national population study to examine the willingness of people to modify their behaviour to ameliorate their risk of developing depression. This information will help us better plan health promotion strategies associated with mental illnesses and genetic testing.

Interestingly, our study suggests that having access to genetic risk information is unlikely to induce a sense of ‘genetic fatalism’ or discourage individuals from reducing their risk of developing depression through behavioural change. Rather, we found that genetic testing may motivate individuals to engage in protective behaviour that sustains their mental health. In particular, we found that those people who perceive themselves to be at higher than average risk for developing depression were most likely to be interested in changing their behaviour, such as reducing their stress levels at work or learning better coping strategies, prior to developing symptoms if they received a positive genetic test.

The study suggests that preventative public health projects to help people learn effective coping skills are likely to be well received.

finding courage

> **“ Like Cyndi, I’m seeking a cure, not just treatment. ”**
>
> *– Luke Taylor*

Luke Taylor – Schizophrenia research volunteer

I was diagnosed with schizophrenia at the age of 22. Since then, through the use of medication, therapy, diet and exercise, I have attempted to deal with this mind and life destroying condition. I made contact with Prof Cyndi Shannon Weickert because, like Cyndi, I am seeking a cure, not just treatment. Without hesitation, I volunteered to participate in the CASSI trial. Through this experience, my naivety of this science has been transformed – not just into knowledge – but into hope. I believe that research such as Cyndi’s is the only source of my possible salvation. And if my participation is able to eventually help others escape this ‘madness’, then that will make my suffering easier to bear. My hopes for the future are simple: I hope once more to be able to function independently, to continue my education and find a profession, and to engage in fulfilling personal relationships. It is these hopes that sustain me.

Prof Cyndi Shannon Weickert – Leader in schizophrenia research

Today my challenge is learning to surf. I’m not very good and maybe I never will be, but that doesn’t mean I won’t try. Facing this challenge helps me appreciate Luke’s approach to life. Luke has volunteered for several of our clinical trials because he wants to improve his concentration and have confidence in his intellect. He aspires to become more than who he is. I have great respect for Luke’s bravery in the face of schizophrenia and his dedication to self growth. He has set himself the challenge of partaking in life more fully. As a researcher, I feel it’s my job to create opportunities for people like Luke. Many people with schizophrenia feel there’s a gap between who they are today and who they want to be in the future, and I believe research into new treatments is one way to fill that gap. Luke’s willingness to try new things is a measure of his courage and commitment to finding answers to the problems he faces every day. He’s not a person who gives up easily. I wish I was more like that with my surfing.

PARTICIPANT

Luke Taylor

RESEARCHER

Prof Cyndi Shannon Weickert

fundamentals of the BRAIN and nervous system

Before we can understand what happens when things go wrong in the brain and nervous system, we need to understand how they function at a fundamental level. This type of research provides a foundation for many other areas of neuroscience research.

PROJECT

How do you know your body is your own?

We are studying how the brain creates a sense of body ownership

" The brain uses information from muscles to tell us what is our body and what isn't. "

Body ownership refers to the feeling that your body belongs to you. We often take this feeling for granted, but it can be disrupted in many common conditions, such as schizophrenia, neuropathic pain and stroke. Some stroke patients, for example, feel that their affected limb no longer belongs to them. This impedes rehabilitation because they disregard the limb and do not use it.

We are interested in finding out how the brain creates this sense of body ownership. We already know that body ownership is generated in part using touch and vision. It has not been clear, however, whether muscle receptors are also involved. In our study, we induced an illusion of ownership over a plastic finger using movement, which excites muscle receptors. The sense of ownership still occurred when participants' fingers were anaesthetised, blocking any contribution from skin (touch) and joint receptors. This indicates that muscle receptors do indeed contribute to the sense of body ownership.

Receptors in our muscles help us to know that our body is our own.

This is the first study to show that the brain uses information from muscles to tell us what is our body and what isn't. This is fundamental to identifying how the brain and body interact to give us a sense of self, and will help in designing clinical tests and treatments for people with disorders of body ownership.

PROJECT

How the brain controls breathing

Prof Simon Gandevia and Assoc Prof Jane Butler measure impulses controlling breathing.

Understanding how the brain controls breathing will help in developing therapies for people with respiratory disease

Control and coordination of our breathing muscles must occur whether we are awake, asleep, speaking, eating or exercising. While respiration is one of the most crucial actions performed by our muscles, we still don't fully understand the fundamentals of how the brain controls breathing.

We are currently examining how the brain controls muscles that allow us to inhale, such as the diaphragm and intercostal muscles. We already know that the amount of neural drive, or 'impulses' that the brain sends to breathing muscles to activate them, is related to how effective the muscle is in helping the lungs to inflate. We now need to uncover in more detail how this system functions, and whether the amount of neural drive (and hence the activation of the muscles) changes when the effectiveness of the muscle is altered by disease – which in turn may affect efficiency of breathing. This may occur in diseases where we know muscle effectiveness changes, such as in chronic obstructive pulmonary disease (a disease that limits air flow to the lungs) and obstructive sleep apnoea. Ultimately, our findings will pave the way for the development of new therapies for people with respiratory disease.

The position of a phantom limb is determined, in part, by levels of nerve stimulation.

PROJECT

How do phantom limbs form?

Understanding the mechanism behind phantom limb formation will help us develop more effective treatments

A person has a 'phantom limb' when they continue to perceive sensations even when the body part is no longer there, such as after amputation, or when the sensory system no longer functions properly, such as in a complete spinal cord injury or after administration of an anaesthetic. People usually perceive their phantom limbs to be in distinct positions and often experience pain in the limb; however the cause of this is not well understood.

We are conducting research to find out how phantom limbs form. When we temporarily anaesthetised participants' hands to induce a phantom limb, we found that the state of the nerves – i.e. how much they were being stimulated – over the period when participants were losing sensation in their hand was key in determining the final perceived position of the phantom hand. This suggests that the state of nerves in the limb at the time the phantom is forming is very important in determining how the phantom develops.

We believe that this might also be true for phantom pain; in other words, the amount and type of nerve stimulation around the time of amputation or injury could also be important in determining the type and degree of pain perceived in the phantom limb. Because distortions of body image, such as phantom limbs, are difficult to treat, a better understanding of the mechanisms behind their formation will help developing more effective treatments.

" Findings may help us understand chronic pain and autoimmune disorders. "

RESEARCHER

Dr Claire Shepherd

BRAIN DONOR

Marg Webb

acts of generosity

“ I feel that brain donors like Marg are incredibly generous. ”

– Dr Claire Shepherd

Marg Webb – Brain donor

We made the decision together, my husband Bill and I. We thought, we won’t be in need of these things when we move on. Bill’s brain is here and I’ll donate mine too, but you’ve got to wait until after my use-by date. I know Claire because I brought my Parkinson’s support group here a few years ago and we were able to look at the brain tissue. I didn’t think I would have any problems, and then, who was the one who cracked? Me. It was two years after Bill died of Parkinson’s disease, so perhaps it was too soon. I have every faith in what Claire and her colleagues are doing. They are working in a direction that’s important to a lot of people. It would be lovely to see more people donating, but it takes courage to make that step. Bill and I made our decision together, and I get strength from that. I know this is what I want to do.

Dr Claire Shepherd – Manager of the Sydney Brain Bank

I feel that brain donors like Marg and Bill Webb are incredibly generous. Without them, we wouldn’t be able to do the research that we do. We’re studying diseases that affect the things we take for granted, like our mobility and our personality, and the best way we can do this is to look at the tissue these diseases occur in. A particularly rewarding part of my job is personally meeting the donors and talking to them about the research that’s made possible by their generous donation. I recently visited Marg in the Southern Highlands where she does a brilliant job organising activities at the local Parkinson’s disease support group. I feel humbled by people who make the decision to donate when they’re facing such devastating diseases, and still have the strength to say ‘yes, we’ll help other people’.

improving the study of NEUROSCIENCE

New discoveries are possible only if we constantly improve our research tools. More detailed maps of the brain, improved techniques for using animal models in research and more comprehensive collection of brain tissue are just a few of the ways our researchers are improving the study of neuroscience.

" Environment and living conditions can have a huge impact on brain development in animal models."

Warren Logge provides a stimulating environment for his charges through regular exercise.

PROJECT

Inside the mouse house

We are investigating how housing conditions impact on the behaviour of animal models

Just like in humans, environment and living conditions can have a huge impact on brain development and behaviour in animal models. A new cage system called individually ventilated cages (IVC) has recently been introduced to large animal facilities. Animals in this system have an individual air supply designed to reduce contamination between cages. As a result, animals are isolated from others in the room; their ability to smell and hear other animals is vastly reduced.

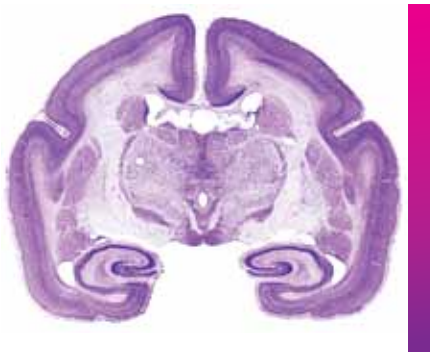
Although there are many benefits, we are concerned that the IVC system may affect physiology and behaviour. Any differences between cage systems would affect the comparability of animal research data between research facilities worldwide. We are also concerned that the IVC system may negatively affect animal welfare by reducing the amount of environmental stimulation the animals receive.

Measuring a number of factors, including anxiety, social interaction and neurotransmitter and hormone levels, we compared the impact of normal cages with IVC cages on mice. Our preliminary results suggest that animals are indeed affected by these housing conditions; in one mouse model, for example, we found differences in how the schizophrenia candidate gene in question affects the behaviour of mice.

Our research suggests that animal researchers must consider which type of cage system to use very carefully to avoid interfering with study outcomes.

PROJECT

Navigating the brain



A stained section of the marmoset brain reveals cell bodies.

We have constructed an atlas of the marmoset brain, which has many similarities to the human brain

The marmoset is a primate the size of a rat, but its brain is very similar to the human brain, which makes it very useful to researchers conducting studies on brain diseases such as dementia and Parkinson's disease.

Our marmoset brain atlas, published in late 2011, contains 400 diagrams and about 20,000 labels, showing a level of detail and accuracy never seen before. This atlas opens up the possibility for many more scientists to use the marmoset as an animal model in their research. Its cortex is far closer to humans than that of the rat (a commonly used animal in research), and its small size makes it much more suitable as a research animal compared to larger primates.

" This atlas opens up many possibilities for scientists studying brain diseases. "

Our atlas will allow scientists to navigate between the human and the marmoset brain to test hypotheses inspired by human considerations and relate the observations back to humans.

Carla Scicluna prepares tissue samples for the Sydney Brain Bank.

PROJECT

Brain donation

Brain donations allow us to see how factors during life affect the brain

Brain donation is essential for gaining an in-depth understanding of diseases such as Alzheimer's and Parkinson's disease because it allows us to directly study the cells that the disease occurs in. We cannot adequately investigate these cellular changes during life, so we rely on generous donations after death from people with an interest in helping our research.

Healthy people donate their brains, and we also work with a number of brain donor programs for people with specific neurodegenerative diseases. An important role of these programs is collecting clinical information from donors during life, such as lifestyle factors and medications that may affect the brain. Each program also conducts specific assessments such as brain imaging and tests measuring mental performance and mobility. This information helps us understand how clinical features in life relate to the underlying pathology we see afterwards in the tissue.

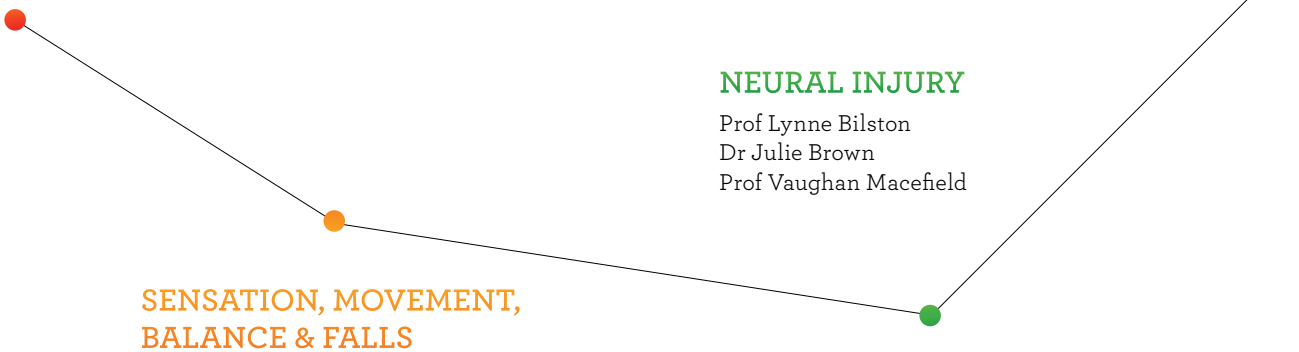
We currently have over 800 tissue specimens, collected by five donor programs, stored in the Sydney Brain Bank at NeuRA. This tissue library is an invaluable resource for neuroscientists not only in Australia, but around the world. Since its inception, researchers using Sydney Brain Bank tissue samples have published over 50 papers in scientific journals and presented their findings at over 80 conferences.

To find out more about brain donation or the Sydney Brain Bank, visit neura.edu.au/sydneybrainbank

behind the RESEARCH

Behind every great research finding are equally great researchers.

After nearly 20 years in existence, NeuRA is home to many great researchers – we have highlighted the achievements of just a few of them here.



NEURAL INJURY

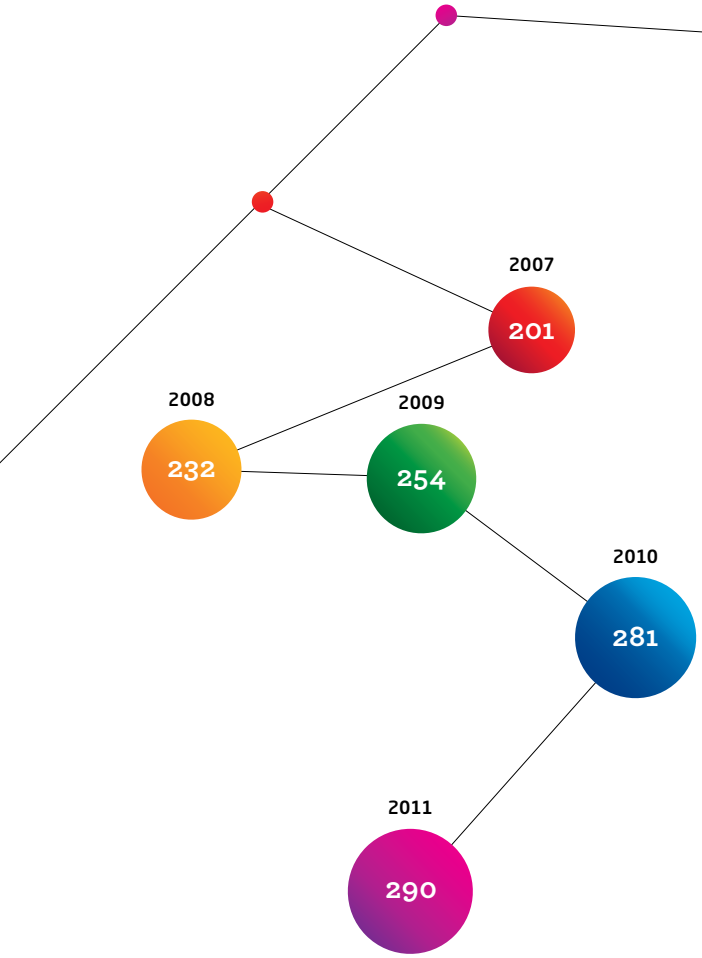
Prof Lynne Bilston
Dr Julie Brown
Prof Vaughan Macefield

SENSATION, MOVEMENT, BALANCE & FALLS

Assoc Prof Jane Butler
Assoc Prof Jacqueline Close
Prof James Colebatch
Dr Danny Eckert
Assoc Prof Richard Fitzpatrick
Prof Simon Gandevia
Prof Stephen Lord
Dr Penelope McNulty
Dr Americo Migliaccio
Prof Lorimer Moseley
Assoc Prof Janet Taylor

BRAIN STRUCTURE & FUNCTION

Prof George Paxinos
Prof Caroline (Lindy) Rae



Staff numbers

NeuRA is almost 50 per cent larger than we were just five years ago. We now have 29 research groups conducting research into countless areas of neuroscience.

Scientia Prof George Paxinos AO
Group leader

For a book that was originally rejected by publishers, *The Rat Brain in Stereotaxic Coordinates* by Prof George Paxinos has certainly attracted its fair share of attention. In 2012, on the eve of its 30th anniversary, it has been cited over 50,000 times, making it the most cited book in neuroscience.

Prof Paxinos, who co-authored the book with Prof Charles Watson, says he's pleased other scientists have found their work useful. "In the 1970's, the atlases were quite primitive; nobody could do their work properly. We were the first to construct an accurate atlas for experimental animals in the world."

Over the past 40 years, Prof Paxinos has worked on atlases of the mouse, monkey, human and bird brain and shows no signs of slowing. His skills, it seems, are still in great demand. "While producing an atlas doesn't have the novelty, our capacity to do it far more quickly than before is an advantage. Younger scientists now know a lot about molecular things, but they don't have that long experience that we've had."

Dr Ans Vercammen
Early career researcher

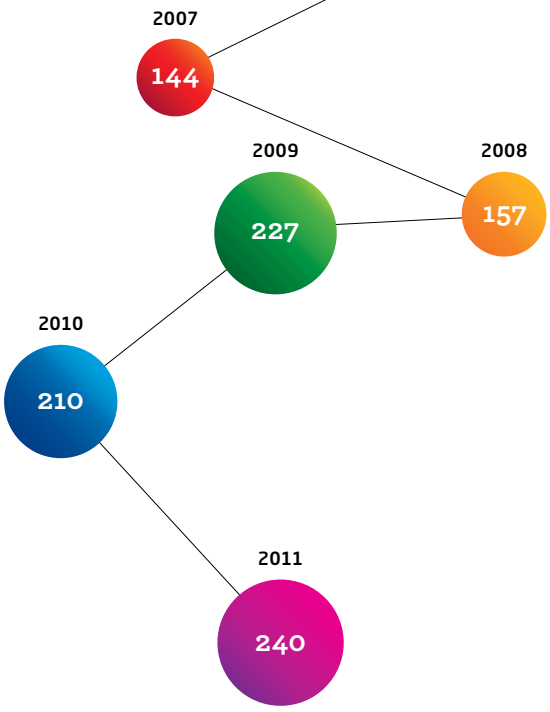
Dr Ans Vercammen became interested in schizophrenia in her early twenties – a similar age to when people start developing symptoms of this mental illness. "It really struck me... I was working on my PhD and had so much in front of me, while the people I was seeing in my research were becoming ill at that age, and were forced to reshape their future. My work made me realise how severe the illness is."

Ans was awarded a prestigious NARSAD Young Investigator Award from the Brain & Behaviour Research Foundation to support her research into brain stimulation for people with schizophrenia. The goal of the treatment is to improve cognitive deficits, such as the ability to focus.

"We're trying to target symptoms that current medications don't alleviate," says Ans. "We hope that by improving cognition and memory, we can also improve daily living skills. Schizophrenia is such a complex illness; there's so much that we don't know and so much to do."

MENTAL ILLNESS

Dr Tim Karl
Prof Rhoshel Lenroot
Prof Peter Schofield
Prof Cyndi Shannon Weickert
Dr Tom Weickert



Publications

Publications provide a means of sharing our findings with other scientists and the community. This increase of 60 per cent more publications compared to five years ago reflects our growing contribution to reducing the health burden created by disorders of the brain and nervous system.

Sharpley Hsieh
PhD student

Having your paper chosen to illustrate the front cover of *Brain*, one of the top journals in neurology, is no mean feat – particularly when you are just starting your career, like PhD student Sharpley Hsieh. "It was pretty unexpected; I didn't actually find out until after *Brain* was published, so it was a nice surprise," she says.

While Sharpley insists she was just "in the right place at the right time", the buzz around Sharpley's findings – that people with Alzheimer's disease retain their ability to recognise music, despite having other difficulties with memory – points to a growing recognition that we need to find better ways of understanding this terrible disease.

"People with a parent or a partner with dementia have told me how they really relate to the findings," says Sharpley. "I think people need to know how they can connect with someone who has dementia. Usually we do this by conversing, but if your parent or partner has problems remembering or understanding, you may lose that connection. So music offers another avenue for communication, and that's really important."

RESEARCH FACILITIES

Genetic Repositories Australia
NeuRA Imaging Centre
Sydney Brain Bank

AGEING & NEURODEGENERATION

Prof Tony Broe
Assoc Prof Kay Double
Prof Glenda Halliday
Prof John Hodges
Dr Michael Hornberger
Prof Matthew Kiernan
Dr John Kwok
Dr Olivier Piguet

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Member Nomination Committee, 2012

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FAICD FAIM FFin MACS (Senior)
Director, 2011 – present

Not pictured
Sally Manion
CFP BCom CA (FPS)
Director, 2010 – present

What we can achieve together

Important discoveries would not happen without your ongoing commitment and support, says David Karpin

Two years ago, as I was sitting watching the morning news, I fell off my chair to the floor. Within the hour I found myself in hospital, having suffered a severe stroke. Afterwards, I could not walk, speak clearly or use my left arm or hand. I was totally reliant on other people. My neurologist advised my son I was unlikely to ever walk again.

Today, I live independently and can speak clearly, walk unassisted and have partial use of my left arm, hand and fingers. My remarkable transformation is thanks to my participation in a stroke rehabilitation study at Neuroscience Research Australia. Using the Nintendo Wii as a rehabilitation tool, this groundbreaking research is translating into results for stroke patients right now.

I am now heavily involved in NeuRA activities as a volunteer, donor and Foundation board member. It is my fervent wish that we help NeuRA to continue delivering real and very tangible results to the community. I therefore invite you to read on the following pages about how others in our community are helping NeuRA's research – and hopefully you will be inspired to also lend your support.

Much more needs to be done to achieve NeuRA's vision of a society free from diseases and disorders of the brain and nervous system. I hope you and many others will share this vision.

David Karpin

David Karpin AM
Co-chair, NeuRA Capital Appeal Committee

Our community of supporters

Tedda Brooks Fundraiser

Even though their oldest member has just turned 90 and the baby of the group is 60 years old, the members of Tedda Brooks' square dancing group aren't about to slow down. They meet several times a week to dance and are currently preparing for the NSW state square dancing convention. On top of that, they are keen organisers of charity fundraising dances, including one recently put on for NeuRA. "We wanted to support NeuRA because we recently lost one of our dancers to stroke," says Tedda.

While they mostly dance for fun – and to fundraise – Tedda says there is an added benefit to square dancing. "We've found that square dancing is so good for the brain. You exercise your body and mind at the same time. I've even invented a dance called 'concentration' where I choreograph a few calls and the dancers have to remember it. I make it a bit tricky at times. I always say you need to keep the brain working efficiently."

To make a donation in support of NeuRA's research, please call 1300 888 019 or go to neura.edu.au/donate

Reverend Dr Jack Hely CBE
Bequestor

Although for many years he forged a path through the corporate world, Reverend Dr Jack Hely says his passion has always been the wellbeing of the community. In his late 50s, he couldn't ignore this calling; he completed a Doctor of Ministry with a focus on Ministry with People with Disabilities and was ordained as a minister in the Uniting Church.

Jack says he preaches the idea that caring for other people is essential for the development of a good society. He also practises this idea as a supporter of medical research and bequestor of NeuRA. "I support NeuRA researchers because they put people first in their studies," he says. "I also believe that research, properly conducted, pays great dividends."

Jack believes his value lies in his ability to spread the word about supporting neuroscience research. "People see cancer as important – and it is. But when you see how problems of the brain cause more death and disability than all the other big disease areas put together, that really makes you think."

For information on leaving a bequest to NeuRA, contact Leonie Harle on 1300 888 019.

Regina Kimpton
Regular giver

A serendipitous drive past our building site in Randwick is what prompted local hairdresser Regina Kimpton to become a regular NeuRA giver.

"My mother passed away from multiple system atrophy, a degenerative neurological disorder, about six years ago. Her ability to control her body broke down. It was a horrific experience and made

me think, right, what am I going to do here? I have always donated to cancer research, and they are doing amazing things, but the brain and mental health are areas that need a lot more money for research. So when I saw your sign, I thought, let's do it."

Regina says the hardest part about her mother's illness was that no one knew what she had or how to treat it. "Up until the last five weeks of her life, we thought she had Parkinson's disease. I didn't think much about brain disease before this happened to my mother. Brain research doesn't have the same sort of profile as cancer, but it needs to."

This building represents...

...more than science, more than research. It is a sign of hope that there are people fighting for answers – *Chontell Johnson*

In late 2011, we launched a Capital Appeal for our new building. With construction already well underway, the focus of the appeal is to raise critical funds to fit out our clinical and research laboratories.

Within these spaces, our researchers will conduct groundbreaking research, tackling some of society's most devastating diseases.

Chontell, a NeuRA research participant, attended the launch and told us that this building represents more to her than just science, more than just the word 'research'.

"It's a sign of hope, a sign that that there are people out there fighting for answers and that those people may just save my life and my family's future."

Coupled with the brilliant scientists already on staff and with additional researchers being recruited, this building will house discoveries that will benefit all humanity.

Your continuing generosity will ensure that we can complete every floor in the building.

If you would like to find out more about donating to the Capital Appeal, **please contact the NeuRA Foundation on 1300 888 019**.

Chontell Johnson
a participant in our international collaboration 'DIAN' study spoke at the launch of our Capital Appeal.

Prof Peter Schofield
stands in front of the open, light-filled atrium which will welcome visitors to NeuRA.

left
Interior level 4
where PhD students will work close to laboratory areas.

right
An inspiring facade
as seen from the corner of Barker and Easy Streets.

Thank you

Philanthropy is woven into the fabric of NeuRA; your support has and continues to shape this institute. Together, we are improving the wellbeing of the community – thank you.

top
NSW – Kylie Baxter (with her late grandmother)
is helping NeuRA by taking part in the Channel Ten 1 Million Kilo Challenge.

middle
Qld – That Elk Omen
raised funds through the Gold Coast Airport Marathon.

bottom
SA – Trent Woodward (shown here with his grandfather)
participated in his first triathlon supporting Parkinson's research.

top
NSW – Guys & Dolls square dancers
organised an event to raise funds for stroke rehabilitation research.

middle
WA – Wendy's Angels
ran an 80km ultra-marathon in outback WA to support neurological disorders.

bottom
Qld – Laurie Cowled
sponsors a postgraduate scholarship – the current recipient is Rachel McBain, shown here with Laurie and NSW Governor, Prof Marie Bashir.

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