# Connections

November 2013 Issue Seven

## A New Chair in Neurosurgery

*Freemasons support launches campaign*


Autism Research Initiative

Brain Day 2013 Report

Huntington's Expert Visits CBR

CENTRE FOR BRAIN RESEARCH
THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau

*Attendees at the Autism Research Network of New Zealand's launch get their first look at the 'Minds for Minds' campaign material, being introduced here by Professor Richard Faull.*

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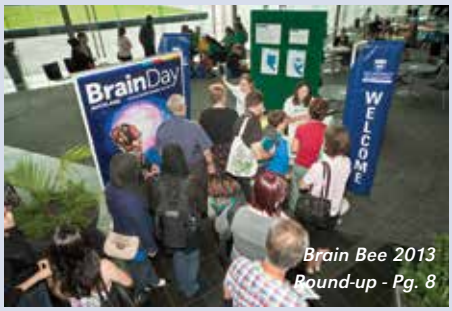


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**Front Cover:** From left, Terry McConnell, Freemasons Charity, Professor Richard Faull, Selwyn Cooper, Freemasons NZ, and David Mace, Freemasons Roskill Foundation, at Freemasons Chair of Neurosurgery campaign launch.


### November 2013 Issue Seven

The Centre for Brain Research is a unique partnership between scientists, clinicians and the community. Research teams carry out world-class neuroscience, alongside clinical collaborations with leading neurologists, neurosurgeons and physicians in the Auckland region.

### Editorial contact details

Connections is published by the Centre for Brain Research (CBR). Previous issues of Connections are available from the CBR or www.cbr.auckland.ac.nz





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# Letter from the Director

2013 has been a landmark year for the Centre for Brain Research. We are celebrating exciting developments which are shaping the future of the CBR. We are all about promoting interdisciplinary, collaborative brain research at the University of Auckland.

Our research spans a divide, combining the expertise and strengths of brain researchers in the University with the neurologists, neurosurgeons and psychiatrists in our hospitals in order to deliver new treatment opportunities to help the community and families affected by brain disease.

Over the last 12 months, our researchers have enjoyed excellent support from our most competitive granting agencies: over $3.5M from the Health Research Council, $1.4M from the Marsden Fund and Royal Society, $400K from the Neurological Foundation, and $453K from the Auckland Medical Research Foundation as well as support from other granting agencies.

However, despite our successes, we continue to rely heavily on philanthropic funding, which is vital to our success at the CBR. Philanthropic funding is the life blood of innovative research developments. It is critical for stimulating blue-sky thinking and gives us flexibility to develop exciting new research initiatives. We are very grateful to have philanthropic experts and pillars of society as our CBR Ambassadors: Dame Jenny Gibbs, Dame Rosie Horton, David Mace, and Sir John Graham, who are working alongside us to raise our profile in the wider community.

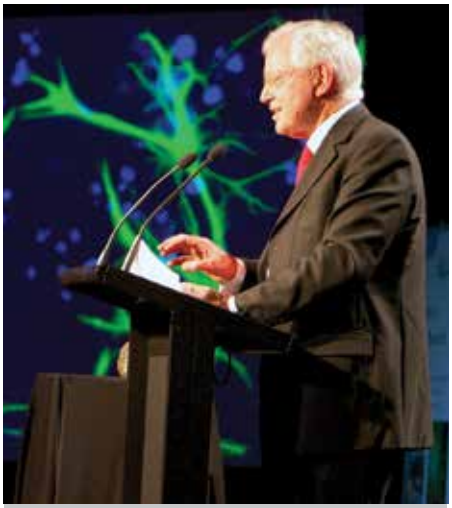
Some of our philanthropic successes and initiatives over the last year are going to change the face of our brain research for ever. Particularly, philanthropic funding packages partnered with University funding have been critical to establishing and expanding new research platforms. Our NeuroDiscovery Research Platform, funded intially with $150K of philanthropic gifts, received a critical additional equipment grant from the Vice Chancellor's Strategic Development fund this year, with matching funding from the School of Medical Sciences. In addition, we have just received another $150K of philanthropic funding from the McHale Trust which will secure a further 2 years for the NeuroDiscovery Unit. The philanthropic seed funding meant we could go to the University for strategic equipment funding and, in turn, this has attracted further philanthropic support for the unit That's the magic of the Philanthropic–University partnership; one drives the other to the benefit of all!

There are other equally exciting stories of philanthropy including: $500K from Bernie and Kaye Crosby's Neuro Research Trust in Hamilton to support Dr Maurice Curtis' research, $50K Freemasons' support to Professor Russell Snell's international effort to create the world first transgenic sheep model for Alzheimer's disease, and ongoing support from the Gus Fisher Trust for Parkinson's disease research.

Finally and most importantly, let's update you on our recently launched philanthropic funding drive towards the establishment of an Academic Unit of Neurosurgery, which is detailed more fully later in this newsletter. Our vision and passion is to provide a bridge between the research excellence at the CBR and the top class Neurosurgery teams at Auckland City and Starship Hospitals by creating a new Chair of Neurosurgery and appointing a top-class professor. There are huge opportunities for our CBR brain scientists to undertake collaborative research with ADHB neurosurgeons to study human brain function and further enhance their surgical treatments. World models in neurosurgical care show that whenever brain surgery is undertaken in an environment of exciting research, patient care and the development of innovative treatments will follow.

The establishment of this new chair has resulted from a special relationship between the University of Auckland, the Neurological Foundation and the Auckland District Health Board (ADHB). The ADHB kick-started this campaign by contributing 50% of the salary for the new professor. The University of Auckland has enthusiastically supported the development of the chair, by jointly funding the remaining 50% of the Professor's salary for the first five years, together with the Aotearoa Foundation from the Robertson family in New York. Our campaign aims to find the remaining funds to support the Chair and Academic unit in perpetuity. To make the academic neurosurgical unit effective, it is critical to provide additional funds for the appointment of a senior research fellow and administrative support to assist the professor in developing an exciting and creative unit. This total package requires an endowment of $8M.

To address this challenge, the University and CBR, in partnership with the Neurological Foundation, launched a fundraising campaign on 17 September in a dazzling gala event at Shed 10 on the Auckland Waterfront. On the night it was my pleasure to announce that the first $2M of the endowment had been generously provided by the Freemasons of New Zealand. In recognition of the Freemasons' generosity the new chair will



***Addressing attendees at our amazing Neurosurgery Chair campaign launch in September.***

be named: 'The Freemasons Chair of Neurosurgery at the University of Auckland'. I would like to thank Mark Winger, the present Grand Master of Freemasons NZ, and David Mace, a past Grand Master and Chairman of the Freemasons Roskill Foundation, who were instrumental in making this happen. This is an incredible and fantastic start. To supplement this incredible foundation grant, Sir Graeme and Lady Ngaire Douglas generously donated $1M to the campaign and Sir David Levene generously contributed $500K. These foundation gifts have made our campaign vision a reality. To date we have a grand overall total support of $4,823,530 towards our $8M target.

Much of this success has been due to the partnership between the University and the Neurological Foundation. The NF created the prototype through the establishment of the Chair in Clinical Neurology which resulted in the appointment of Professor Alan Barber. Professor Barber's appointment has made a mindset change in enhancing neurological research between the Centre for Brain Research and the Auckland Hospitals, and now that vision can be extended and realised for neurosurgery.

In conclusion, to our scientists and clinicians, donors and supporters – thank you for your contributions and unwaverying support, in the past, in the present and in the future.

# Freemasons Neurosurgery Chair

Over four hundred people, including some very distinguished guests, joined with the Centre for Brain Research at the newly refurbished Shed 10 on Auckland's waterfront to celebrate the launch of our campaign to fund a Professorial Chair in Neurosurgery, with the aim of generating strong research-led advances in the field.

*Professor Richard Faull with two of CBR's most dedicated ambassadors, Dame Jenny Gibbs (left) and Dame Rosie Horton (right), at the Shed 10 launch event.*

The event, held on September 17, was attended by two Dames, seven Knights including two All Black Knights, and the University of Auckland Chamber Choir chorales. Many exciting gift announcements were also part of this gala cocktail evening which launched our campaign for an inaugural Chair in Neurosurgery in Auckland. This visionary new campaign, kick-started with donations totalling $4.5 million, was celebrated at Shed 10 on Auckland's Queen's Wharf and was attended by more than 400 people.

The director of the University of Auckland's Centre for Brian Research, Distinguished Professor Richard Faull, announced that a generous gift of $2 million from the Freemasons of New Zealand had been pivotal in the campaign initiative to establish the Chair. The position would be named The Freemasons Chair of Neurosurgery at the University of Auckland in recognition of their contribution.

Mark Winger, speaking on behalf of the Freemasons said, "We are delighted to have enjoyed a relationship with Professor Richard Faull for nearly fifteen years – facilitating brain research into Huntington's disease, Alzheimer's and associated afflictions. Our support for the Centre of Brain Research is well founded, and so it was a logical step for our support to extend to the Chair of Neurosurgery."

"The Auckland District Health Board has generously recognised the need for more brain surgery at Auckland and has funded half of the Professorial chair appointment in perpetuity. The other half salary has been funded for the first five years by the University of Auckland and the Aotearoa foundation from Sir Julian Robertson in New York"

***"I am delighted to announce that this chair will be named The Freemasons Chair of Neurosurgery at the University of Auckland"***

***Professor Richard Faull***

# campaign launch a dazzling night

A further generous gift of $1 million from the Douglas Charitable Trust (Sir Graham Douglas) has secured the appointment of a Senior Neurosurgical Research Fellow and $500,000 from the David Levene Foundation (Sir David Levene) has resulted in substantial progress towards the goal of $8 million to fund the Chair in perpetuity.

"We're thrilled that we are able to launch with the announcement of these remarkable gifts, we're over halfway there already," says Professor Faull.

"We want to attract a first class neurosurgeon with an international reputation, who is also a first class researcher, in order to provide a bridge between University of Auckland brain researchers and the top class neurosurgeons at Auckland and Starship Hospitals," says Professor Faull.

"We now need to raise the funds to ensure the new unit is established and funded in perpetuity," he adds. "We are creating an endowment, which the University of Auckland will invest, and the interest generated will be used to fund the neurosurgery chair and research into the future."

At present Auckland has six neurosurgeons who are fully employed on call with a 24-hour roster led by the Head of Neurosurgery, Dr Edward Mee. This team performs 1500 brain surgery operations each year (an average of 30 per week) including paediatric surgery at Starship Hospital.

"Auckland is already recognised as a centre of excellence for brain surgery in New Zealand," says Professor Faull. "Our surgeons work around the clock performing life-saving operations on patients with tumours, epilepsy, Parkinson's disease, brain haemorrhages and traumatic brain injuries from sport, road accidents and other causes, as well as spinal cord injuries.

"We want to extend this work and ensure strong linkages, forming a virtual bridge across Park Road between brain researchers from the CBR at the University and Auckland City and Starship hospitals, so that vital brain research can continue in tandem with an increased capacity for brain surgery," he adds. "Whenever we do brain research, we have the potential to increase the level of patient care."

Professor Faull says there are existing research links with brain surgeons and some very productive research projects have already been established, for example in epilepsy.

***"We want to attract a first class neurosurgeon with an international reputation, who is also a first-class researcher"***

***Professor Richard Faull***

Young people who have brain surgery for severe epilepsy can benefit from having a temporal lobectomy, removing the area where the seizures originate. Before the lobectomy, they were having multiple daily seizures which were poorly controlled by drugs.

"There has been an incredible recovery rate with carefully selected patients who are now seizure-free and show minimal deficits from the surgery," he says. "With the patients' consent, part of the removed brain tissue is used for CBR research and part of it goes to pathology.

"We now have 20 years of research papers from this on-going work, which help us to understand what happens in the epileptic brain, and the tissue we receive is used for research and to grow brain cells in our Biobank for further laboratory research and drug testing."

The Centre for Brain Research already has an international reputation for progress in its research into diseases such as Alzheimer's, epilepsy, Parkinson's, Huntington's, motor neuron disease, schizophrenia and other brain diseases, which can affect people of all ages.

"We have enormous expertise from a myriad of scientists, which covers more than 55 research groups across the University of Auckland, and we work closely with the community to ensure our research findings are used to help people who are suffering from brain diseases," says Professor Faull. "We have the capacity to extend this world class research for the good of New Zealanders."

***Pictured here with Professor Richard Faull at the Neurosurgery Chair Campaign Launch are (from left), Mr Max Ritchie and Mr Ian Robertson, Executive Director and Chair, respectively, of the Neurological Foundation, and Mr David Mace, of the Freemasons Roskill Foundation. The Neurological Foundation have partnered with CBR for the campaign and will provide invaluable support. The Freemasons Roskill Foundation provided funding for the launch event itself, ensuring a great time was had by all!***

# Heavyweight support for CBR

The Centre for Brain Research's neurosurgery chair campaign received a boost when several high-profile figures from the world of rugby weighed in with their support.

Two current All Blacks, lock Steven Luatua and fullback Charles Piutau, attended the campaign launch event at Shed 10, along with former All Blacks Sir John Graham, Sir Colin Meads, Brian Williams and Rubgy Union executive members, including NZRU Chief Executive Steve Tew, as well as former coach Sir Graham Henry.

Their interest in neurosurgery is due to the fact that rugby, being inherently a contact sport, carries a risk of hread injury to players. Very occasionally a player suffers a major head injury during play, as happened during a club rugby game in Auckland in July of this year. Such cases, rare though they are, ususally receive significant publicity. However, much more common is the incidence of mild traumatic brain injury (mTBI), such as concussion.

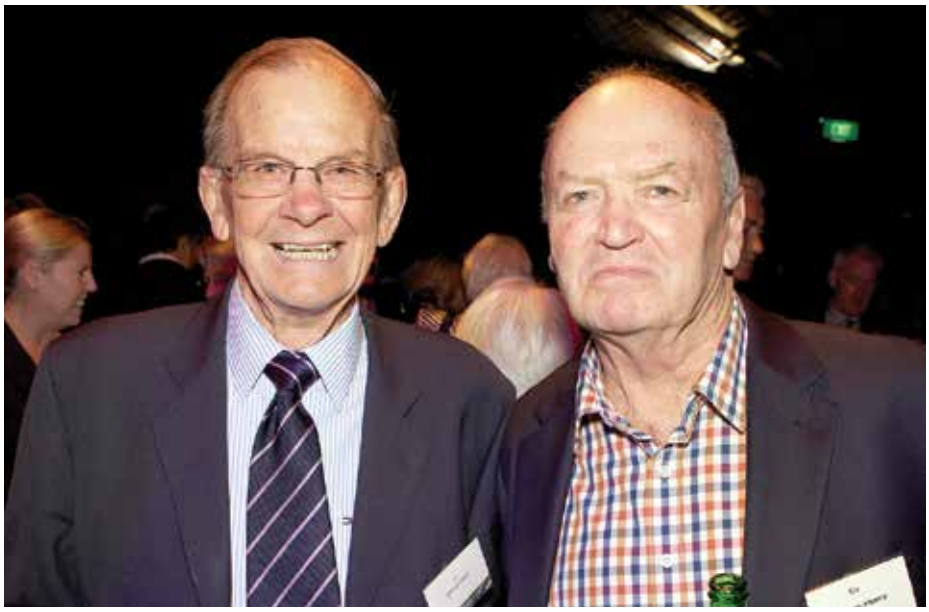
***"There are 7000 traumatic brain injuries a year in New Zealand and around 2000 result from sports related injuries. In recognition of this, our campaign has the support of the NZRFU"***

***Professor Richard Faull***

Mild traumatic brain injury differs from severe forms in that loss of consciousness (if any) is brief, and the observed effects of the 'knock on the head', such as headaches, dizziness, difficulty concentrating, irritability and confusion resolve in a short timeframe, usually within a fortnight. Until recently, concussions have been an accepted part of contact sport, with attention focussed on simply assessing and managing the immediate symptoms to ensure that they are not suggestive of a more major injury.

However, an increasing body of work suggests that, while observed symptoms of mTBI may resolve quickly and apparently completely, there are ongoing or possibly permanent effects on the brain that are not apparent at the behavioural level. A 2007 study conducted in the United States on former NFL players (a sport predicated on contact and in which concussion rates are high) found that these players had much higher rates of depression and memory problems later in life, compared to those who had not received repeated concussions.

Other research suggests that an additive effect exists, so that after one mTBI incident, subsequent injuries are easier to contract and produce apparently greater and /or more long-lasting sumptoms. This effect is especially pronounced if a subsequent injury is experienced before there has been a complete recovery from the first.



***Sir John Graham and Sir Graham Henry at the launch event***

***Charles Piutau and Steven Luatua pose with the Head of Neurosurgery, Dr Ed Mee and event organiser Bridget van der Zjipp***

Sporting organisations around the world, including the All Blacks, have altered their policies and management of players who have apparently received a concussion in response to this research. Measures include substituting off players, and implementing a physical and mental rest period followed, (once symptoms have cleared) by a step-by-step process of gradual return to training, with each step in the process monitored to ensure that the activity is not causing a return of symptoms.

For further information about how you can be involved in the campaign for the Chair of Neurosurgery at the University of Auckland by making a donation, please contact:

Emma Dent, Campaign Manager

Phone: +64 9 923 7275
Email: emma.dent@auckland.ac.nz

Alternatively, to make a donation online, visit:

https://www.givingtoauckland.org.nz/Donate-Online/Choose-Where/Medicine-and-health.aspx

# Neurosurgery changes a life

Read the inspiring story below of a little girl whose life course was dramatically altered by neurosurgery, as told to attendees of the Neurosurgery Chair campaign launch.

inside the inside

## Miracle Mia

Mia was 4 months old when she was diagnosed with chronic epilepsy. By the time Mia was 5 she was having 50 seizures a day and losing her battle with the disorder.

Her desperate parents searched the world for a cure, refusing to give up hope.

One day Mia's mother, Anna, attended a Brain Awareness Week lecture and heard Starship's Neurologist Dr Claire Spooner speak about surgery involving the removal of pieces of the brain to stop epileptic seizures. Within days, the family arranged to see Claire and Mia was deemed a candidate for the epilepsy surgery. Starship Neurosurgeon Peter Heppner operated on Mia in June 2009 and removed part of her brain.

*"Those first 24 hours were the worst. I was terrified the operation hadn't worked, and there was a considerable risk that she might have some paralysis,"* says Anna.

But the operation was a success story. Four years later Mia has not had another seizure and after intense rehabilitation is a keen dancer, swimmer, loves to read, is learning to play the drums and is generally loving life.

Some of the brain tissue that was removed from Mia's brain is part of a unique research study into future treatments and cures for epilepsy. This special project, is a collaboration between the Neurosurgeons at Auckland Hospital and the scientific researchers at the Centre for Brain Research. *"This study is leading to all kinds of insights into how this disorder affects the brain, how the cells relate to each other, and how the chemical composition of the brain is altered in those with epilepsy,"* explains Professor Richard Faull. *"Our unique approach attracts international collaborations and has led to key developments in our understanding of epilepsy."*

Anna says she and Mia are thrilled that by agreeing to be part of this study they are making a significant contribution to research that will be life-changing for many New Zealanders in the future.

CENTRE FOR BRAIN RESEARCH THE UNIVERSITY OF AUCKLAND Te Whare Wānanga o Tāmaki Makaurau

NEUROLOGICAL FOUNDATION OF NEW ZEALAND

inside the inside

## Changing lives

**How research creates life-saving opportunities**

# Brain Day 2013

This year's theme 'Your Creative Brain' provided much food for thought for attendees both young and old.


*Neurosurgeon Dr Ed Mee and neuroscientist Professor Richard Faull co-presenting the opening address on Brain Day 2013*

**Universities are traditionally a hive of creativity, but on Saturday 16 March this year CBR delved deeper into the processes behind it, as our scientists explored just how creativity happens.**

The neuroscience of art, music and dreaming were all showcased as part of Brain Day 2013, under the theme of 'Your Creative Brain'. The free annual expo, which CBR runs with support from the Neurological Foundation of New Zealand, is part of international Brain Awareness Week.

Over 2000 members of the public attended the event at the University of Auckland's Business School, which featured science laboratory experiments, musical performances, and kids' hands-on activities. The highlight, however, was a packed-out lecture programme that ran throughout the day, with over 900 people attending lectures every hour!

Centre for Brain Research Director Professor Richard Faull kicked off the day with an address covering the creative thinking needed to develop collaborations between groups of researchers, bringing together scientists from divergent fields along with clinicians and the community. Professor Faull shared his lecture with neurosurgeon Dr Ed Mee, in a fantastic example of the process in practice, with Dr Mee taking the latter part of the lecture to discuss the history of neurosurgery up to the present date, and the extent of its reliance on research to advance. Professor Faull then revealed the latest plans to grow neurosurgery research in Auckland, with a campaign being launched later in the year to fund a new Chair of Neurosurgery.

The day's second lecture was on the topic of 'Mind Wandering' by Emeritus Professor of Psychology Mike Corballis, which he defines as, what your mind does when it's not doing anything. This wandering activity (called the Default Mode Network) can be captured by fMRI scans, like task-focused activity can, which take in the regions of the brain most closely associated with memory and imagination, so that mind wandering encompasses both the real and the imagined, and this continual background processing and reprocessing connects the past with the future in a continuous stream.

This material provided a fantastic background for Associate Professor Donna Rose Addis, and her talk, titled 'Imagination and Creativity'. Donna sought to answer the following questions: Why do we imagine? What is our brain doing when we imagine? Are creative people better at imagining their futures? and What goes on in the creative brain?

Studies of memory show that it is not a record which is retrieved whole, but is 're-assembled' when needed. This means that memory isn't always as accurate as we'd like to think it is – but it is great for imagination. The ability to 're-assemble' scenarios from diverse bits and pieces of our memory makes for a vivid imagination, which is also associated with creativity. But why did we evolve a memory system more specialised for imagination than keeping an accurate record of the past? The key is that imagination can enhance an individual's success. If we can simulate some upcoming event, entertain and try out multiple alternatives, we can troubleshoot and problem solve in advance. This ability to generate lots and lots of potential ideas is called divergent thinking. It is thought that this happens by way of making new links between distinct ideas

stored in memory; the most original ideas linking concepts or ideas that would normally never go together.

Neurologist Dr Barry Snow took a different tack with his lecture, titled 'Silver Linings', in which he reviewed various cases of unusual levels of ability in people with neurological conditions or following brain injury; from autistic 'savants' with amazing numeric or photographic memory, to people who discovered a previously unknown artistic capacity or a complete change in their artistic outlook as a result of a brain injury. He suggested that possibly all brains have latent untapped potential which is kept in check by 'higher order processes' which, of course have their own uses. In the case of strange abilities emerging after injury, he presented MRI scans showing that when a part of the brain associated with a particular task is damaged, other parts of the brain are recruited to help out. Those parts have been engaged to do things they would not normally have to do. Usually, these parts do their best, and mostly they don't do it as well as the usual parts. Often they do it rather poorly in fact, but sometimes, those parts have hidden talents, and when they are asked to help they sometimes produce remarkable outcomes.

Professor Faull is keen to stress that everyone can be creative; "Every amazing work of art, literature or music in the history of civilisation has been generated by the human brain. We know from our studies that the more we keep active and expose ourselves to new experiences, the more new brain cells are generated. So it's important to indulge in being creative – music, art and stimulating conversation will help to keep you young!"

Running parallel to the lectures was a discussion series featuring scientists and community experts discussing hot topics in the science of creativity. Members of the CeleBRation Choir, the university's music therapy choir for people with neurological conditions, gave a well-received performance. Associate Professor of Education Peter O'Connor stressed the importance of play, while Oscar winning scientist Dr Mark Sagar discussed developments in computer animated life-like human faces.

Schoolchildren from across Auckland also had the chance to test their experimental skills, with the new 'Students as Researchers' programme. The scheme is a collaboration between the CBR and LENScience, a schools programme funded by the National Research Centre for Growth and Development.

***Two young neuroscientists-in-training get to grips with the structure of neurons, with axons and dendrites represented by branches on a stick***

***Children get in touch with their creative brains the artisitic way at Brain Day 2013***

Promising students were given the opportunity to run psychological tests on the public, which they will then present to their scientist mentors in an upcoming seminar.

The venue had a wonderful vibe thanks to music from talented young musicians, including a jazz quartet from the School of Music and a string quartet from the Medical School. The Polytonix Chorus even treated the kids' area to an impromptu rendition of Jingle Bells, along with former children's TV presenter Suzy Cato.

The Chair of the CBR Community Committee which organises the day is Dr Cathy Stinear. "Brain Day is always a great opportunity for people to interact with clinicians, scientists and community support groups, and this year we were really inspired by the creativity theme. We are just so grateful for all the support we receive to make this day happen."

# New initiative to fight Autism

An exciting new multi-pronged approach to Autism Spectrum Disorders was recently launched, with help from the Centre for Brain Research.

In early August, the Centre for Brain Research was the setting for the launch of the 'Minds for Minds' campaign, an initiative of the Autism Research Network New Zealand (ARNNZ), to raise awareness and funding for research into the genetic causes of Autism.

They are also asking people on the autism spectrum to join a research register, which will be used to collect genetic and autobiographical information, and allow for easy recruiting for any potential future testing or research.

The scientists from The University of Auckland (many of them CBR members), are working to unlock the causes of Autism Spectrum Disorder (ASD), and believe they can accomplish great things by working co-operatively with each other and those affected by ASD. This unique community-researcher partnership has the effect of bringing together researchers, health professionals and the community from across the country to facilitate understanding and treatment options for ASD.

ASD is a group of complex brain development disorders that affects around one in 100 New Zealanders. Learning more about the underlying causes may allow people to be diagnosed earlier and more easily, may help them to better understand their condition, and may eventually inform any educational programme or other desired treatment.

***"International studies have indicated that the genetics of autism is very complex, with many genes involved. We want to understand our New Zealand populations, which will contribute to the international effort and may identify genetic variations that are specific to New Zealanders."***

***Dr Jessie Jacobsen***

Geneticist Professor Russell Snell from the School of Biological Sciences, says that the aim is to contribute to the worldwide effort to unlock the causes of autism, "I have no doubt that New Zealand researchers will make a very significant contribution to the better understanding of ASD and the development of specific treatments. This is of course in collaboration with our international counterparts. Genetic testing remains expensive, hence the need to raise funding, but it offers a real way forward in an area where we still have little understanding of causes"


*Members of the Autism Research Network New Zealand unveil the 'Minds for Minds' campaign material. From left: Associate Professor Karen Waldie, Dr Johanna Montgomery, Professor Ian Kirk, Dr Mike Taylor, Professor Russell Snell, Dr Jessie Jacobsen, and Dr Rosomund Hill*

One of the new research projects within the network will investigate the genes and microbes of people with ASD. The researchers are encouraging New Zealanders on the autism spectrum (whether high-functioning or severely affected) to register on a database from which samples will be used to study the causes of the disorder.

Dr Mike Taylor is studying the microbial communities (microbiome) in the gut of people with ASD. "This is an area that's getting a lot of attention internationally," he says. "It's clear that there is some link between the microbiome and ASD, but exactly what is happening is an open question at the moment."

"International studies have indicated that the genetics of autism are very complex, with many genes involved," says award-winning young scientist Dr Jessie Jacobsen, who last year received a Rutherford Discovery Fellowship for her research on the genetics of ASD.

"We want to understand our New Zealand populations, which will contribute to the international effort and may identify genetic variations that are specific to New Zealanders."

Other members of the network to date include University researchers Dr Jo Montgomery, whose work on the synaptic connections between neurons in ASD captured headlines last year, functional biologist Associate Professor Klaus Lehnert, developmental neuropsychologist Associate Professor Karen Waldie, and psychologist Professor Ian Kirk; as well as clinical neurologist Dr Rosamund Hill, who has a severely autistic son.

On the launch date, over a hundred people packed our seminar room area to hear a series of the lead researchers from the Autism Research Network give a precis of their work and how it contributes to the overall picture, before the unveiling of the fundraising campaign 'Minds for Minds', together with its appealing brain logo.

## What is ASD?

ASD is a disorder of development that affects language, social skills and behaviour. People with ASD are unable to interpret the world and what is happening around them in the same way that others do. There is a range of ability, from the severely impaired with classical autism, to those with Asperger syndrome or high-functioning autism. People with Asperger syndrome may have a high level of intelligence but have difficulty with social interaction.

The term ASD is used to refer to the group of pervasive developmental disorders which include: classical autism, Asperger syndrome, and those with similar features which do not fit into these diagnostic categories. ASD may cause difficulties with communication, social interaction and lead to restricted, stereotyped routines and repetitive interests or behaviour.

# Brain Bee 2013

The Centre for Brain Research continues its links with the International Brain Bee Challenge, a worldwide neuroscience quiz for high-school students.

In a close final round, Auckland Grammar student Thomas Chang won the North Island Brain Bee Challenge, held at The University of Auckland's Faculty of Medical and Health Sciences on 3 July.

The runners-up were Tiger Huang from Auckland International College and Stephanie Soon from Westlake Girls High School.

These students took the top three spots from a group of seven finalists who took part in a final round scored 'live', showing each student's progress.

The Teams final was won by Epsom Girls Grammar with Westlake Girls High second, and St Cuthberts College third; the first time that the competition has returned a clean sweep by girls' colleges in the teams competition.

The day's neuroscience knowledge challenge was contested by nearly 200 students from 44 North Island schools. The quizmaster for the day is CBR member and Research Fellow in biological sciences, Dr Jessie Jacobsen.

The running of the day was co-ordinated by Dr Maurice Curtis and the founding organiser of the NZ Brain Bee, Professor Louise Nicholson, both CBR members, and hosted by the Centre for Brain Research.

During the day, students took time out from answering questions to ask some of their own while participating in tours of the research laboratories, hands-on activities, visiting the MRI scanner and the Anatomy Learning Centre.

"The visit is inspiring for the students and we believe that their experience with us here at the Brain Bee influences their choices as they move forward into tertiary study," says Professor Louise Nicholson.

The Brain Bee has been going since 2007, so many of the winning students are now in tertiary study including past winners: George Shand, William Zhang, Rachel Wiltshire and Kate Burgess, who are all studying at the Faculty of Medical and Health Sciences. 2012 winner Jiantao Shen, of Mt Roskill Grammar, performed very well in the International Brain Bee Vienna in 2013, reaching the final round and coming third overall.

The Brain Bee is one of the largest student competitions in New Zealand. Round one was held during Brain Awareness week in March when the 1500 plus registered participants competed in an on-line multi-choice quiz, run within their schools.

"We invite the top 200 to this North Island finals day, with the winner of each of the North and South Island competitions go to Australia for the National finals", says Professor Nicholson. "The Australia/NZ national final involves the eight states and two from New Zealand, all competing to represent their respective countries in the International Brain Bee final which this year is in Vienna."

The CatWalk Spinal Cord Injury Trust is the main sponsor of both the North and South Island competitions, while the Centre for Brain Research sponsors the winners to Australia, with Freemasons NZ sponsoring the overall winner to the international final.

*Thomas Chang with his trophy*

# Development agenda for Postdocs

Leigh Marine Laboratory hosted the first postdoctoral retreat for CBR's emerging researchers.

*Team-building exercises in the sunshine between sessions*

## Feedback from the day:

Organising committe members Dr Simon O'Carroll and Dr Erin Cawston report that the meeting was a great success, with the vast majority of participants saying they would attend a similar event in the future. The participants felt that it was well organised and competently run. Below are some of the comments received.

"A great opportunity to meet and interact with fellow Postdocs and late stage PhD students, not only to discuss research and careers but also socially."

"I enjoyed myself thoroughly"

"It's very useful to meet with people at different stages of their career to talk openly and genuinely about their research and career opportunities and development."

"It was great to have the opportunity to hear an international speaker"

"Good to get a better understanding of what the expectations of a Postdoc are"

## Postdoc retreat

CBR's recently established Emerging Researchers Committee, charged with assisting researchers and research leadership development within the Centre, set themselves the challenge of planning, organising, and securing funding for a postdoctoral retreat and they delivered in style!

The goals were to promote professional and social interaction by emerging researchers across the Centre and provide mentoring and advisory opportunities by and for early career researchers.

The retreat incorporated a number of sessions, including a plenary lecture from exceptional young New Zealand neuroscientist Dr Jason Shepherd, as well as many opportunities for participants to present and discuss their research in both formal (seminars) and informal social settings.

Dr Shepherd, who has a BSc from the Univeristy of Otago and PhD from Johns Hopkins University, is now an Assistant Professor in the Department of Neurobiology and Anatomy, University of Utah. His research focuses on the fundamental cellular and molecular processes underlying memory formation and how such processes breakdown in neurological diseases.

Despite only completing his PhD 5 years ago, his work has already had a considerable impact on the field, including multiple publications in top journals such as *Nature Neuroscience* and *Neuron*. The opportunity to meet and talk with such a successful young kiwi was a very inspiring and valuable opportunity for our emerging researchers.

*Sharing ideas over dinner on day one*

The retreat concluded with a panel discussion that allowed the attendees to discuss and present their ideas for the future of the CBR and neuroscience in New Zealand. Bringing together the different areas of neuroscience with the goal of developing inter-disciplinary research is one of the aims of the Centre for Brain Research. This event provided a forum for emerging researchers to make the contacts and start the conversations that will allow them to develop their scientific careers and hopefully create a template for successful postdoctoral events in future years.

The organisers of the retreat received support from: In Vitro Technologies NZ ltd, Coherent Scientific, Abacus ALS, Medica Limited, Raylab NZ Ltd, and the Neurological Foundation of New Zealand.

NEUROLOGICAL FOUNDATION OF NEW ZEALAND

# Inaugural PhD student day

CBR brings together cross-faculty PhD students.

## PhD student day

The brightest and best upcoming talent from across the five schools and sixteen departments which make up the Centre for Brain Research all came together in one place on July 12 for the first ever CBR PhD Student Day. The day was conceived, organised, and executed by students, for students, with a committee led by psychology PhD students Carolyn Wu and Valerie van Mulukom. Presentations, question-and answer panel with experts in various fields, and interactive sessions such as 'speed dating' and a variant of the 'three-minute thesis' challenge held annually by the University, which sees PhD candidates challenged to explain the thrust of their research inside of three minutes, were all part of the day.

The highlight of the day, according to attendees, was the opening address by Dr Mark Sagar, CBR member and principal investigator of the Laboratory for Animate Technologies at the University of Auckland. Mark's pre-academic career incorporated a period of time working at award-winning company Weta Digital, where he helped create the technology that allowed for the astonishing animation used in movies such as 'Avatar'. Mark covered the progress of his interesting journey to date, with a few tips and points of advice for PhD students in terms of thinking broadly about careers, and the importance of communication and building networks for the future.

The day also featured a research showcase, with attendees encouraged to draw/write about the topics and techniques that they encounter in their daily research, and group these with others, then make connections between their research and related disciplines/techniques, with the result taking on a very web-like or perhaps cell matrix-like appearance. People were keen to participate, as the photo above shows, with the pictures representing, from left: a synapse for cellular or sub-cellular level research, a brain for functional and anatomical research, a whole person for clinical research and on to the right (obscured), research which includes a population approach.

The organisers say everyone caught on really quickly to the nature of the exercise, and it was a great way to get people talking about how their work related to that of others and to understand the breadth and potential of the 'whole picture' approach to research that the Centre for Brain Research represents, in contrast to the traditional university approach whereby researchers are grouped according to the department in which their research falls.

**Congratulations to:** Associate Professor Donna-Rose Addis, who has recently been appointed Secretary to the International Society for Behavioural Neuroscience.

Professor Richard Faull, who was appointed as Chair of the Prime Minister's McDiarmid Emerging Scientist Prize panel.

Associate Professor Debbie Hay, who was awarded the New Zealand Society of Biochemistry and Molecular Biology Senior Scientist Award, and delivered her award lecture at the Queenstown Molecular Biology meeting in August 2013.

Toby Lowe, who had an image from his paper selected for the cover of the 'Journal of Cerebral Blood Flow and Metabolism'. This is a significant achievement for any researcher.

# Research funding success

An overview of the recent Centre for Brain Research programmes and projects receiving endorsement in the form of funding.

## The Auckland Face Simulator: A new tool for research in face perception

A project to develop a scientifically informed computer simulation of the human head and face, led by three CBR researchers from three different faculties, has won major funding support from a fund intended to facilitate the development of new collaborations and initiatives.

Associate Professor Paul Corballis, from Psychology, Dr Ben Thompson, from Optometry and Vision Science, and Dr Mark Sagar, from Engineering, together with colleague Jason Turuwhenua, won funding to develop a realistic computer-based, physiologically controlled simulation of the human head and face, the Auckland Face Simulator, to serve as a powerful new research tool for a wide variety of applications in the cognitive, clinical, and social sciences.

***"This is a transformational project that by its nature must be interdisciplinary. It combines advanced engineering, computer graphics, and mathematical modeling with basic and applied cognitive neuroscience, social, perceptual and developmental psychology."***

***Associate Professor Paul Corballis***

The simulation, part of a larger set of autonomously animated systems developed by Dr Mark Sagar, includes models of the musculature and nerves of the face and eyes based on human data. This will be used to generate a large, user-configurable set of dynamic face stimuli for research into the perception of facial recognition, which is Associate Professor Paul Corballis' main research interest.

The perception and recognition of faces is arguably the most complicated visual ability in humans. Despite the fact that all faces possess essentially the same set of features, people are evidently able to recognise an essentially unlimited number of faces. The accurate perception of faces presents a considerable challenge to the human visual system. On one hand, recognition of identity, gender, and ethnicity are within-category discriminations involving features invariant across expressions and facial postures. On the other hand, the recognition of emotions, and cognitive states involve dynamic variations in the facial muscles. Because of the importance of faces

as sources of information about identity and emotional state, the visual processing of faces has been a major focus of research across a number of areas in psychology and related disciplines.

Principal investigator for the project, Associate Professor Paul Corballis, says; "The core idea of this research is to use the face simulator as a powerful new tool to investigate face processing, and in turn to further refine and expand the capabilities of the simulation as a realistic model of the human face and head. This is a transformational project that by its nature must be interdisciplinary. It combines advanced engineering, computer graphics, and mathematical modeling with basic and applied cognitive neuroscience, social, perceptual and developmental psychology.

Once the face simulator is up and running, the researchers plan to utilise it in a number of ingenious ways. Dr Ben Thompson sees the potential to conduct an investigation into the influence of abnormal visual development on the perception of facial identity and affect in a condition known as Deprivation Amblyopia.

This is a severe visual disorder in which patterned visual input does not reach the retina. Complex abilities such as the recognition of facial expression seem to be particularly susceptible to this sort of early visual deprivation. Understanding how visual deprivation influences face processing once vision is restored would be invaluable in predicting outcomes, managing patients' expectations, and in the development of rehabilitation techniques.

Dr Jason Turuwhenua, meanwhile, plans to harness the simulator's unique customisability to investigate the influence of Maori facial tattooing (moko) on the perception of facial affect. This third project will include a computer art component 'digital moko'. This diverse group of projects was selected to illustrate the wide variety of potential research applications of the Auckland Face Simulator.

THE AUCKLAND FACE SIMULATOR: A NEW TOOL FOR RESEARCH IN FACE PERCEPTION ($100,000)

University of Auckland Cross-Faculty Research Fund

## Pesticides and Parkinson's

Parkinson's disease (PD) is one of the most common degenerative brain disorders leading to motor deficits such as tremor in hands, slowness of movement, muscle stiffness and gait disturbance. Importantly, PD patients also suffer from debilitating non-motor symptoms, such as sleep disturbance, cognitive and mood disorders and dysfunction of the

cardiovascular system, bowel and bladder, which cause additional disability and severely impact the quality of life of those affected with PD. Previous research indicates that at least some of these non-motor symptoms are due to degeneration of nerve cells in the Locus Coeruleus (LC), but the cellular mechanism of this damage is not known. Remarkably, degeneration of this area can exceed damage of the Substantia Nigra pars compacta (SNc) associated with the 'classical' motor symptoms of the disease.

The present study, led by Professor Janusz Lipski, will be conducted on isolated animal brain tissue, and will compare the effects on Locus Coeruleus neurons of two environmental toxins/pesticides which have been implicated in the pathogenesis of some cases of PD: rotenone and MPP+. The researchers will also compare the effects evoked in LC neurons with the responses induced in SNc neurons, and a further group of neurons which is not affected in PD. This research will advance understanding of the mechanisms of action of parkinsonian toxins on neurons vulnerable in PD, and should help to clarify the complex relationship between the motor and non-motor symptoms in this debilitating disorder.

EFFECTS OF PARKINSONIAN TOXINS ON THE LOCUS COERULEUS ($103,000 – 2 years)

Auckland Medical Research Foundation

## New therapies for NMDA-related conditions

Associate Professor Debbie Young has received a grant to continue her investigation into the NMDA receptor, which plays an important role in the brain, covering functions such as learning and memory. Over-activation

or dysfunction of the NMDA receptor that occurs in certain neurological diseases causes neuronal cell death or can affect learning and memory making this receptor a key target for therapies. Traditional NMDA receptor blockers that aim to prevent the deleterious effects associated with NMDA receptor dysfunction are associated with adverse side-effects in humans which limits their usefulness. We have shown that antibodies to the NR1 subunit of the NMDA receptors can alter the function of NMDA receptors leading to improved learning and memory, and resistance to experimentally-induced brain insults in rats. Anti-NMDA receptor encephalitis, a disease associated with seizures and memory loss in humans is mediated by NR1 antibodies that could be binding to a region of the NR1 protein that is different to our cognitive-enhancing and protective NR1 antibodies. Here, we use rat models to help distinguish the parts of the NR1 subunit important for generating NR1 antibodies that produce beneficial and detrimental effects on cognition and neuroprotection. These results will contribute to the development of a new class of safe therapies applicable for a broad range of neurological conditions.

HOMING IN ON THE EPITOPE TARGETS FOR NR1 ANTIBODIES ($138,076 – 2 years)

Auckland Medical Research Foundation

## Cannabinoid receptors in the diseased brain

Cannabinoid receptors are cell membrane receptors which play an important part in cell-to-cell signalling within the body. Associate Professor Michelle Glass, along with colleague Dr Scott Graham, has long been interested in the potential of these receptors as sites of targeted treatment. Cannabinoid CB2 receptors have been suggested to be an appealing target for neuroinflammatory disorders as many believe them to be found only on immune cells. However, their distribution is actually highly controversial with some groups reporting wide spread neuronal distribution, while others see little evidence for CB2 in the brain. Associate Professor Glass says, "Part of the reason for these discrepancies is that the antibodies used to detect this protein are not entirely specific. Furthermore, many of the assumptions about CB2 expression in the brain are based on animal studies and may not represent the situation in the human brain. As many drug companies are aiming to bring CB2 directed therapies onto the market it is critical that the localisation of the receptor be accurately determined. We have recently developed a sensitive method for determining the expression of CB2 in the normal healthy brain, which we now wish to apply to diseased brain tissue from the Neurological Foundation of New Zealand Human Brain Bank, giving us the best possible indication that we have found something of therapeutic importance."

CB2 IN THE DISEASED HUMAN BRAIN ($66,792)

Auckland Medical Research Foundation

## Impulsive behaviour and Dopamine

CBR member Professor Winston Byblow is the recent recipient of a grant from the Neurological Foundation of New Zealand. His research aims to develop behavioural tests and identify genetic markers which may be used in future to indicate whether or not a patient with Parkinson's is a good candidate for dopamine agonist medication, and is entitled: Falling off the curve: the link between impulsivity and dopamine.

Dopamine agonists, which mimic the action of dopamine upon its specific receptors, are a mainstay of the treatment regimen for Parkinson's disease, and lead to significant improvements in quality of life for the majority of patients. However, like all medications, they have side effects, and these manifest in different ways in different people. For some people (10-20%), side effects include the development of impulse control disorders such as gambling addiction, hypersexuality, and compulsive spending.

The possibility for these side effects to occur in patients receiving dopamine agonist therapy was noted about a decade ago, but at that time scientists were not able to tell whether or not the affected patients had any particular features which made them especially vulnerable to developing compulsive behaviour disorders. Later studies have suggested that this sub-population may have a particular profile, and Professor Byblow's study aims to further identify this, and develop a tool for clinicians to make good prescribing choices for their patients in future.

FALLING OFF THE CURVE: THE LINK BETWEEN IMPULSIVITY AND DOPAMINE ($52,682)

Neurological Foundation of New Zealand

# Huntington's expert visits CBR

In August, staff and students at the Centre for Brain Research had an opportunity to hear from one of the world's most prominent researchers in the field of Huntington's Disease.


*Professor Anne Young poses with Professor Richard Faull in the Centre for Brain Research's reception area.*

Professor Anne Young, of Harvard University, who is also a clinical neurologist practising at Massachusetts General Hospital, visited New Zealand to be a key speaker at the Australasian Winter Conference on Brain Research, which runs annually in Queenstown.

Following this, she visited Auckland for a day, and gave a public lecture at the University in the evening, a free event sponsored by long-time CBR supporters, the Freemasons Roskill Foundation.

Earlier in the day, she held CBR and Auckland District Health Board staff spellbound as she took them on a journey through the history of Huntington's disease, from the earliest recognition of a cluster of motor symptoms leading to the original naming of the condition as Huntington's Chorea, based on the first thorough elucidation of the hereditary patterns of the disease by Dr George Huntington in 1872.

From there she moved through the efforts of the teams who sought to identify the genetic basis of the disease, to today's multi-faceted research efforts aimed at understanding the genetics, diagnostics, disease progression, and clinical presentation of the disorder.

Prominent in the seminar were first-hand accounts and video footage of interactions with individuals living with the effects of Huntington's. Included in this category was Professor Young's account of her frequent past visits, with a team of researchers including Nancy Wexler, president of The Hereditary Diseases Foundation, to the Lake Maracaibo area of Venuzuela, which is home to a significant population (about 14,000) of people with an unusually high incidence of Huntington's Disease. In addition to the high incidence, many members of this population have two parents with Huntington's, rather than the more usual one, meaning that at least some of them have two copies of the expanded *huntingtin* gene that produces a mutant form of the *huntingtin* protein, which damages the brain.

Genetic analysis of samples taken from this population allowed for the breakthroughs which lead to the isolation of the chromosome carrying the defective gene and finally the discovery of the *huntingtin* gene itself.

Professor Young paid tribute to these people, most of whom lead impoverished lives even by local standards, due to the demands of care for affected family members, in participating in research for which they themselves stood little chance of receiving benefit from.

In the lively and extensive question session which followed the lecture, Professor Young was asked if she believed there could ever be a cure for Huntington's. She replied that she believed it would, in time, be possible to 'turn off' the Huntington's gene, but emphasised that there is still much to be discovered about the mechanisms of the disease and how these relate to its clinical manifestations.

To find out more about 'turning off' or 'turning down' the gene for Huntington's, and how the Centre for Brain Research and some of our partner organisations are involved with research in this area, see our update on page twenty-one of this issue.

*Communications Manager Andrea Lee managed to catch up with Professor Young for an interview during her whirlwind visit.*

*As a successful scientist, doctor and member of the CBR Scientific Advisory Board who were your main influencers growing up? Did you have a mentor?*

I was fortunate enough to have excellent mentors. My first mentor was my pediatrician who was a family friend and recommended I pursue a combined MD and PhD program. My next mentors were in college – particularly my biochemistry professor. In graduate school, Solomon Snyder, was a fantastic mentor who showed me that research was fun, exciting and surprising. Later my first boss, Sid Gilman, was a great mentor who helped my career get off the ground.

*What advice would you give to young Post-Doctoral fellows embarking on a career in medical research?*

Follow your passion. If science is for you, then you can't live without it. Be stubborn and pursue your dreams.

*There is currently a predominance of young women among CBR PhD students and fellows. Is this the same in the Young Laboratory? If so, why do you think this is?*

My lab was predominantly full of men. When my lab was thriving, fewer women students expressed an interest in research. Now, with the changing times, more and more women are joining the field and hats off to the CBR for bringing them along.

*How have you seen the role of women in medicine, and in science generally, develop over your career?*

When I started in my career there were only nine women in a class of 110 and now women make up more than fifty percent of the class. Then it was very difficult to become a professor as a woman and now that barrier is slowly breaking as well. At Massachusetts General Hospital, I was the first woman chair of a department but now there are three.

*What motivated you to choose neurology and neurological disease as your speciality?*

The brain was the great unknown and it seemed like the most fun to explore. I also liked how the physical examination tells you a great deal about what's wrong. In the laboratory, neuroscience was fascinating and a never-ending puzzle. Combining lab work with clinical work was fun and logical.

*Where do you see the differences between the 'kiwi' research approach and the American way of doing things?*

I would say that the two are very close. Research is really global.


*Professor Anne Young is pictured with Professor Richard Faull, and Mr David Mace of the Freemason's Roskill Foundation, following the public lecture sponsored by the Foundation*

*How do you address work/life balance issues?*

I was lucky to have a husband who worked with me in the clinic and in the lab. He also did more than his fair share of raising our two daughters. Work has dominated my life but we always had breakfast and dinner together with the children and we spent time with them at the weekend. Life outside the work and home was minimal although we had marvelous opportunities to travel and we often took the children.

*Do your children/grandchildren also share your passion for science?*

One daughter teaches science and math to seventh graders and the other is an MD/PhD in neuroscience and pursuing a residency in neurology.

*What personal qualities have helped you overcome challenges?*

Stubborness and a will to win.

*You have visited New Zealand a number of times, where are your favourite spots?*

I love all aspects of New Zealand! I love the people, the countryside, the birds and wild life and the stunning scenery.

*What other interests do you enjoy outside your research and academia?*

I like photography, swimming, kayaking and walking, sports and reading.

*Is there anything else you would like to comment about?*

Kiwis are great hosts!!

# Awards

Two CBR members receive accolades from outside academia, while travelling fellowships give other members an opportunity to forge new links with research groups in high-profile institutions.

## Reeves Lecture 2013

Centre Director Professor Richard Faull was invited by Leadership New Zealand to give 2013's Reeves Lecture, a public lecture series set up to honour the memory of the late Sir Paul Reeves, former Archbishop of New Zealand and Governor-General. The Leadership New Zealand Trust exists to enrich New Zealand and to foster a culture of leadership in our nation. The focus is on bringing leaders from every generation and every sector of New Zealand together; to connect them through conversation; and to challenge them with making a difference. Richard's lecture, which was titled, 'Imagine Tomorrow's World' outlined the progress of brain research in this country and the prospects for development of further treatments. He focused on showing what New Zealanders can achieve by working collaboratively.

## Woman of the Year Awards

Associate Professor Bronwen Connor, who heads CBR's Neural Repair and Neurogenesis research group, was recently named as the Health and Science recipient in the NEXT magazine Woman of the Year awards.

"What's great about this award is that women are generally not promoted as science leaders" says Bronwen whose parents were both role models for her.

Her father is an engineer with additional degrees in math and physics and was her mentor as she moved into management and leadership roles.

"While bringing up her young daughters my mother also studied part time at university. My parents have always supported me, always behind me 100 per cent," she says.

After completing her PhD at the University of Auckland, she then spent three years as the Neurological Foundation of NZ Wrightson Fellow, undertaking postdoctoral study in the use of gene therapy for the treatment of Parkinson's Disease at Northwestern University in Chicago, before returning to establish her lab at the University of Auckland.

Her ground-breaking work involves the direct reprogramming of adult human skin cells to brain stem cells. This technology allows researchers to take human skin cells, over-express two of the genes involved in brain development and transform the skin cells to become brain stem cells. The brain stem cells can then be grown into any type of mature brain cell.


*Associate Professor Bronwen Connor*

Her technique is unique in that it uses adult human tissue which removes the need for embryonic stem cells and the ethical issues associated with their use. Most importantly, this technology allows the use of a patient's own skin cells to generate brain stem cells, removing issues of rejection.

Bronwen's unique technology allows researchers to generate human brain cells from patients with neurological disorders, such as Parkinson's disease or autism, in order to gain a better understanding of the cause of these disorders. In addition, new drug therapies can be identified and tested on disease-specific human brain cells. Alternatively, using this technology, brain stem cells can be generated for transplantation into areas of brain cell loss or damage due to disease or injury.

## Kellaway Fellowship

Dr Bruce Russell was awarded the Gavin and Anne Kellaway Medical Research Fellowship by the Auckland Medical Research Foundation, and has made excellent use of the opportunities provided, fitting in attendance at two conferences, and a great deal of collaborative work, during his time overseas.

The first of these is Dr Jeff Dalley (Reader in Molecular and Behavioural Neuroscience) at the University of Cambridge. Dr Dalley is also a Pharmacy graduate from NZ, whose main research focus is addiction, an interest Bruce shares. On a previous visit they completed a book chapter relating to PET scanning and addiction/ADHD, and are hoping for a similarly productive visit this time.

Following this, Bruce travelled to Munich to attend annual meeting of the European Brain and Behaviour Society, and from there on to the 4th European Conference on Schizophrenia Research in Berlin at which he and one of his students are presenting.

Then it was back to the UK to visit a group in Kings College London's of Psychosis Studies Department to discuss an area of research as yet unexplored at CBR, with a view to future collaborations, the on to the University of Oxford's Department of Psychiatry and their Centre for Functional MRI of the Brain. The reason for visiting these groups is a shared interest in schizophrenia and psychosis.

Then finally, *en route* back to New Zealand, Dr Russell visited Professor Mark Geyer's research group at the University of California San Diego to work towards developing a collaborative project, utilising Professor Geyer's experimental paradigms to investigate the underlying pathology of psychiatric illnesses in people and in preclinical models.

## Grass Fellowship

Dr Chantelle Du Toit was selected for a 2013 Grass Fellowships at the Marine Biological Laboratory (MBL) in Woods Hole, Massachusetts. These fellowships support investigator-designed, independent research projects by neuroscientists early in their career. Just twelve scientists from around the world received a fellowship in 2013 to perform independent research for the duration of fourteen weeks during the summer of 2013.

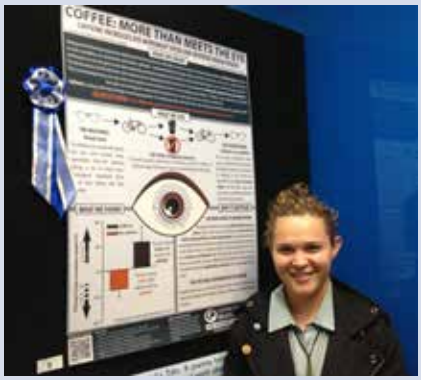
Grass Fellowships are supported by The Grass Foundation, a non-profit private foundation that supports research and education in neuroscience. Chantelle says, "This was a superb opportunity to work on my very own dream project with full financial support as well as to interact with world class scientists who gather at the MBL each summer to do research. Working alongside many great neuroscientists in this unique environment was an inspiration for my current and future scientific work. I also made friends for life with the other Grass Fellows as we worked alongside each other during the summer."

"The extensive equipment loan program specifically for Grass Fellows meant that I could work with the latest and greatest equipment during this summer. Although the project was challenging, I have learnt so much and have grown as a neuroscientist. I have brought back a wealth of experience in

in the area of optogenetics that could enhance future projects done here. Altogether this was a once in a life time opportunity that has changed my future forever and I am very grateful to have been a part of it."

## Student Awards

Students from the CBR scooped the prize pool at the University of Auckland's Faculty of Science Poster Competition in September, taking out first, second, and third prizes. First prize winner Charlotte Connell, from the Exercise Metabolism Laboratory, also took out the top poster award at EXposure 2013, the University of Auckland's research showcase, with her poster titled: "Coffee: More than meets the eye - Caffeine increases eye movement speed and reverses brain fatigue"




***Charlotte with her winning poster. The runner-up was Yvette Lamb from the Human Neuroscience Laboratory, and thid prize went to Aleea Devitt, from the Memory Lab.***

Two CBR students had their work recognised during New Zealand's annual Queenstown Research week this year. Amy Smith (Pharmacology) won the AWCBR Goddard award for best student oral presentation in Queenstown, while Tania Fowke (Physiology), won the Physiological Society of New Zealand best student poster presentation.

A further two CBR students received acknowledgement of their work at KiwiCAM, the conference for students of cognition and memory. Jordan Searle and Rachel Sumner both won awards for their excellent oral presentations at this year's student-led symposium held at Otago University.

Four CBR students were awarded prizes following this year's HealtheX medical research expo. Lucy Goodman took first place for the doctoral student oral presentation, as well as receiving the AMRF Emerging Researcher Award, while Danielle Lee was runner-up in the non-doctoral oral presentation category. Tania Fowke and Shelley Lin also deserve recognition for taking both runner-up spots in the poster arm of the competition.

# International visitors

The Centre for Brain Research has hosted key international researchers in a number of areas and continues to develop productive collaborations with overseas groups.

## Professor Rob Shepherd

In June, Rob Shepherd, (pictured right), Director of the Bionics Institute, and a Professor of Medical Bionics at the University of Melbourne, visited the Centre for Brain Research to discuss aspects of his work, including a review of the basic development of neural prostheses (such as cochlear implants or spinal cord stimulators) and the key components of a modern device. He also provided examples of neural prostheses in widespread clinical use together with devices currently in the translational pipeline towards development. Finally, he briefly discussed the current progress in development of devices at the Bionics Institute, which is working toward improving the functionality and applicability of cochlear implants, while working on developing neurobionic devices, and pursuing the holy grail of bionic vision.

***Professor Rob Shepherd***

## Professor Mark Rees

Professor Mark Rees, of the Institute of Life Science and College of Medicine at Swansea University, visited the Centre for Brain Research for a short period ealier this year after being awarded a Seelye travelling fellowship. Professor Rees spent five years at the University of Auckland doing post-doctoral research earlier in his career, and it was here that he first developed the research interests that he has built up into a significant force at the University of Swansea, leading a team of 20 clinical and biomedical investigators. These interests include epilepsy, neuronal migration disorders, paroxysmal movement disorders, cardiac arrythmias, and sudden death syndromes in the young.

## Professor John Rothwell

Professor John Rothwell, from University College London's Institute of Neurology, discussed his current research projects which include using neurophysiological techniques to study the mechanisms of neural plasticity that underpin motor learning, and using this knowledge to devise new therapeutic interventions for rehabilitation after stroke. His laboratory specialises in devising new techniques to study the physiology of the human motor system in intact, awake volunteers. The work extends from the study of spinal or brainstem reflex systems to basal ganglia and cerebral cortex.

This has provided insight into the mechanisms of action of deep brain stimulation for the treatment of Parkinson's disease The laboratory has also devised new methods for repetitive TMS that lead to effects on brain function that outlast the period of stimulation. This gives insight into how the remainder of the brain reacts to changes in function of another part, as well as to possibilities for therapeutic applications in rehabilitation of brain injury or chronic disease.

## Assistant Professor Silvia Mangia

Assistant Professor Silvia Mangia visited CBR in November 2013, from the Centre for Magnetic Resonance Research at the University of Minnesota, and presented a lecture about her research in Magnetic resonance spectroscopy (MRS), which is a non-invasive analytical techniquefor investigating metabolic changes in the brain. It can be very useful in identifying abnormalities.

As a technique, it is often used to complement the more common Magnetic Resonance Imaging (MRI). Both techniques use signals from hydrogen protons, but MRI uses the information to create images of structure of the brain, while MRS uses spectroscopic signals to determine the relative concentrations of specific chemicals within the brain.

Dr Mangia has a specific interest in using functional MRS to study the brain's metabolism during periods of activation. These studies are critical not only for basic understanding of overall brain function, but also for the understanding and monitoring of those brain disorders which originate from an improper balance between neuronal excitation and inhibition, like schizophrenia, epilepsy or Parkinson's disease.

# Research re-examined

The Neurological Foundation's Scientific Director, Dr Douglas Ormrod, outlines the processes by which scientist approach their work, and an example of the process from within CBR is featured.

## How Science and Research Work, by Dr Douglas Ormrod

Neurological Foundation supporters know their donations will be used 'to alleiviate suffering from diseases and disorders of the brain the nervous system through research and education'. Although most realise the research we sponsor involves finding out things we don't already know in relation to neurological diseases, I suspect that not many actually know how science and research are carried out in practice. This article is an attempt to demystify the process.

### The Scientific Method

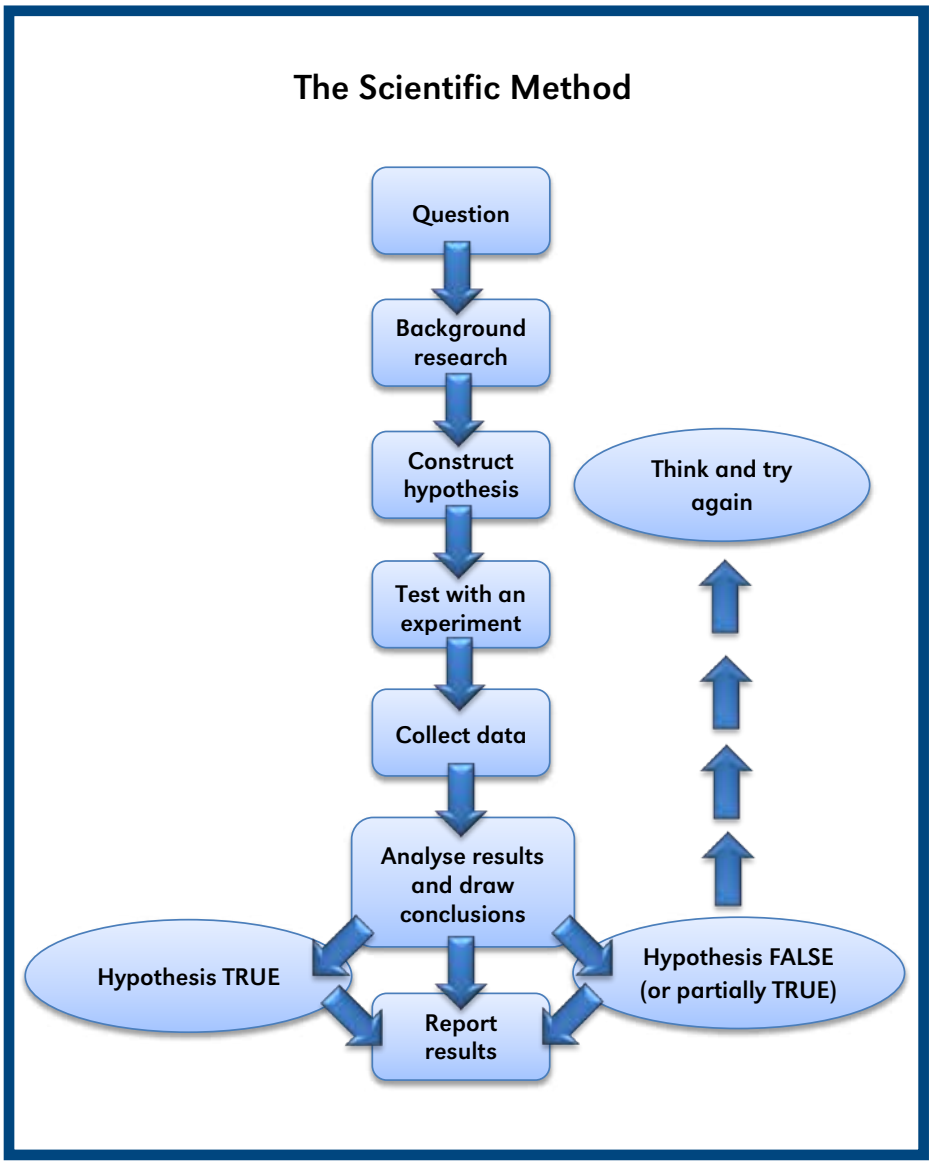
The early scientists used trial and error or the 'suck it and see' method – you may remember the picture of Benjamin Franklin flying a kite in a thunderstorm with a key attached to the metal tether just to see what would happen. In the 20th century, the formalised 'scientific method' became the way of conducting science, as outlined in the diagram included here.

This is an idealised scheme for an ideal world and how it appears in grant requests! In reality things are less linear and serendipity often plays a role, but as Louis Pasteur said, "fortune favours the prepared mind". Without a prepared mind Alexander Fleming would not have deduced that the rogue mould that prevented bacterial growth on his petri dish might be making an antibiotic, and now we have penicillin.

The big advantage of following this method is that scientists all over the world can compare their work with that of others and use the data to further develop their own research and extend the boundaries of knowledge. This is why the free exchange of research results through international publication and conferences is so important.

### The Hypothesis

Hypotheses are guesses based on theory. But importantly, hypotheses are guesses that can be tested by experiment. For example, based on previous observations and published data tables, I hypothesise that the sun will rise in Auckland at 7.03am on 16 August 2013. This hypothesis can be experimentally tested by careful observation at sea level using an accurate watch. If the sun does rise at 7.03am we have more data which strengthens the theory that sunrise and sunset times progress in a predictable manner through the year. Eventually, if enough supportive data are collected, a theory can become as close to fact as is possible. For example, the relationship between the seasons and the orbit of the earth around the sun, or Darwinian evolution, were both regarded as controversial theories when first proposed, by are now accepted as fact.




Another key requirement of the scientific method is that results must be repeatable. Whenever a scientist come up with a new finding that challenges or extends a current theory, other scientists will repeat the experiments and either prove them wrong or confirm the results. Once enough confirmation is obtained, the new concept is slotted into the theory and further work is planned. This is how scientific progress is made - step by step. Sometimes a hypothesis is found to be false, and that's fine - knowing what something isn't can be as important as knowing what it is.

### Research

Braodly speaking, there are four types of research. Taking the outbreak of Psa infection in kiwifruit vines as an example:

1. Fact gathering, eg: how many New Zealand kiwifruit orchards are affected by Psa?
2. Applied research, eg: develop a Psa-resistant kiwifruit vine (Hort 16A)
3. Hypothesis-based research, eg: Hort 16A is Psa-resistant because...
4. Blue-sky research, eg: why are some kiwifruit green and others yellow?

The Neurological Foundation primarily funds hypothesis-based research, which is a mix of biomedical research carried out in the lab, and clinical research, which involves patients. Bridging the two is what is known as trans-lational research; bringing the lab to the bedside. The Neurological Foundation Foundation Professor of Clinical Neurology Alan Barber fills the latter role in Auckland.

As I outlined in Headlines volume 95 last year, we put an enormous amount of effort into making sure that we fund the best researchers and the best projects. This involves twice-yearly grant rounds where applications are

## Putting it into practice

It is all well and good to have an agreed-on process for undertaking scientific research, so that continuity is assured and results may be replicated, but as we all know, things are rarely simple and linear in the real world, and even less so when your research is conducted with real live humans and across disciplines, as is much of CBR's research!

The following is an example of how the process plays out, using Professor Grant Searchfield's search for an effective treatment for tinnitus as an example.

**Question(s):** Why do people report hearing noise which is not associated with a noise-producing stimulus in their environment? How can we treat this problem?

**Background research:** Bearing in mind that much of science is 'standing on the shoulders of giants', background research usually involves reading and interpreting studies and experiments undertaken by others, to see how they might provide a basis.

Prior studies show how that 15-20 percent of the population report tinnitus, and 15-20 percent of these sufferers experience it as distressing. Other studies have shown that it is often associated with damage to the auditory system, usually via noise-induced hearing loss, and that there are changes in the brains of those with tinnitus which go beyond the auditory system, possibly as the brain attempts to compensate for loss in this area.

Studies relating to the brain in other areas, such as psychology, have also shown that the majority of people do not attend to much of what is going on in the environment around them most of the time - this is most obvious when people are concentrating, of course, but it goes on all the time. People are able to perform routine tasks such as eating with a knife and fork without giving them much conscious thought, and phenomena which are routine are disregarded, as anyone who has lived with a railway line close by their house will be able to attest.

Summarising these background facts gives us the following:

1. Tinnitus is associated with damage to the auditory system.
2. The brain changes itself response to this damage (plasticity).
3. People have a natural ability to 'tune things out', which they do automatically much of the time.
4. Tinnitus is common in the population and often experienced as distressing.

**Construct Hypothesis:** It should be possible to reduce the distress experienced by sufferers of tinnitus through training the brain to disregard the tinnitus noise.

**Test with an experiment:** In this case, the experiment involves computer-based training and MRI scans of participants with tinnitus, which makes use of visual and touch feedback alongside the noise feedback, to train the brain to ignore the tinnitus noise.

**Collect data:** In the form of participants' performance tests as recorded by computer, and self-reports of distress experienced.

**Analyse results and draw conclusions:** Compare participants' before-treatment reports of how tinnitus is perceived and how intrusive or distressing it is with after-treatment reports, and against results shown by earlier or different treatment programmes.

**Report Results:** This stage of the project has not yet been reached, but conclusions drawn from the results will be used to further refine equipment and techniques used.

subject to rigorous local and international peer reveiw. Only the best get through to where our budget allows.

Once a project is completed, the final step is to publish it, and again scientists subjects themselves to another round of peer review as their paper is pulled apart and critcised by journal editors and reviewers. There can be several months of to-and-fro, argument and counter-argument, but it is important to get it right, as others will base their work on what you put your name to. As you might imagine, there is much celebration when a paper is finally accepted for publication. Once the champagne is finished we sit down and start writing the next grant request, and so it goes on. Step by step, problems are solved and answers are found.

*By Dr Douglas Ormrod - reproduced with permission from 'Headlines' Vol. 99, National Newsletter of the Neurological Foundation of New Zealand.*

## Huntington's sheep update

The birth of the original ewe lamb, 'Kiwi' over seven years ago was a major step towards developing a large animal model of Huntington's disease (HD). This has been a major undertaking and was made possible by early and ongoing support from the Freemasons.

Kiwi enabled the breeding of a large flock of sheep living in Adelaide, from which the team, comprising Professors Russell Snell and Richard Faull, and Dr Susanne Reid, are starting to understand the early changes in HD. The animals appear outwardly normal, yet subtle alterations are now being identified; molecular changes here at the CBR, and behavioral changes by our collaborators. Neuropathological analysis has shown the loss of various receptors within transgenic

animal basal ganglia regions. Aggregates, a characteristic feature of the human disease, are seen in transgenic animals, mostly in cortical regions. The team is finding interesting alterations in metabolites and proteins, and look forward to completing RNAseq and genotyping analysis. The researchers are delighted by findings so far and excited to be moving into a phase of disease mechanism discovery.

# Introducing

In this feature we introduce new members of the Centre for Brain Research.

## Andrea Lee, Communications Manager

*You have one minute to describe your work to the Prime Minister – what would you say?*

I manage the profile of CBR through communications and public relations with scientists, stakeholders and the wider community.

*What has been your career journey to bring you to this point?*

Well it's a journey from sales to marketing and divisional manager at Philips NZ Ltd. I took time off to raise my daughter and then I became a student at The University of Auckland and got a Postgraduate Diploma in Business (Marketing). I worked as a marketing and communications co-ordinator for Parnell Trust. Drawn back for more study and tutoring resulting in a Master of Management degree. My research looked at marketing in the governance of NZX 10 listed companies (professional diversity around the board table). This is significant because of the board's role in strategic development and the critical need for New Zealand companies to be market-focused so that they remain competitive.

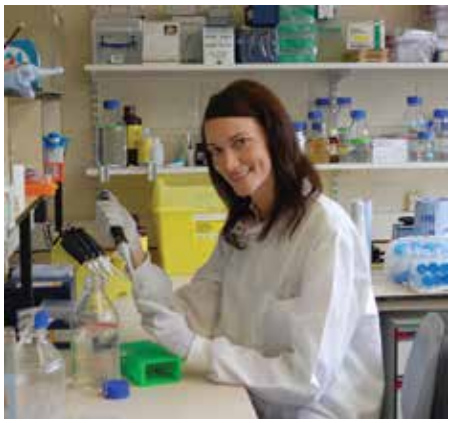
*What interests you about being part of the Centre for Brain Research?*

I think you would be hard-put to find a more stimulating work environment anywhere in New Zealand! The breadth and depth of the research work is truly mind-blowing and vitally important. My colleagues are very capable, talented and interesting and I think we have the best boss in the city.

*Our theme for Brain Day this year was creativity. Where do you draw inspiration from?*

Creative people! From fine arts to fashion, celebrity chefs to architecture, poetry to Harry Potter, jewellery to dance; creative people bravely share their vision, their craft and enhance our world.

## Emma Scotter, 2014 Aotearoa Fellow



Motor Neuron Disease researcher Dr Emma Scotter is the recipient of the fourth Aotearoa Fellowship, provided by Sir Julian Robertson's Aotearoa Foundation. This enables CBR to recruit and repatriate excellent young researchers so they can begin to establish a research base for themselves in New Zealand.

Emma is a graduate of the University of Auckland, where she developed her interest in the misfolding of proteins while working with Associate Professor Michelle Glass and Professor Mike Dragunow, both founding members of the CBR. Her ongoing interest in the role of these proteins within cells has seen her focus on the phenomenon of misfolding in Motor Neuron Disease (MND, also known as amyotrophic lateral sclerosis or Lou Gehrig's disease).

For the past three years Emma has been part of the Department of Clinical Neuroscience at King's College London, under Professor Christopher Shaw, a world leader in MND research, having received a Marie Curie International Incoming Fellowship to study at that institution.

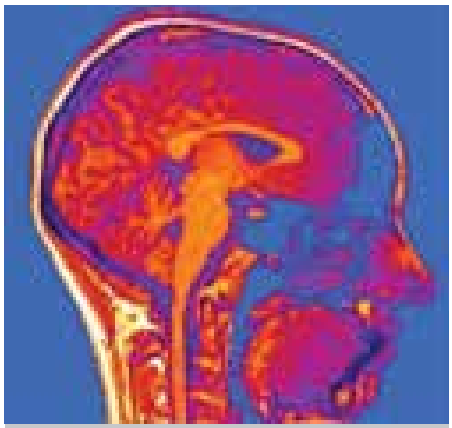
Emma has also been instrumental in arranging for a major collaborative project between the laboratory at Kings College London and a pharmaceuticals producer to screen for potential effectiveness some 300,000 compounds.

This experience will come in handy, as her Aotearoa fellowship project, to be overseen by CBR researchers Professor Mike Dragunow and Professor Margaret Brimble, will involve utilising their established drug discovery platform for screening natural compounds for efficacy in alleviating human neurodegenerative diseases. This proposal would extend the current scope of their collaboration to include MND and FTD (fronto-temporal dementia). This work would be performed in parallel with, and share elements with, the development of novel bioassays for other diseases.

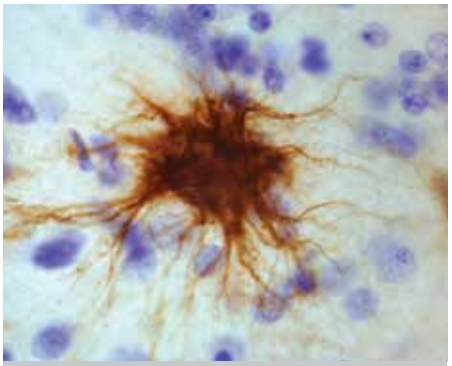
Professor Mike Dragunow is excited about the skills Emma will bring to the the CBR, and the Biobank in particular, and her potential to increase the skill base across the team and reinforce connections with the Neuroscience Medicinal Chemistry lab. He explains, "In addition to her basic research on Motor Neuron Disease, Emma will also be involved in helping to coordinate the screening programme of the Biobank and in particular of the compounds from Margaret Brimble's Natural Product Library. She has very strong expertise in high content screening and drug testing, obtained both during her PhD and also during her current post-doctoral studies, and this expertise and experience will be invaluable to the CBR Biobank screening work."

Emma herself is equally enthused about the opportunity her Aotearoa Fellowship presents. She says, "Working within the CBR has long been a part of my career plan, having experienced the excellent working environment and high calibre research generated by its members. I believe that the CBR embodies collaborative and cross-disciplinary research more than any other neuroscience cluster in NZ, and I look forward to being part of this exciting approach to neuroscience research."

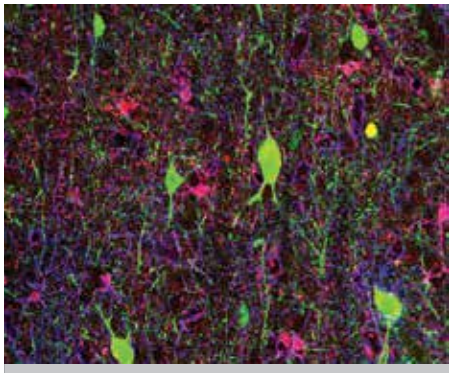
The Trustees of the Coker Trust, who support CBR research in Motor Neuron Disease, have generously offered $40,000 to fund Emma's 'consumables' (that is, the chemicals, and small equipment) which will be used during her research project.



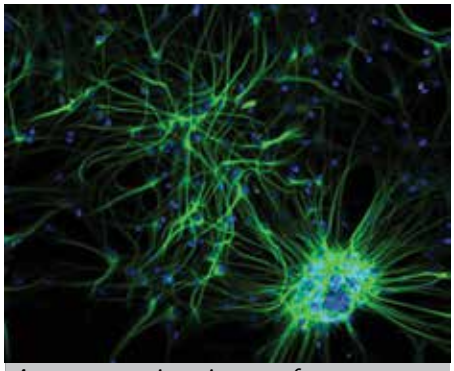
***Above and opposite: Images from the thirteen finalists in the Centre for Brain Research's 2014 Calendar Competition. Above: fMRI image by Valerie van Mulukom, Memory Lab.***



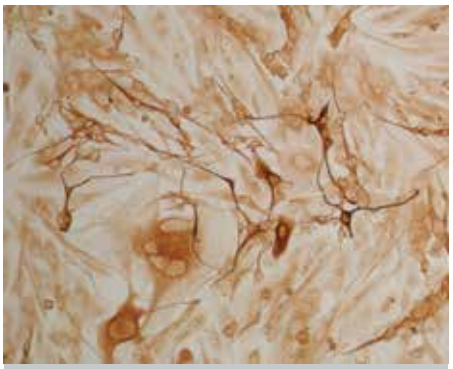
*'Cotton Candy' astrocyte cell in the Brain: Jennifer Song, Neuroanatomy and Neurodegeneration Laboratory.*



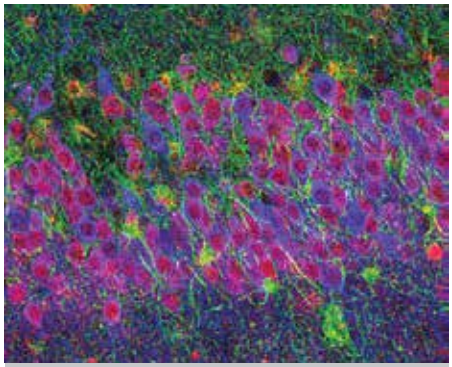
*The Colours of Brain Energy. Toby Lowe, Neurogenesis and Neurodegenerative Diseases Research Group.*



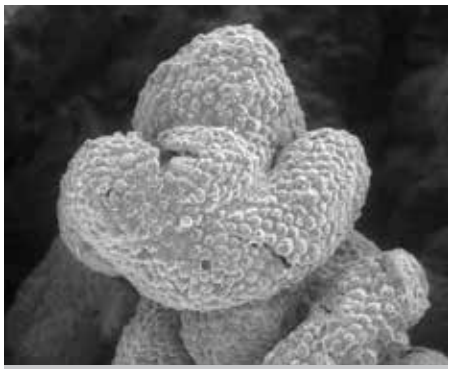
*Astrocytes migrating out from neurosphere. Daniel Mee, Human Neurogenesis and Progenitor Cell Migration Group.*



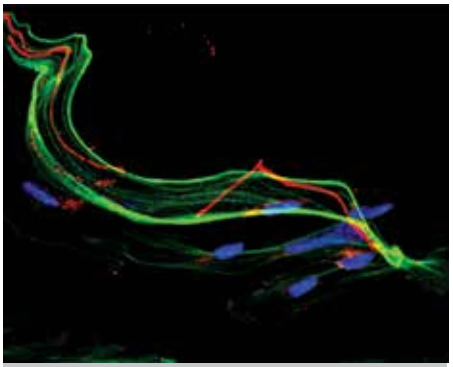
*Microscope image of glioblastoma cells. Michelle McRae, Molecular Neurotherapeutics Group.*



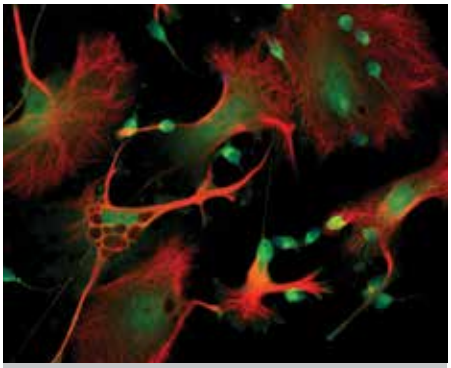
*Psychedelia. Toby Lowe, Neurogenesis and Neurodegenerative Diseases Research Group.*



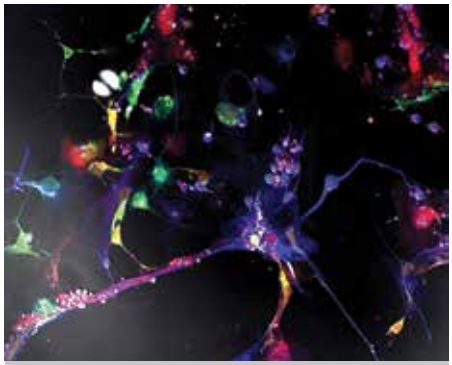
*Scanning electron microscopy of human choroid plexus. Daniel Mee, Human Neurogenesis and Progenitor Cell Migration Group.*



*Human differentiated SH-SY5Y cells. Birger Victor Dieriks, Human Neurogenesis and Progenitor Cell Migration Group.*

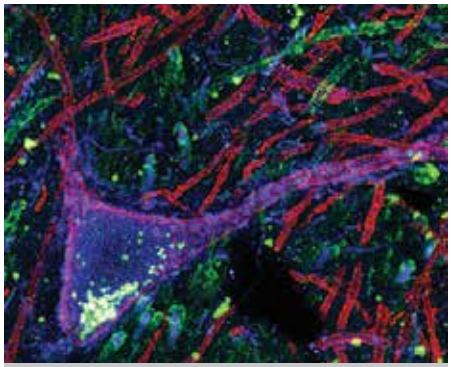


*Mixed culture of NT2 derived neuronal and pre-astrocytic cells. Christa Macdonald, Neuroengineering Group.*

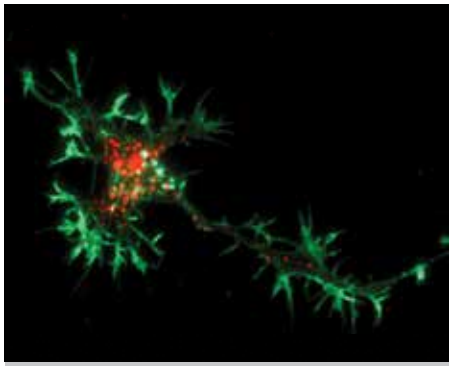


*Human skin cells are transformed into functional neurons. Kathryn Jones, Neural Repair and Neurogenesis Group.*

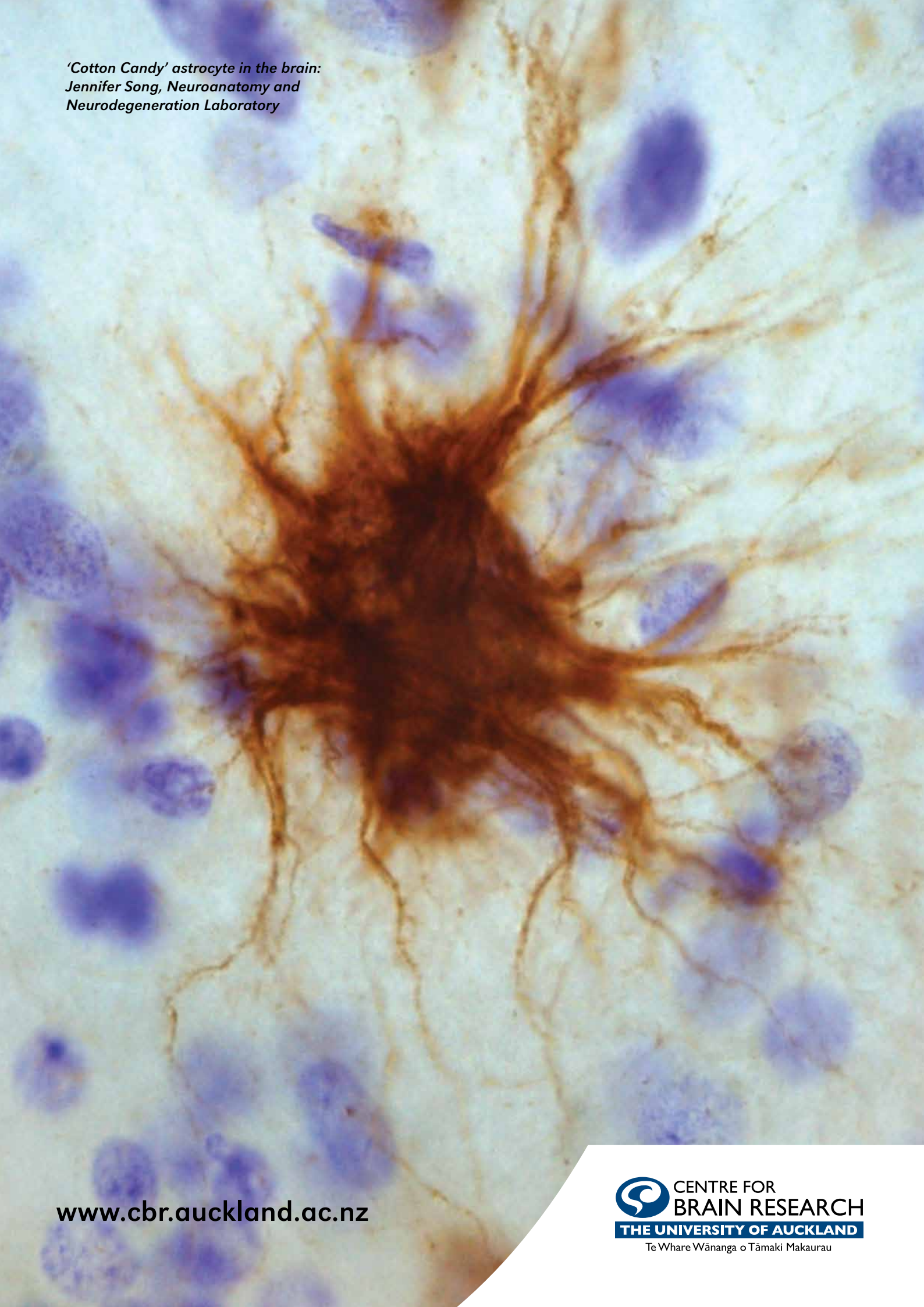
*Panel image of rodent hippocampus. Debbie Young, Molecular Neurotherapeutics Research Group.*



*Receptor labelling in the human globus pallidus. Brittney Black, The Human Neuroanatomy Group.*



*Structure of a cortical neuron. Tania Fowke, Developmental Neuroscience Research Group.*



*'Cotton Candy' astrocyte in the brain:*
*Jennifer Song, Neuroanatomy and Neurodegeneration Laboratory*

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