Welcome to the Florey Annual

Report from the Chairman of the Board, Mr Harold Mitchell AC, and the Scientific Director, Professor Geoffrey Donnan AO.

Medical research is a wonderfully creative and hopeful endeavour. As you look over our highlights of the last year, you will read of hope, resilience and determination. Medical research demands hope. This might sound rather unscientific but it is an essential quality for a medical researcher to possess – and for people living with brain diseases and disorders. Being hopeful is not naïve. We must all be capable of seeing a brighter future for humankind.

I am so proud to support their research. My donations are helping to reveal medicine’s final frontier – the mysteries of the brain. With one in four of us affected by an affliction of the brain or mind, I can’t think of a group of people I would rather support. The Florey’s scientists are seeking to improve lives, and to address some of the most horrible conditions like motor neurone disease and Alzheimer’s. I am regularly humbled by the ingenuity of the Florey scientists – and the sense of optimism despite the myriad challenges they face.

Without hope, we wouldn’t have our researchers working into the night as they chase a new idea – perhaps identifying the role of iron in the brain, or the way stem cells might cure Parkinson’s disease. They wouldn’t dare to remove small pieces of the brain to cure a patient’s epilepsy. They wouldn’t strive, relentlessly, to find ways to block the brain pathways causing addiction.

Donors who choose to support us come along on an exciting journey. As the Chairman of the Florey, I am regularly humbled by the ingenuity of the Florey scientists – and the sense of optimism despite the myriad challenges they face.

Here at the Florey, we are applying for and winning grants, attracting funds from philanthropists and securing the futures of our brilliant researchers.

As Harold mentioned in his message, this is my last year as Scientific Director. I will return to research in 2019. But before then, I would like to thank the Chairman and the Florey Board for their support and enormous interest in the scientific endeavour of the Institute. Thank you, also, to our donors. We depend on you to improve lives of those suffering now and to help us prevent people in the future from succumbing to the most unsettling diseases known to medicine.

From the Chairman

After another stunning year of discovery, I continue to be inspired by the 600 people here at the Florey, dedicated to improving the lives of others – and of those who help us in our quest.

We have so much support and this reflects a recent survey by Science and Technology Australia which found 94 per cent of the population believe Australian science and technology are important to their health and wellbeing. Ninety per cent agree that the very latest discoveries should inform our response to global challenges. Some eight out of 10 think we should invest more in research. How sensible!

We are tackling gender inequality and creating flexible working conditions. We are application for and winning grants, attracting funds from philanthropists and securing the futures of our brilliant researchers.

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The mood is buoyant and there’s a sense that our time has come. The brain is the most exciting 1.3kg of spongy mass. We wouldn’t be anywhere else.

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To block the brain pathways causing addiction.

Professor Geoff Donnan announced his intention to step aside as Scientific Director at the end of 2017. We will be building even stronger links to external scientific review – a task all medical research institutes should undertake if they are to remain relevant and competitive on the world stage. The reviewers were Professor Ataifar Buchan, the Dean of Medical Sciences at Oxford University; Professor Seth Grant, a professor of molecular neuroscience at the University of Edinburgh; Professor Sarah Dunlop, the Head of Experimental and Regenerative Neurosciences at the University of Western Australia; Nobel Laureate and cell physiologist Professor Bert Sakmann, and Professor Mike Caulfield, the Provost of the University of Tasmania.

The panel met with many staff members and professional groups before providing 11 recommendations. There was solid recognition of the great leadership of Professor Geoffrey Donnan who announced his intention to step aside as Scientific Director at the end of 2018. In 2019, Geoff will continue to conduct stroke research, for which he is internationally renowned.

As we undertake a global search for a new leader, the reviewers’ recommendations are shaping our approach. We will be building even stronger links with the University of Melbourne, Austin Health and the Royal Melbourne Hospital. Discovery neuroscience – that is lab bench basic research – will continue to serve the whole Institute, including a wide range of brain diseases. Our successful, translational research in areas like stroke, epilepsy, dementia and mental health will continue to grow and attract funding.

It has been a year of clarity and growth.

I congratulate all the researchers for their hard work, their imagination and hope.

From the Director
From strength to strength

Dr Ying Ying Lim is the 2017 Young Researcher of the Year for the Bethlehem Griffiths Research Foundation. Yen was recognised for her outstanding research in Alzheimer’s disease. The award is just one of a string of highlights in 2017 for this young researcher. Despite being just four years post-PhD, Yen has been involved in several prevention clinical trials and she has attracted more than $1 million in research grants. Yen is a born leader and media star, having been the face of the Florey’s AFL Brain Game when Collingwood played Essendon at the MCG. Yen grabbed the chance to promote the Healthy Brain Project – a major study of dementia which is seeking 5000 volunteers. To find out more, visit healthybrainproject.org.au

Reaching for the sky

Congratulations to Dr Dominic Hare, one of the ten Young Tall Poppy award winners announced by the Australian Institute of Policy and Science. Dominic, head of our Analytic Neurochemistry lab, has applied new ways of imaging brain chemistry to find the cells which die off in Parkinson’s disease. The implications of this are tremendous, because if we can find a way to prevent this reaction occurring, we could stop Parkinson’s disease in its tracks. Dominic also received the NHMRC Research Excellence award for highest ranked industry career development fellowship. Onward and upward, Dom.

Florey stars shine

A stroke of genius

Two leaders in emergency stroke care have fulfilled a dream – to bring a mobile stroke unit to Melbourne’s streets. The specially equipped ambulance contains a CT scanner, allowing paramedics to make a fast diagnosis at the scene of the patient’s stroke, accelerating treatment in the vital minutes following. The Australian first is the brainchild of old friends and colleagues, Florey Director Professor Geoffrey Donnan AO and Translational Neuroscience Professor Stephen Davis AM, from the University of Melbourne and Melbourne Health. The ambulance is based at the Royal Melbourne and has a 20 km radius. It attends about 40 suspected strokes each week. Geoff and Steve will oversee an analysis of the five-year, $8 million trial to assess the impact of the vehicle on patient outcomes and cost-savings resulting from reduced disability and health care costs.

What was I thinking?

Dr Lucy Palmer has been awarded a prestigious Senior Medical Research Fellowship by the Sylvia and Charles Viertel Charitable Foundation. Lucy will receive $1.225 million over five years to tease apart the inner workings of our brain’s basic wiring circuitry, looking at how we make everyday decisions. “We commonly ask ourselves ‘why did I choose to do that?’ and scientifically speaking, the answer is ‘we don’t know’,” Lucy says. Her results will greatly benefit the Australian community by helping us understand many diseases of the brain where decision-making is impaired, such as Alzheimer’s and Parkinson’s diseases, depression and schizophrenia.
Watching brain circuits fire

Dr Philip Ryan works in the Florey Institute’s unofficial disco division. To watch the images from his research is to see brains division. To watch the images of Washington, where he studied innovative genetic manipulation techniques. He learned to inject calcium indicator dyes into parts of a mouse brain, witnessing cells lighting up when they fired in response to drinking water or ingesting salt.

“Providing the framework for the underlying disease processes, like anxiety, depression, addiction.”

A passion for clinical science in a very witty and informative way. Bill Bryson also includes some very humorous tales about the scientists behind the discoveries and some of their eccentric behaviours.

Dr Martina Kocan shares with us her favourite book “Squash: A Brief History of Manoeuvred” by Vladimir Kozlov.

This professor of history took a “big picture” look at our species, trying to tell what it is about our nature and history that has led us from being a small population belonging to one amongst several primitive tribes to reach our present position where we dominate the planet. It is one of the great books, full of important insights that can change your views. And it is brilliantly written.

Florey in a Flash

Dr Martina Kocan

Martina is originally from Slovakia. She was born in Bratislava but has lived in Australia since the age of 10 after her family fled here in the 1980s during the Cold War. She sees Australia as “one of the last heavens on Earth” due to our multicultural cities, freedom to be oneself, and harmonious communities.

Colleagues Professor Ross Battergate, Dr Daniel Scott and Dr Akhter Hossain work with Martina in the Discovery Science beam. They examine how new drugs help brain cells communicate with the rest of the body, especially the heart and blood vessels.

“Other possible medical conditions might be fluid overload in heart failure, kidney failure, or liver cirrhosis, where patients can become really fluid overloaded”. In hospitals, such patients are sometimes put on restrictive diets but battle severe thirst sensations. They really struggle to keep to a certain amount of drinking, so if you could find a way to make them less thirsty, that could be useful for those type of conditions.”

A passionate mentor of the next generation, she is committed to fitting this responsibility around her laboratory work. She is a strong believer in loving what you do, which leads to success. “I just love seeing my students grow. They arrive not knowing anything and when they leave they are confident scientists. It also leads to strong collaborations down the track, although that’s not why I teach. I have former students at Oxford and in Singapore, for example. It builds great friendships.”

She is exploring why a potentially powerful drug for acute heart failure - the protein hormone relaxin – failed stage III clinical trials. She’s also examining if drugs targeting specific G protein-coupled receptors could be important in treating brain illnesses in the future, including Alzheimer’s and Parkinson’s diseases, epilepsy and schizophrenia.

Melbourne’s only Slovakian restaurant sadly closed down, but as Slovakian food and Polish food are quite similar, Martina and her family can still find a fix of borscht when she yearns for a taste of home.

Dr Martina Kocan loves skiing, mountain biking and other alpine-related activities. She was thrilled when she moved to Melbourne, from Perth, to discover Victoria had genuine mountains. She would love her son to share her passion for ice hockey, but admits he is currently teaching her about Aussie Rules football, and particularly the Tigers.

Dr Martina Kocan and her husband, Dr Martin Kocan, were born in the same hospital on the same day (after the maternity ward, they first met in high school). She says they almost shared the same birth date but birth date can be really annoying when buying plane tickets as people always assume there’s a mistake and there’s only one person. Martin is an electronic engineer. They have a son, Matthias, who has just started primary school.
Sixty minutes with...

“Dr Lachlan Thompson

“I admire Clare immensely. She is extremely dedicated to the science and is very organised.”

Clare and I are still competitive, as scientists are, but we are good willed about science and neither of us have Type A personalities. It’s not always smooth sailing and we can have frank discussions when we need to, but I think we both recognise that sometimes we have to step back for the long-term good of our work.

I admire Clare immensely. She is extremely dedicated to the science and is very organised - and someone has to be in a professional partnership. She has shown incredible resilience, having a child and then losing an entire year to battling ill health, yet she is still here, one of the top scientists in her field.

Away from the office, our families are friends and share social circles. I’m close mates with her husband, Davor, who also works at the Florey. At work, Clare and I catch up for regular coffees as a nice environment to discuss a range of ideas and professional issues. It’s a wonderful professional relationship.

Professor Clare Parish

“Lachlan is such a healthy sounding board. That’s one of the things I most enjoy about working together.”

I must say, it was very unusual, how we were both in Sweden at the same time. We were very aware of each other - another Australian in a lab 700 km away - but every time I went to do some work in Lund he was back in Australia.

We finally met in a pub for a pint and realised we were probably going to both come back to the Florey. When we arrived, it was a challenging period to integrate back into the Australian scientific community. They were not receptive to neural transplantation and the direction of research we were taking, so we weren’t supported to work together and in fact discouraged not to. But after a year or so, we finally teamed up.

We run our two labs separately but they are very overlapping. We co-supervise all our staff and students. Sometimes I actually drive more projects with his students than he does his own, and vice versa. It just depends how a project escalates and what the interest of an individual is, so we have a very strong trust and respect for each other’s research.

At the Florey, we are given great freedom to do the research we want. We have the freedom to drive our research in the direction we want to go and nobody ever says: “You can’t do this” or “The institute wants to go in a direction that is not aligned with what you’re working on”. That’s been a major attraction for us. Also, the animal facilities here are phenomenal, state of the art. We work with the animals that have compromised immune systems and need extra special care, and the housing conditions at the Florey are really the only ones in the country that can accommodate them.

Lachlan and I have both got a bit of each other's skill set, yet my strengths lie in developmental biology and stem cells and Lachlan's in neural transplantation. I think that's why it works so well. It can't optimally do my research without him and he can't do his research without me. That helps create boundaries on the work as well.

Lachlan is such a healthy sounding board. That's one of the things I most enjoy about working together. He will tell me very openly if he thinks something is a bad idea.

Mostly we are both highly supportive of each other's career development and, in such a competitive environment, it's nice to have support from somebody. Lachlan is the one who will say: “You know, you're really good at this, you should pursue that, it speaks to your strengths” or “Watch out, you're getting distracted, channel your energy better”. I love his honesty and frankness.

When I became ill with breast cancer, Lachlan was amazing. There was roughly 16 months where I wasn't able to work at full capacity, but he ran both labs. He would visit me at the hospital, at home or a local coffee shop when I couldn't get in to the Florey. And he'd be like: “Just touching base. This is what’s running; these are problems; how do you want to manage this?”. He saved me having to come in and manage the team. Instead, I was interacting just with him and he was running the info back to them. He was really great.
Your brain in a flash

Dr Simon James combines his polymath knowledge of chemistry, physics and biology to find causes of dementia. The secret to his success? A transparent, one-millimetre-long roundworm who would rather be in the soil than a Synchrotron.

**Aging is the biggest risk factor for a host of diseases, including dementia. Why?**

SuJ

One of the greatest mysteries is why the risk rises so dramatically as we age. Most people living with Alzheimer’s disease are 65 or older and for those over age 85, the risk rises to nearly 50 per cent.

**Surely ‘aging’ is a pretty complex phenomenon. How do you study the biology of ‘aging’?**

SuJ

The brain is a monstrously complex bit of biology, made up of roughly 100 billion cells or roughly half the number of stars in the Milky Way. Throw in myriad changes and individual experiences that accumulate over a lifetime and it becomes very difficult to identify the specifics driving age-related disease. Luckily, we are able to simplify some aspects of the brain’s biology with the latest clinical information to find causes of dementia. The secret to his success? A transparent, one-millimetre-long roundworm who would rather be in the soil than a Synchrotron.

**How useful can studying a worm really be?**

SuJ

Although the whole animal only has 302 of these ‘neurones’, we share an enormous amount of biochemistry, making it an ideal model organism. Neurones (the brain cells that die off in Alzheimer’s) are very active and generally are not replaced. This is true for our worms as it is for people. Compare a 2-stroke Victor lawn mower with James Bond’s Aston Martin Vanquish. S (my much-coveted car). The two machines are very different but both use internal combustion engines. So, while our human, Vanquish-like nervous systems do all sorts of important things, the worm’s humble, mower-like nervous system does not, many of the central, essential processes happen in both.

**So which processes are you actually studying?**

SuJ

I focus on how neurones manage the trace mineral iron. To build on the analogy above, in cell metabolism iron plays a role akin to a spark plug. If a spark plug is firing too much or too little, neither of those machines will run smoothly and eventually the machines will ‘mish’ the engine’s internals. Every cell in our body depends on iron to “fire” correctly but as neurones are so incredibly active they are more sensitive to “mish”ing than most other cell types. The long life of a neurone means there is greater opportunity for small misfirings to accumulate and cause trouble. We study how the worm’s neurones handle iron and use these insights to increase our understanding for what’s going on in the human context.

**What have the worms taught you about human aging dementia?**

SuJ

Just like humans, worms show changes in iron metabolism as they age. The cells can no longer handle iron properly – something like spark plugs wearing out with time and never being replaced. We have actually been able to see this happening in worms using the Australian Synchrotron. It may seem strange that we need a 400 metre-long, high powered X-ray microscope to study such a small creature, but it allows us to study iron biochemistry in a way simply not possible in humans.

**What’s next?**

SuJ

One of the best things about working at the Florey is the breadth of expertise. While we are chasing nitty-gritty iron biochemistry, other scientists are chasing down how our findings apply in a clinical context and all of this work together informing a search for a cure. We lead the world in identifying iron’s role in dementia. The team incorporates basic biology with the latest clinical information to carve out an understanding of the causes of this devastating disease.

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**Dementia’s research – a year of discovery**

**Melbourne Dementia Research Centre**

Federal Health Minister, Greg Hunt, launched the Melbourne Dementia Research Centre in October, establishing a collaborative team of researchers from the Florey and the University of Melbourne.

Headed by one of the world’s most cited neuroscientists, Professor Ashley Bush, the dementia centre has already had a major impact on Alzheimer’s research. The group has announced a trial to assess the impact of iron in the brain on the progression of Alzheimer’s disease. Ashley says: “The dementia centre will focus on integrating basic and translational research into dementia, with a special focus on clinical trials and clinical longitudinal studies.”

**Boosting Dementia Fellowships**

The Federal Government has declared dementia a priority research focus and funded the NHMRC Boosting Dementia Research Fellowships. Congratulations to the four Fellows in 2017 - Dr Thirhaut Rendler, Associate Professor Brad Turner, Dr Daniel Scott and Associate Professor Elaine Roberts. They have been awarded a combined $2.88 million over three years to continue their innovative research into gene-environment interactions, develop blood-based biomarkers to diagnose Alzheimer’s, produce next-generation receptor targeting therapeutics and improve high-throughput drug screens for frontotemporal dementia.

**Passing the sniff test**

Dr. Mathias Dutschmann wants to discover how we generate complex breathing patterns in the brainstem. His group has developed sophisticated ways to reproduce these patterns in the lab, like sniffing in response to airborne irritants. Significantly, the group has observed cell death in the brainstem occurring much earlier than in the higher brain regions responsible for memory loss and personality changes in Alzheimer’s. People in the early stages of dementia and motor neuron disease often have subtle problems with complex breathing patterns. Matthias believes these could be detected using a simple “sniff test” given by a GP. If a patient fails the “sniff test”, they could be recommended for further Alzheimer’s tests, speeding up diagnosis and aiding trial recruitment.

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**Victoria Fellowship**

Dr Erin McAllum has been awarded a prestigious, Victoria Fellowship to travel to the University of Bordeaux, France, to learn more about a specialised chemical imaging technique. This expertise she gains will then be brought back to Australia to further her research into dementia with Lewy bodies. You can watch Erin explain her work in more detail on our YouTube channel.

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The Florey Annual | The Florey Annual 2017

2017
In 2009, British army reservist Tia Cummins wondered amid the yelling and screaming of a bayonet training exercise if the ramped-up aggression was the best approach.

Tia, who’d been an army cadet since she was 14, was studying psychology at university at the time of the bayonet exercise. She tested her question about aggression in her final year studies, finding that soldiers who acted more aggressively in a military shooting drill had a faster reaction time but that they were not always more accurate.

This finding led to a fascination with military research and later the long-term affects of combat on the brains of veterans, the ‘cognitive casualties’ of war. Eight years later, Tia has completed a PhD at the Florey, discovering links between military veterans with traumatic brain injury (TBI), post-traumatic stress disorder (PTSD) and dementia.

A member of Professor Christopher Rowe’s laboratory, Tia has collated data from a five-year study into veterans and Alzheimer’s disease – a world-first in the field.

Studies had previously suggested that veterans with PTSD and TBI were more at risk of developing Alzheimer’s disease in later life than civilians. However, the mechanism in the brain that might be involved was never understood, and there were yet other studies that disputed the idea.

Collaborating with the University of California, San Francisco, and Austin Health, the Florey researchers recruited 127 Australian Vietnam war veterans aged 60 to 85 years, dividing them into three groups: those who had PTSD, TBI acquired in service in their early 20s, and a healthy control group. The men had full psychiatric assessments and cognitive tests for memory and attention. Their brains were scanned for two proteins that are the hallmarks of Alzheimer’s – amyloid plaques and tau tangles. The scientists tested brain metabolism “to see if brain cells were firing correctly” and took blood tests for genetic dementia risk.

They used magnetic resonance imaging (MRI) to look at brain structure and function, checking for any shrinkage in gray matter that would indicate Alzheimer’s and for small tissue tears in the white matter of brains of the veterans with TBI. “White matter is the ‘wiring’ connecting brain cells to each other and to the rest of the brain,” says Tia. “Specifically, we were looking for tears in the corpus callosum, which connects the two hemispheres of the brain, the part most at risk of damage due to head injury,” she says.

In 2015, Tia’s team published their findings in the journal Alzheimer’s and Dementia. The study showed that those with TBI who had no PTSD were at risk of developing Alzheimer’s disease with the same aggression as civilians, and those with PTSD were even more at risk.

“Many of the health issues we are seeing in this group of veterans, 50 years after their service, are preventable and I think it enforces the need to spend more on looking after troops as soon as they get back from Iraq or Afghanistan to address what could become lifelong issues.”

Tia Cummins

The Florey thanks Michael Ingram, 71, who is one of 127 Vietnam veterans, many with PTSD, who volunteered to be part of Tia’s research.

Michael received severe head injuries when he was 21 in 1969 when a rocket grenade hit the tank he was driving.

Half a century later, Michael knows that when he’s tired or run down, the PTSD is likely to reappear. “My secret to beating it is to keep my mind and body active,” says the retired landscape gardener.

“I’ve been really happy to be part of Tia’s research. I’ll do all I can to help the guys coming home now from war,” Michael says.

The veterans’ head injuries ranged from being shot through the head, blast exposure and motor vehicle accidents to non-combat-related injuries sustained playing football in Vietnam.

The findings have been revealing – with mixed news for veterans.

“We’re not finding the proteins associated with Alzheimer’s disease. We haven’t left any stone unturned – we looked extensively for those proteins but we’re not seeing them.”

Cognitive casualty

More surprising for Tia was the data from the TBI group, which showed that those who’d sustained moderate and severe head injuries during their army service did have thinking and memory problems, but that these did not appear related to the dementia process.

“It looks like they were from the time of injury from the actual impact, things they’ve actually had to cope with and live with. Somehow, they have been able to compensate for the injury,” she says. “It shows how well these guys have learnt to adapt.”

The study showed that the men’s health issues are preventable after troops as soon as they get back from Iraq or Afghanistan to address what could become lifelong issues.

Tia is passionate about raising awareness around the long-term effects of combat on veterans, speaking at the RSL and conferences here and overseas, spreading the word about what she calls the invisible wounds of war.

The study was partly funded by the US Department of Defense.

Richards is a very talented author who is able to guide the reader through a very difficult and important subject. Very rarely do we read biographies of mental illness communicated so well, and I think Richards shows the reader to clinical experience what it is like to live with such issues.

“Madness, A Memoir” by Kate Richards

* Our cover photo shows Michael in our CT scanner.

Tia shares with us her favourite book: "Madness, A Memoir” by Kate Richards.
Where our work begins

Neale Daniher has been battling what he calls ‘the beast’, motor neurone disease, for almost four years, and is the driving force behind the FightMND Foundation.

Following the ‘call to arms’ for people living with MND to donate skin cells, Neale was the first to volunteer at Calvary Health Care Bethlehem. Neale is one of many people from Victoria and around Australia who have come to Melbourne to donate cells at Calvary Healthcare. The cells are transported to the Florey’s MND laboratory, run by Associate Professor Brad Turner, where our work begins.

Inside the lab: fighting the beast

A renewed hope for a treatment

Dr Christopher Bye and his team produce motor neurones from patient skin cells, like Neale’s. The search for treatments has been limited in the past because we could not model the most common form of MND in the laboratory. The development of stem cell technologies now allows us to test drugs directly on individual patients’ motor neurones. This new generation of research offers renewed hope for a treatment.

The robot is fast tracking our search

Thanks to the support of FightMND, the Victorian Government and Nick Baldi Constructions, drug screening is now conducted in a state-of-the-art facility, including a $1 million automated liquid handling robot. We have always tested a range of existing drugs, hoping they may slow down the disease’s progress. The robot is fast tracking our search. Instead of testing a few drugs in a week, we can now test hundreds per week. Every drug tested is one step closer to a treatment for individual patients.

Evaluating the effect of different drugs

Once the robot has treated the patient’s motor neurones, a high capacity fluorescent microscope images the neurones to evaluate the effect of the different drugs being trialled to keep patient’s motor neurones alive.

A promising lead...

When a drug is deemed to be a promising lead, Chris will then test it in pre-clinical MND models, before progressing to human clinical trials. Drugs already in MND clinical trials include a copper-binding drug and anti-retroviral drug similar to drugs already used to treat the human immunodeficiency virus.

The Florey’s new high throughput drug screening platform will dramatically fast-track the progression of new treatments from the lab bench into the clinic.
What makes a memory?

Filoney Honorary, Associate Professor Tomás Ryan, is collaborating with Dr Lucy Palmer and Professor Anthony Hannan. While in Melbourne recently, he presented the first of the Florey’s 2018 public lectures, “In search of lost time – What makes a memory?” Tomás is fascinated by memories – how we make them, how we lose them and, importantly, if we do lose them, can we regain them? The Florey’s Dr Tom Keeble sat down with Tomás for a chat about his work in Dublin and his initial visit to the Florey.

TR In your lecture you described memory storage as being like the dark side of the moon. Can you answer the question posed in your lecture – what makes a memory? Does a group of cells, when activated, recall a specific memory that you can point to and say – there is my first kiss, there is my wedding day, there is the birth of my child? 

TK [laughs] If I could answer that question I would be working on something else. The reality is that we do not currently know how memories are really stored in the brain. It is my hope that with further efforts we can begin to make some progress in answering this question. I think it is fair to say that it is not just about identifying the cells involved. It is also about understanding the meaning of those cells to the organism relative to its environment.

TR Your work in mice has shown that it is possible to implant ‘false’ memories, and to retrieve old memories that were thought to have been ‘lost’. This relies on amazing technologies like optogenetics and viral transduction. Will we ever be able to apply these or similar techniques in humans, for example to treat addiction, post-traumatic stress disorder or amnesia? 

TK It is possible to use these techniques in humans right now. However, we do not yet know the long-term side effects of the transplantation of these constructs to the human brain. Moreover, the implantation of optogenetics requires invasive surgical procedures. Therefore I think it much more likely that optogenetics will primarily be used as an experimental technique in fundamental research. It is likely that other, less invasive, but similar techniques will be developed for treatment of human conditions.

TR You’re currently working on a project with Dr Lucy Palmer, who you described as one of only a handful of people in the world able to do what she does. Can you briefly describe the aim of your current project with Lucy and why you chose to embark on this collaboration? 

TK All good collaborations grow from the creative collision of different ideas. You move from a broad question and a rough intuition to a specific experimental design, and hopefully, a clear answer. Lucy Palmer, and her research group at the Florey, are excellent collaborators not only for their expertise but also because of their open minded and progressive attitude towards doing new and innovative science. The initial, and evolving, aim of our current project is to more deeply understand how information is encoded in engram cells during learning.

TR Your hypothesis that memories and instincts share a common informational language is fascinating. You propose that if we can change memories, we should be able to change, for example, some of the more damaging male innate instincts and behavioural disorders. This sounds a bit like “A Clockwork Orange”, would you care to elaborate on that? 

TK I am sceptical of any deterministic description of behaviour. Instincts are fundamental to how we think, and evolved for ecological systems and social environments that (I hope) are no longer relevant. Good education systems modulate and temper our instincts to make them manageable in the current world. It has taken us a very long time to get to a place where many of us have the privilege of educating our children to manage most of their instincts and emotions whilst also learning a great deal about their world in order to become effective individuals. We can greatly improve this progress in the future by working to integrate the outcomes of research in neuroscience and psychology with education.

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TR What do you hope will be your scientific legacy?

TK To produce something that students choose to read whether it’s on their course syllabus, or not.

TK Juvenile amnesia is where kids essentially forget their first 3-4 years of life. As the dad of two young kids, what childhood memory would you most like to give them access to now, or when they’re adults? 

TR The first question that they had but could not verbalise, and then forgot.

TK What do you hope will be your scientific legacy?

TR To produce something that students choose to read whether it’s on their course syllabus, or not.
Quantitative autoradiographic imaging of the serotonin 1a receptor in the human prefrontal cortex – the seat of our personality, and our rational, planning, thinking brain. Warmer colours (yellow/orange/red/black) indicate high receptor levels, and colder colours (green/blue) indicate lower levels. Fascinatingly, our scientists have observed anatomical differences in serotonin 1a receptor distribution throughout the cortex, with three distinct layers of binding.

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Image credit: Dr Geoff Pavey (Biological Psychiatry)

Paul Adlard: zinc ahead

1. Each year, the National Health and Medical Research Council chooses 10 projects it has funded to showcase the very best in Australian medical research. Associate Professor Paul Adlard and his team are researching the role of metals in the healthy ageing brain.

The next step? Novel compounds to prevent age-related cognitive decline.

NHMRC investment: $789,733.

2. Impaired memory is one of the most debilitating features of ageing. We want to understand how zinc is critical for normal cognitive function and how restoring zinc levels in the brain could lead to improved memory as we age.

3. Losing brain function does not need to be inevitable. We are motivated by the plasticity of the brain. I strongly believe that with sufficient knowledge and insight we can harness the brain’s complexity to improve its function and promote healthy, happy ageing.

4. The aged brain will perform well if help is offered: Simple behavioural modifications through to pharmacological interventions can positively impact brain structure and biochemistry, resulting in improved cognition across age and also in disease.

5. A new drug could regulate zinc: We know zinc plays a critical role in regulating communication between brain cells. The highest concentrations of zinc have been found among the brain cells in the hippocampus, one of the key centres of learning and memory in the brain. If there is a zinc deficit it precipitates a decline in cognitive function, and we can target this with new drugs.

6. Synapses need zinc: I have discovered that zinc at the synapse—the signalling connection between brain cells—is vital for normal learning and memory. So this is the focus as we target a medication that restores zinc levels. A commercial partner is on-board and there is much optimism for clinical translation.

7. Next steps: What is the optimal therapeutic approach to achieve prolonged and healthy cognition throughout life? I’m focussing in on the metal transporter proteins that alter with age while also broadening out to large-scale population studies to determine whether we can predict cognitive decline by identifying specific variations in metal transporter proteins.

Associate Professor Paul Adlard works with Dr Victoria Perreau, Dr Feng Chen, Ms Krista Dent, Ms Amelia Sedjautara, Ms Lydia Gunawan, Ms Lisa Bray and Mrs Kali Perrones.

“I continue to be amazed at how extraordinary the human brain is, how it defines us, and how easily the capacities it affords us can be taken away by disease, injury or ageing.”
Calm after the storm

Flory researchers are developing new medicines to treat childhood epilepsy caused by genetic mutations. At the helm are Deputy Director and NHMRC fellow, Professor Steve Petrou, and his colleague Associate Professor Chris Reid.

Chris Reid has researched epilepsy for more than 15 years, a basic scientist driven by the urge to solve biological mysteries and garner fundamental knowledge to further medical science. It was a huge eye-opener for him to receive an appeal from, then to meet the parent of a baby girl who was having severe seizures.

“It’s rare for me to be in contact with patients. It was a real insight, working in my ivory tower doing my research on biological puzzles,” Chris says. “For families, having a child with epilepsy is devastating.”

Epilepsy, an electrical disorder of the brain causing debilitating seizures, affects 1-2 per cent of the population. It arises in many forms. Ebony had her first seizure when she was three months old. Her mother Alli watched alarmed as her baby daughter frothed at the mouth, stiffened, convulsed and struggled to breathe before being airlifted to hospital. Ebony was hospitalised for 11 weeks after the second seizure, with Alli staying in a nearby ward, as husband Tim took leave to care for the couple’s four-year-old son. Ebony was weaned by up to 20 seizures a day as doctors desperately tried various medications. The medicos could only say that Ebony had a rare condition but that they didn’t know what it was. Ebony went home on four medications all of which carried warnings about possible side-effects, including irreversible eye and liver damage.

Troubled by the amount and nature of the drugs being administered to his daughter and keen to find out if there were more specific, effective medications, Tim contacted a paediatric doctor who’d met on an overseas work trip who practised at a Munich children’s hospital.

He mentioned ‘de novo’ (‘of new’) mutation Ebony had been diagnosed with - HCN1 - and was told there was a scientist in Melbourne whose HCN1 research was known to German researchers.

Chris Reid was keen to help. His first task was to create a means to study the specific disorder, in this case a specially engineered mouse model of the HCN1 mutation.

“We are pretty excited about this,” says Alli. “And very thankful he is taking it on.”

Says dad, Tim: “Our hope is that we can rationalise Ebony’s medications and find something that can help her better. We’d be happy if anything that could help her came out of the research.”

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Ebony was discharged home when she was five months old, but now had to take five medications, with the aim of reducing this number and keeping a close eye on side-effects.

Ebony had been diagnosed with - HCN1 - and was told there was a scientist in Melbourne whose HCN1 research was known to German researchers.

“Origin” by Dan Brown

Chris shares with us his favourite book “Origin” by Dan Brown

“After a light-read on Monday - Chris studied new book ‘Origin’ is an interesting take on the evolution of artificial intelligence.”

“The upside is that we know precisely what the genetic mutations are and can study the mechanisms to understand the root cause of the disease, and deliver a therapy, rather than just treating the symptoms.”

Steve and colleagues have entered an exciting new phase; turning the fruits of their research into gene therapies. He has founded two companies in the US - one with early clinical trials on the way, and the other, preparing trials for a new type of customised gene therapy in a few years.

Gene therapy for Ebony’s epilepsy is one of Tim and Alli’s dreams.

“We’re happy if anything that could help her came out of the research.”

Pictured above: Tim, Alli, Lachy and Ebony.

Ebony’s epilepsy, potentially extending to therapies for other sick kids.

Chris’ work into childhood epilepsy overlaps with that of fellow basic scientist and Deputy Director, Professor Steve Petrou.

Steve is also investigating “de novo” mutations - new genetic mutations found in children but not in their parents, which can cause rare yet very severe epilepsies.

“There’s a massive clinical need for these children - they’re falling through the cracks,” Steve says. “No therapies work, creating a huge burden in society and for the carers. These children need round-the-clock care. It’s a massive medical problem, even though the mutations are rare.”

Steve is focussing on mutations in other excitability genes, one of which causes Dravet syndrome, in which seizures begin in the first year of life and are prolonged. “Some of these kids can live to 30 or even 40 but a lot will die of what’s called SUDEP, sudden unexpected death in epilepsy - it’s like the Sword of Damacles hanging over them and their parents,” he says.

“Our hope is that we can rationalise Ebony’s medications and find something that can help her better. We’d be happy if anything that could help her came out of the research.”

And if it could help other people,” adds Alli.

The targeted approach may help with Ebony’s care, but beyond this may provide a broad brush understanding of the mechanisms underlying epilepsy-caused by genetic mutations. At the helm are Deputy Director and NHMRC fellow, Professor Steve Petrou, and his colleague Associate Professor Chris Reid.

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Dr Robyn Brown was researching cocaine addiction at the university in Southern California in the US when she looked around one lunchtime at the preponderance of obese people in the canteen and wondered. A typical canteen lunch was a burger-sized ‘sandwich’ with fries, a sugary sweet soda and a packet of potato crisps to follow. Colleagues often expressed a desire to eat more healthily, but never seemed to change. Was the high-fat, high-sugar diet causing changes in the brain that made such food addictive?

Curious, Robyn switched focus to investigate food addiction. In a study finalised when she returned to the Florey, she found that a proportion of rats that had become obese by eating the rat-equivalent of junk food, displayed very similar behaviour and had the same activity in brain cells of the so-called ‘reward centre’ of the brain as did cocaine-addicted rats. She is now looking more closely at what changes high-fat high-sugar foods make to this part of the brain.

The ground-breaking research has attracted attention. Obesity is new in epidemic proportions in Australia. Latest statistics show nearly two-thirds of Australian adults (17.2 million people) and about a quarter of Australian children are overweight or obese. Obesity is a major risk factor for cardiovascular disease, type 2 diabetes, some cancers, bone health and dementia.

‘Food addiction is a potential explanation for why our current approach to obesity isn’t working,’ Robyn says. ‘However, it is still a controversial concept in the scientific literature,’ she says.

Overeating is one of a number of ‘behavioural’ addictions, including online pornography, gambling and gaming addictions, sex and shopping addiction. Each is attracting both public interest and scientific scrutiny. But can they be regarded in the same way as the irresistible physiological drive to abuse narcotics, for example?

Gambling, porn and alcohol

‘Behaviourally there are a lot of similarities between problem gamblers and problem drug and alcohol users for example, in fact a number of medications used are common to both,’ says Andrew. ‘Drugs used to treat alcohol abuse disorder are also used to treat gambling disorder – that’s telling you that there’s a chemical similarity in the brain underlying those different manifestations of a compulsive behaviour.’

Cambridge University scientists scanned the brains of addictive pornography users and found that the reward centres of their brains reacted to seeing explicit material just as a person with alcoholism might react seeing an ad for alcohol.

The brain’s reward circuit, a network of neurones, is an evolutionary device that ensures you repeat behaviour that’s good for survival, such as eating and procreating. But drugs of abuse act on the same network. Because the euphoric experience they bring is relatively short-lived, a strong desire to repeat the experience occurs. The neurotransmitter dopamine is released in the reward circuit. The trade-off for the euphoria is the come down.

Addiction is defined by Andrew as a transition of a motivated behaviour into a habit and then a pathological habit. There is another common theme: damage.

‘Drug and alcohol abuse, combined, costs the Australian economy $55 to $60 billion a year.’

This includes costs to the judicial system, health system (including the cases of organ damage and cancer; hospital, emergency department treatment, GPs, lost productivity, road trauma, harm prevention programs, death, child maltreatment and family abuse predominantly by men. Alcohol abuse is one of the main causes of early onset dementia.

Nicotine addiction adds tens of billions of dollars more to the economic bottom line.

Entwined with the financial and health burden of addiction is the haunt-like caused to the people close to substances abusers, the effect on society more broadly, and the stigma felt by addicted people themselves.

Andrew’s focus is on alcohol addiction, in particular, relapse.

‘ Globally alcohol is the leading cause of death in people aged 15 to 49, the most productive sector of society. The so-called “ice epidemic,” in terms of the number of people affected, is a powerful comparison.’

‘Alcohol is under-recognised now and has been historically for a number of cultural and legal reasons – drinking is almost a national pastime in Australia. People who abuse alcohol are thought of as having a flawed character but it’s not the case – it’s a genuine disease and should be recognised as such.

‘There are only three pharmaceuticals on the market now for alcohol addiction, and none of them work well at a population level.’

Andrew heads a team of more than 20 addiction researchers who use animal models to interrogate addictions including alcohol, food, cocaine, methylamphetamine and opiate addiction.

‘We are trying to identify novel therapeutic targets.’

Andrew’s own laboratory was the first to show the role of orexin, a peptide in the brain implicated in the cues that prompt alcohol relapse behaviour. A common theme in alcohol addiction is a period of months or years at abstinence being undone by having “just one drink” – a process known as cue-mediated relapse.

Eleven years later, Andrew is hoping to embark on a small-scale trial in patients at St Vincent’s Hospital of a drug developed by his team, orexin receptor 1 antagonist, which blocks the action of orexin, which should help prevent relapse. The drug was originally developed and approved to counter insomnia. ‘Based on our data on dopamine, we now see alcohol users with drug and alcohol problems. That’s really exciting.’

Along with other Florey scientists, Andrew also identified a critical role for a peptide called relaxin3, demonstrating that the neurones producing relaxin-3 interact with the same reward circuit. But rather than the cue-mediated relapse brought on by orexin, relaxin-3 is linked to relapses driven by pleasurable experiences. Having patented this as a therapeutic target, the scientists are working with overseas collaborators to find a small molecule with drug-like properties to develop therapeutically.

Recently, Andrew’s laboratory, collaborating with the Monash Institute of Pharmaceutical Sciences, identified another therapeutic target involved in relapse called the muscarinic M1 receptor.

Lean rats

Robyn is pressing on with her studies, trying to see if it’s possible to change the brains of obese-prone rats to be like those of obesity-resistant or lean rats. She and her colleagues will soon trial a compound known to reset the addictive environment in cells to normal in cocaine and nicotine addiction, and other compulsive disorders. If it works, clinical trials in people could quickly follow.

The idea that food can change the brain has many ramifications.

‘We know that this high-fat, high-sugar diet affects young kids’ ability to learn, and that there are associations between poor diet and the population with Alzheimer’s disease,’ Robyn says.

She is also working with a dietitian from NSW to test a low-salt diet. ‘We found in humans that when we reduced salt intake, and the sodium content in the diet, we had a reduction in the craving for salt and for the things that contain salt.’

Andrew heads a team of more than 20 addiction researchers who use animal models to interrogate addictions including alcohol, food, cocaine, methylamphetamine and opiate addiction.

The role of salt

Salt is necessary for bodily functions, including controlling muscles and regulating the balance of body fluids – the amount of water in the blood – which needs to stay within a small range and which is addictive. Excessive salt consumption can contribute to cardiovascular and other metabolic problems.

‘We think there might be a link between the circuits that drive this fundamental instinctive behaviour of seeking out salt and seeking out other reward influences so we’re researching that as a very basic condition and a more inclusive behaviour’, Andrew says. ‘Clearly it’s behaviour that’s been conserved over millions of years of evolution.”

The researchers have preliminary data that the preference for salt changes in obese-dependent mice, which is backed up in human studies. The high salt content would, of course, be an invasive feature of the menu of that canteen in South Carolina.

The addicted brain

“There’s something distinct about the addicted brain –...there’s an incredibly addicted brain – distinct about the preponderance of obese people in the canteen and wondered. The Florey’s research has attracted...about a quarter of Australian children are overweight or obese. Obesity is a major risk factor for cardiovascular disease, type 2 diabetes, some cancers, bone health and dementia.”

As the Queensland community of his musings about how mankind has evolved and how we’ve become the dominant species on the planet and the consequences of that. The Florey Annual 2017
A clear window into a patient’s brain

Florey researchers are leading the world as we look inside the brain like never before using sophisticated imaging techniques. The excitement is palpable; the implications for patients, profound.

Associate Professor David Abbott hunches forwards in his office chair, mousing and clicking around his computer screen with his renowned intensity and eagerness.

"Look at this! This is really cool..." he enthuses as he brings up two images of squiggly lines jiggling across the screen. In the ‘before’ image, the jumbled traces of the brain’s electrical activity dance wildly. In the ‘after’, the lines are more serene, with the exception of a few jagged peaks arising like rocky outcrops from an otherwise calm ocean.

David is excited for a reason – together with Professor Graeme Jackson and the epilepsy imaging team, they are the first researchers in the world producing such accurate traces of people’s brain activity while they lie inside an MRI scanner. "The end goal is to help our epilepsy clinicians diagnose patients faster, more accurately, and to develop new treatments targeting certain epilepsies that affect specific brain networks" says David.

So how has David developed such detailed images?

By eliminating the tiniest movements that interfere with the brain signals obtained, David is producing images of exquisite clarity. Even movements as tiny as a patient’s pulse can obscure the results.

David corrects the signals using a specialised set of three motion detection loops placed on the patient’s head, one in each axis, in addition to the standard recording electrodes on the electroencephalogram cap.

The specialised carbon fibre loops, which measure voltage changes induced by movement in the MRI scanner’s strong magnetic field, were designed and constructed by Florey electrical engineer Steven Fleming.

By removing the spurious movement effects from the patient’s brain’s electrical trace, the team can much more accurately pinpoint the abnormal electrical discharges that might be the crucial clue in diagnosing a patient’s epilepsy.

Commercial partners are interested in this innovative technology.

German EEG manufacturer Brain Products GmbH is currently evaluating the technology, in the hope that the rest of the world can catch up and begin to improve their epilepsy imaging.

When diagnosing someone with epilepsy, the brain’s electrical discharges are only one clue. The team also simultaneously scan the brain’s blood oxygenation, so called functional MRI. This gives them a precise location for the activity’s source, either focal, or perhaps in a particular brain network.

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One such ‘network’ epilepsy is Lennox-Gastaut Syndrome.

Lennox–Gastaut Syndrome (LGS) is a severe, disabling epilepsy, characterized by frequent seizures. The condition typically begins early in life, leaving children severely disabled with recurring seizures throughout their adult life. LGS is hard to treat, and the seizures often result in developmental regression and cognitive impairment. It is not uncommon for middle-aged patients to require full-time care in a nursing home.

PhD candidate Aaron Warren, along with Austin Health neurologist John Archer have been using the motion-corrected simultaneous fMRI/EEG developed by David Abbott’s team to scan LGS patients. They believe they have identified a structure deep in the brain that may be responsible for the seizures.

Using deep brain stimulation, a common treatment for Parkinson’s disease, the team are planning a clinical trial to insert stimulating electrodes deep into patients’ brains, with the hypothesis that activating this structure will inhibit the brain’s aberrant electrical activity.

Prof Graeme Jackson, head of the Florey’s advanced epilepsy imaging team, says "Reducing seizure frequency and severity should result in much better long term outcomes for these patients and their families. We really think we’re pushing the boundaries of how good this technology can get, which means we can treat more people with greater success."

Several brain networks were discovered to be associated with the brain’s spiking electrical activity in subjects with absence epilepsy. Each row in this picture maps a network of brain regions with a distinct time-course of spike-related activity. Warm colours indicate increased activity, cool colours a decrease.
If not us, then who?

Dr Jennifer Hollands, a postdoctoral researcher in the Neurogenesis and Neural Transplantation laboratory, visited Canberra recently to attend the two-day ‘Science meets Parliament’ event. Run by Science and Technology Australia, it brings together key decision makers, scientists and technologists from all over Australia to promote the role of science, technology, engineering and mathematics (STEM) in Australia’s future prosperity.

‘Scientists and technologists are solution makers’ – inspired by these words, I met with South Australian Senator Stirling Griff and his advisor.

My research, with Associate Professor Lachlan Thompson and close collaborator Associate Professor Clare Parish, aims to develop a cell replacement therapy to treat Parkinson’s disease. We use human pluripotent stem cells to generate dopaminergic neurons – the type of brain cells lost in Parkinson’s disease. Our aim is to use these lab-grown brain cells to treat Parkinson’s patients and we are moving toward clinical trials in the next two to three years.

Meeting parliamentarians in Canberra gave me the chance to hone our pitches, even down to a 30 second pitch! And the gala dinner with parliamentarians at Parliament House was a great chance to put these skills into practice in a relaxed atmosphere.

Professor Emma Thompson, director of Science and Technology Australia, highlighted in her National Press Club address that ‘scientists and technologists are solution makers’. Inspired by her words, I met with South Australian Senator Stirling Griff and his advisor. The meeting was really interesting, giving me a rare insight into how parliament runs. I pitched our cell therapy-solution to treat Parkinson’s disease and also highlighted some of the roadblocks we researchers face. I explained how our work towards early phase clinical trials has highlighted some major hurdles for the translation of stem cell-derived therapies from the bench to the bedside. Senator Griff took these concerns and he and I are working together to tackle the underlying issues.

It was an overwhelmingly positive experience and I’d recommend the event to researchers at all stages of their careers. Science and technology are so important for Australia’s future and we need to ensure it becomes and remains a top priority for governments. This event has made it even more clear to me that we (researchers) need to be advocates for STEM. If not us, then who?

Smashing gender assumptions in science

Dr Amy Heffernan is a feminist, science communicator and NHMRC-ARC Dementia Research Development Fellow in the Molecular Gerontology laboratory.

In July 2017 she was named one of 30 ‘Superstars of STEM’ – smashing society's gender assumptions about scientists and increasing the public visibility of women in science, technology, engineering and mathematics (STEM). We asked Amy to report on an action-packed year.

In July 2017, Science and Technology Australia launched the inaugural Superstars of STEM program. This 12-month program aims to raise the profile of Australia’s most dynamic female science and technology researchers and professionals. I was one of 30 successful women selected from more than 300 applicants drawn from science, technology, engineering, mathematics and medicine disciplines across Australia.

Superstars of STEM was founded on the principle that visibility matters in achieving equality – you cannot be what you cannot see. Girls and boys have an equal interest in STEM until the age of 11 when girls’ interest starts to wane. The lack of visible and accessible female role models is a key factor in maintaining girls’ enthusiasm for STEM, and ensuring young women see STEM as a viable career option. As such, one of the main objectives of the program was to create a cohort of visible and relatable female role models at the national level.

As part of the program I have received extensive training in public speaking, storytelling, communicating with influence, and social media; been involved in outreach activities, including mentoring, high school talks, and increased social media presence (you can follow me on Twitter @DrHeffo); and attended national face, including the Science and Gender Equity (SAGE) Symposium in Brisbane and Science Meets Parliament in Canberra.

Diversity brings unique perspectives to STEM, increasing the probability of creative and innovative solutions to the world’s grand challenges. Enthusiasm and support for the program has been overwhelmingly positive. In February 2018, the Australian Government committed resources to expand the Superstars cohort to 60 women per year for the next 4 years.

However, much work remains to be done. It is essential that equity and diversity initiatives move away from “fixing women” via upskilling, or stuffing more young women into a pipeline fill-to-bursting at the junior levels, and redress the structural and sexual barriers that prevent the retention and promotion of women. Australia’s future depends on it.

Superstars of STEM was founded on the principle that visibility matters in achieving equality – you cannot be, what you cannot see.
Whether it has been designing and building electronic apparatus to be used in experiments, repairing electronic or mechanical pieces of equipment, maintaining and troubleshooting computers – be it hardware or software, rescuing speakers with audio-visual nightmares in the lecture theatre, or helping out in so many other ways, Simon Miller has been the go-to man in the Florey for the past 37 years.

Always with good-humour, utter willingness and a ready smile, no problem is ever beyond Simon to have a go at tackling. So many scientific projects and discoveries would not have occurred without his skill, ingenuity and practical knowledge.

Simon Miller is one of the true legends of the Florey Institute.

— Professor Michael McKinley
The Florey Institute of Neuroscience and Mental Health acknowledges the traditional owners of this land, the people of the Wurundjeri people and the Kulin Nations. We pay our respects to their elders, past and present. We would like to acknowledge that our three sites rest on this precious land.

The Florey Institute of Neuroscience and Mental Health is one of the largest brain research centres in the world and the biggest in Australia. Our scientists share a common goal - to improve people’s lives through brain research and, ultimately, to influence global wellbeing and health economics.

Neuroscience is an area of medical research attracting enormous attention as our understanding of the brain rapidly evolves. Internationally, populations are ageing and there is a sense of urgency to find causes, treatments and cures for conditions affecting the brain and mind. We are addressing these conditions to avoid suffering and to contain health-related expenditure.

The Florey is a world leader in imaging technology, genetics, stroke rehabilitation and epidemiological studies. Mental health research is a growing focus with psychotic illnesses and neurodegenerative diseases demanding attention.

We study:

- Addiction
- Alzheimer’s disease
- Anxiety
- Autism
- Bipolar disorder
- Cardiovascular disease
- Concussion
- Depression
- Epilepsy
- Huntington’s disease
- Motor neurone disease
- Multiple sclerosis
- Parkinson’s disease
- Schizophrenia
- Stroke
- Traumatic brain and spinal cord injury

To keep up to date with Florey events, news and research, visit florey.edu.au or email: info@florey.edu.au