ADDICTION

What happens in the brain when we become addicted?

Professor Andrew Lawrence heads the Florey's addiction team
see pages 4-5
As the festive season approaches, the Florey’s scientists are heads down, fingers to the keyboard, applying for precious grant funding to help secure their employment for another few years.

Of course, the Florey does all it can to support our researchers but at the end of the day, the National Health and Medical Research Council supplies scientists’ wages. Christmas can be a tough time, wondering if one’s grant application will be successful, hoping to continue a promising advance in brain disease or a treatment for mental illness.

With this in mind, I am very excited to tell you about a wonderful new initiative called the Florey Brains Trust.

A unique fundraising group is being created, led by some truly great Australians. These well-known ambassadors are soon to help us spread the word about the Florey and our efforts to build a secure endowment for the Florey’s future. We look forward to making an announcement soon.

If you are interested in joining the Brains Trust, please visit www.floreybrainstrust.com.au or call 1800 063 693.

We are asking members to:

- Encourage family, colleagues and friends to join the Florey Brains Trust and to give generously.
- Keep in touch with the great work happening here and to give generously.
- Come along to our events and build the network of people who care about brain health.

The Florey Brains Trust is headed by Ross Oakley AM, the ex-St Kilda great and former CEO of the AFL. He is doing a wonderful job as our Foundation Council Chairman.

I urge you to join. We have some truly fascinating events planned exclusively for members involving social and informative opportunities to listen, share and enjoy.

When you join the Florey Brains Trust, you will be a member of something special.

Yours truly at this joyous time of the year,

Geoffrey Donnan
Director, the Florey Institute of Neuroscience & Mental Health

"We need to do all we can to help those with a suspected stroke to receive fast, expert assessment – wherever their location."

The Hon Sussan Ley

**Time-critical stroke care for Albury**

People living in the Albury Wodonga region who suffer a suspected stroke will now receive expert neurological opinion from Melbourne – without leaving their hospital bed.

The new stroke telemedicine program was launched by Federal Health Minister, Hon Sussan Ley MP and Florey Chair, Mr Harold Mitchell AC.

“"This service is vital when you consider that over 400 people in the Albury Wodonga region suffer a stroke each year and approximately 250,000 Australians are living with the consequences of stroke," Ms Ley says.

“It is the leading cause of long-term adult disability with about 50 per cent of survivors dependent on others to help them with everyday living. For this reason alone, we need to do all we can to help those with a suspected stroke to receive fast, expert assessment – wherever their location.”

The Florey has developed the stroke telemedicine program, linking city-based neurologists to emergency department doctors in 16 rural and regional Victorian hospitals.

Patients are now assessed to determine if they are suitable for new endovascular surgery where a brain clot is removed using a stent. These recent advances are improving survival rates and are reducing disability but rapid diagnosis and treatment (within six hours of the stroke onset) is essential for the best outcomes.

"The Hon Sussan Ley launches the Florey’s stroke telemedicine program.

With this in mind, I am very excited to tell you about a wonderful new initiative called the Florey Brains Trust.

**Take a deep breath...**

Dr Mathias Dutschmann is fascinated by the body’s innate desire to breathe. Of course, we all take breathing for granted until something interrupts the automatic mechanism and suddenly, we are acutely aware of our need to get oxygen into our lungs.

Breathing is central to life, making it one of the oldest and most fascinating areas of neuroscience. Amazingly, we still don’t really understand it. Apart from being an intriguing puzzle, we need to know how breathing works so we can address a range of medical problems.

Matt and his team from the Systems Neurophysiology division know their work will help us find new ways to diagnose neurodegenerative diseases like Parkinson’s and Alzheimer’s, and provide insights into autism, Rett syndrome and speech disorders in premature babies.

“Breathing is the first thing you do when you’re born, and the last thing you do before you die. It is life’s most central process – I’m compelled to study it,” Matt says.

Breathing depends on a master command system in the brain, driving 24/7 skeletal muscle contractions. It is actually the same process used to keep your feet moving so you don’t fall over, but the breathing pattern never stops; it just alters when we talk, cough, sneeze, sniff or hold our breath.

This perpetual motor pattern is generated in the brainstem, the “bridge” of the brain. As Matt says when lecturing: “The captain stands on the bridge.”

"The body’s innate desire to breathe."

"Take a deep breath..."
Addiction can tear families apart. Whether people are addicted to drugs like alcohol, nicotine, cocaine, ice (methamphetamine), or to destructive behaviours such as gambling or overeating, the consequences can be devastating. People vulnerable to addiction may lose their jobs, incur huge financial debts, or suffer from a number of associated health disorders.

Addictive substances activate the brain’s reward pathway that evolved to make us keep doing things that are good for passing genes, such as eating food and having sex.

There is also an emerging debate around “behavioural” addictions, such as overeating, online pornography, or gambling. Are these true addictions, in the same way that people are compelled to seek drugs? Increasingly it seems the answer may be yes.

In the past, addiction was seen as a failure of will power, but recent discoveries at the Florey shed light on the underlying biochemical and environmental reasons. Why are 10-20 per cent of people susceptible to addiction when they start using drugs, while others stop using when the negative consequences outweigh the high? As Professor Andrew Lawrence, head of the Florey’s addiction research team, says, “These numbers are akin to playing Russian roulette. The best option is not to play. In reality though, people like using alcohol and drugs, and for many this will not lead to a problem.”

“Addiction is a chronic relapsing brain disorder, not some kind of moral weakness.”

Andree’s addiction group is particularly interested in the relapse process. An addict may abstain for a period of time, but when presented with a drug-taking cue or a stressful experience, they can quickly relapse into drug use. Why does this happen? How can we prevent it? Florey researchers have identified underlying brain regions and pathways involved, and are probing new treatment targets that may help to prevent relapse.

Alcohol

The Florey’s investigation of binge drinking examines its serious consequences including brain inflammation, brain cell death and effects on learning and memory.

According to Dr Christina Perry: “We know that long-term alcoholism causes severe and irreversible brain damage, but the effects of binge drinking punctuated by periods of abstinence – behaviour typically seen in teenagers and young adults – are far less well understood.”

This work will have immediate public health benefits, providing more accurate information on the effects of binge drinking. Much like road safety campaigns, benefits are seen when people are shown the effects of their behaviour, rather than just being told to not do something.

Christina has been awarded a Society for Mental Health research grant to enable this work, as a result of the ABC’s “Mental As” campaign.

Methamphetamine

“Ice” is the crystallised form of methamphetamine. Users experience euphoria due to its ability to powerfully activate the brain’s reward pathway, which evolved to respond to natural rewards like food and sex.

Prolonged ice use leads to chemical changes in the brain’s reward pathway that reduces the user’s ability to experience pleasure from other activities such as socialising, and may eventually lead to disorders like depression.

Chronic users also begin to associate the paraphernalia or cues to drugs with cues to drug-taking, so that cues powerfully activate the brain’s reward pathway, which evolved to respond to natural rewards like food and sex.

Dr Jee Hyun Kim and Dr Heather Madsen are studying these effects in a model of adolescent methamphetamine abuse. The reward pathway in the adolescent brain has not finished developing and may in fact be overactive, making the power of drug associated cues harder for adolescents to resist. This may prolong drug cravings for recovering addicts, and the researchers’ ultimate aim is to develop a therapeutic intervention to overcome these cravings and help keep kids off drugs.

“The work will have immediate public health benefits, providing more accurate information on the effects of binge drinking.”

Inhalant use

Florey research aims to address the very serious fact that more and younger adolescents are abusing inhalants. Teenagers who abuse inhalants risk brain damage, altered growth, metabolic disorders and a potential for an increased risk of adult-onset disorders such as diabetes.

Between 2007 and 2010, inhalant use skyrocketed by 23 per cent. Of concern, two-thirds of all inhalant users are adolescents, and of those, half are just 12 to 13 years old. This is thought to be driven by the fact that commonly abused products such as paint thinners, super glue, aerosols and petrol are all easily obtained by teenagers.

In addition, inhalants result in a rapid high which wears off quickly so it’s much easier to keep substance use hidden from family and teachers. Subtle initial deficits in users gradually become amplified, resulting in global brain damage.

Dr Jodie Duncan is currently interested in metabolic consequences of inhalant abuse on height, weight, and dietary preferences. Her lab integrates epidemiological data with an animal model of inhalant abuse, the only group in Australia conducting this type of research.

Jodie has found that rats sniffing the harmful compounds found in glue for example prefer diets high in fat and sugar during extended abstinence but actually have lower weight gain if exposure occurs during adolescence. She believes this is due to a failure in the body’s sugar regulation and abnormal fat deposition, which could lead to long lasting consequences such as type 2 diabetes.

Jodie’s current work is aimed at translating these findings into human populations, beginning with Indigenous communities from the Northern Territory.

“Two-thirds of all inhalant users are adolescents, and of those, half are just 12 to 13 years old.”

Food addiction

Obesity has major implications for public health policy. Our research indicates the need for tightly regulated advertising of foods high in fat and sugar.

So-called palatable foods, high in fat and sugar, have become widely available. In rats, exposure to a high sugar and fat diet, around one-third will stay a normal weight (by simply reducing their intake of food), one-third will become overweight, and one-third will become obese. These proportions parallel those found in western societies today. As with drug addiction, not everyone exposed to high fat high sugar food will overeat and become obese, leading Dr Robyn Brown to ask – is some obesity due to food addiction, rather than simply eating too much?

Robyn has measured the connections between brain cells in animals on high fat and sugar diets and has found significant changes in neuroplasticity – the brain’s mechanism to facilitate new learning. This altered plasticity resembles that seen in cocaine-addicted animals. This suggests that for some people high fat and high sugar foods could be addictive.

She is now testing an altered form of a naturally occurring compound that restores correct levels of the brain’s reward pathway activation. The compound restores appropriate synaptic plasticity, behavioural flexibility and a reduction in addictive behaviours.

“The work will have immediate public health benefits, providing more accurate information on the effects of binge drinking.”
Keep your mind active - learn something new!
Have you been to one of our public lectures this year?

This year the Florey has offered 20 free public lectures this year from our Parkville headquarters. The auditorium has been abuzz with members of the public and community groups coming to hear how we can keep our memories active, present a stroke, live with Alzheimer’s, avoid depression, and cope with Parkinson’s... to name just a few of the topics discussed.

Engaging with the Florey’s amazing researchers is a great way to keep your mind stimulated and learn something new. While we are researching very complex brain diseases and disorders, we also celebrate the wonders and capacity of the human brain.

If you are interested in attending events in 2016 or organising a group to attend, please email us at info@florey.edu.au. Details of the 2016 lecture series, including new topics and favourites from this year, will be posted on our website soon.

The financial cost and human toll is huge so we are driven to find answers. We need your help to develop the technology to determine whether an individual is on the pathway to Alzheimer’s. This early detection means we can start to give drugs in the early stages of the disease, with the aim of preventing or delaying its progress.

The public talks in 2016 will include another series on Parkinson’s disease, the legacy of Mal Horns, sport and concussion with Prof Paul McCrory, retaining an active memory (a well-in in 2015) with Prof Bob Wood and a forum on Alzheimer’s with a range of experts.

If you are not able to come to the Florey, many of our lectures are recorded and placed on our YouTube channel so you can watch from home. If you are interested in attending events in 2016 or organising a group to attend, please email us at info@florey.edu.au. Details of the 2016 lecture series, including new topics and favourites from this year will be posted on our website soon.

I am very interested in developing ways to cure brain diseases and making lives better for people with quadriplegia. Thank you.

www.florey.edu.au/news-events/events-seminars

Florey Institute of Neuroscience & Mental Health

THE FLOREY INSTITUTE OF NEUROSCIENCE & MENTAL HEALTH

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BRAIN Matters summer 2015

Improving lives through brain research

Donate to the Florey at www.florey.edu.au
Stop press: A bionic twist in gut inflammation

Thanks to a large US grant, the Florey will lead a major new project to:
- define neural pathways that reduce inflammation of the gut
- develop bionic technology to electrically stimulate and record signals from the vagus nerve
- fast-track the pathway to human clinical trials of neuro-stimulation for the treatment of inflammatory bowel disease.

According to principal investigator, Professor Robin McAllen, inflammatory bowel disease is debilitating to patients and expensive to communities and health services.

“Current therapies are inadequate in terms of effectiveness, side-effects and cost. In the US, irritable bowel disease, ulcerative colitis and Crohn’s disease are very common. Annually, they cost $6.3 billion in direct care, the productivity loss due to absenteeism is $3.6 billion and the personal suffering is huge,” Robin says.

Fellow principal investigator, Professor John Furness adds that these diseases are relapsing and remitting, beginning in young adulthood and continuing throughout life. “And what’s more, the prevalence of irritable bowel disease is increasing,” John says.

Professor Rob Shepherd, Director of the Bionics Institute and another principal investigator, says the strength of multi-disciplinary research in Melbourne is renowned, citing the development of the cochlear implant and a bionic eye. “Therapeutic nerve stimulation for the treatment of inflammatory conditions is a novel approach that requires the specialist team of scientists, engineers, computer scientists and clinicians,” he says.

The vagus nerve travels from the base of the brain to the chest and abdomen, carrying a wide assortment of signals to and from the brain. It supplies the heart, lungs, digestive tract, pancreas and other organs. It has only recently been discovered that it controls inflammation.

The increased incidence of inflammatory bowel disease in war veterans may be stress-related. Post-traumatic stress causes immune deficiencies which, in turn, can trigger lung, gut and other inflammatory illnesses.

A surgical team, led by Professor Bob Jones at the Austin, is renowned for establishing both the first liver and the first intestine transplant surgery in Australia. The team will create detailed functional and anatomical maps of the vagus nerve pathways.

The Florey is leading the four-year, $US6.07 million project with partners, the Bionics Institute, the University of Melbourne and Austin Health. The Defense Advanced Research Projects Agency will fund the work.