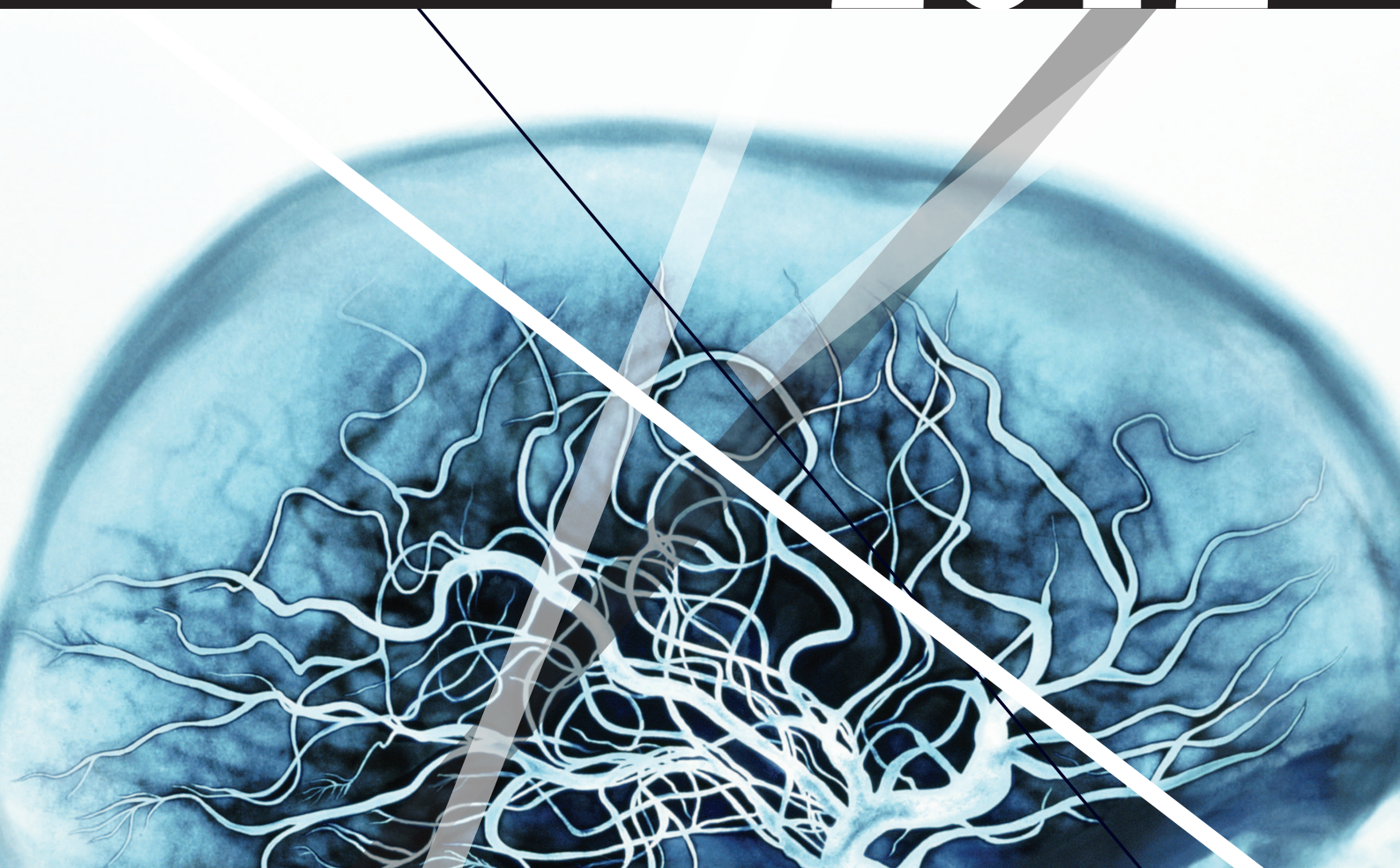


Melbourne Neuroscience Institute Annual Report



MELBOURNE
NEUROSCIENCE
INSTITUTE

2012



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Melbourne Neuroscience Institute Annual Report

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Message from the Director

The Melbourne Neuroscience Institute (MNI) is charged with the responsibility for enhancing interdisciplinarity in neuroscience through stewardship of cross-faculty activities which involve collaboration between researchers in diverse fields ranging from Medicine to Mental Health, Engineering, Optometry and Vision Sciences, Ophthalmology, Law, Economics, and the Social Sciences. The year 2012 was an exciting time for neurosciences and, in particular, for Neuroscience at the University of Melbourne.

With the assistance of the MNI, neuroscientists at the University are encouraged and assisted to think big, to collaborate, to translate their research and to engage in ways that were previously difficult to effect. The consolidation of interdisciplinary themes and of grand research challenges are the most tangible examples of this transformation but it also pertains to the coordinated approach to linkage creation and knowledge transfer that MNI has nurtured.

The MNI has now settled into the world-class facilities of the Melbourne Brain Centre (MBC) in Parkville, one of three nodes in Melbourne (including nodes at the Austin Hospital and Royal Melbourne Hospital). This location has seen neuroscientists well-placed to foster interdisciplinary relationships with researchers around the University of Melbourne, and within the Parkville precinct in general.

The MNI continues to promote and cement productive interactions with our principal partner within the MBC, the Florey Institute of Neuroscience and Mental Health (FINMH). The MNI has assisted in providing a coordinated voice for University Neurosciences alongside our partners and has provided a key mechanism for the partners to interact effectively with the broad church of university neuroscience and related disciplines.

Over 350 researchers and interested parties have now taken advantage of the opportunity to become an affiliate of the MNI. Our outreach activities have broadened in 2012 and now encompass a work experience program, a well-attended public seminar series and a range of events and symposia designed to encourage an interest in neuroscience at the University of Melbourne.

As Director of the MNI, I would like to thank the members of the Advisory Board of MNI who have collectively provided excellent advice to the Institute, particularly in the strategic arena. One of our key goals is to establish, maintain and enhance our discipline-based research strengths. By engaging with our stakeholders outside the University, we also aspire to build relationships that endure and to ensure that we are a prominent voice in neuroscience research. With the support and expert leadership and guidance of our Advisory Board Chair, Professor Liz Sonenberg, we are well on the road to achieving our goals. It is also important to acknowledge those who have provided exceptional assistance to MNI and who have contributed so much to its success. First and foremost, each of the MNI staff, namely Rozanne Blok, Amy Bugeja, Carmel McFarlane, and Andrew Dalziel have each provided exemplary support.



MNI team: Amy Bugeja, Carmel McFarlane, Trevor Kilpatrick, Andrew Dalziel, Trish Weston

Our MNI researchers have made a number of significant achievements in 2012.

- Dr Ben Emery from the Centre for Neuroscience Research has been awarded a 2012 Young Tall Poppy Science Award. Dr Emery's research aims to understand what controls the development of oligodendrocytes in the brain and the communications between nerve cells and the oligodendrocytes that stimulate the adjacent nerve fibres. The Young Tall Poppy Science Awards aim to recognise early career researchers who have achieved significant research outcomes and who have demonstrated their passion to engage with the community in science.
- Professor Stan Skafidas, Director of the Centre for Neural Engineering has led a team of Australian researchers to develop the first known genetic test to predict the risk of children developing an autism spectrum disorder (ASD). The scientists also identified genes that protect against ASD, in addition to genes linked to an increased risk of the disorder, leading to a paper published in the journal *Molecular Psychiatry*, which could potentially lead to drug treatments for ASD.
- An international team of researchers led by Professor Martin Pera has discovered a novel marker that plays an important role in our understanding of how cancer develops in the liver, pancreas and oesophagus. The study, published in the journal *Stem Cell*, adds to our understanding of the role of stem and progenitor cells in tissue regeneration and in the diagnosis and treatment of cancer.

These achievements are a testimony to the expertise and fortitude of our researchers and also to the support offered by the Melbourne Research Office and, in particular, the Faculty of Medicine, Dentistry and Health Sciences, Melbourne School of Engineering, and the Faculty of Science

Given the strong foundation of achievements in 2012, I have no doubt that in 2013 the University of Melbourne can look forward to another year of world-class neuroscience fostered by the MNI, ranging from the discovery stage right through to translation.

Professor Trevor Kilpatrick

Director, Melbourne Neuroscience Institute



Trevor Kilpatrick, Director of the MNI

Message from the Host Dean

The Melbourne Neuroscience Institute (MNI) is part of a portfolio of Institutes that draws on the breadth of the University's research activity, whilst retaining and respecting disciplines strengths. The MNI brings together researchers from across the University to form new teams to tackle big, complex issues.

Since its inception, the MNI has successfully fostered some key research themes in the neurosciences, including the Music, Mind and Wellbeing initiative, Stem Cells Australia, the Melbourne Brain Imaging Unit and the Centre for Neural Engineering. The MNI has also been successful in attracting a broad base of external stakeholders. At the individual level, this is exemplified by the registration of over 350 MNI affiliates, external to the University. The MNI also has brokered key engagements with industry, for example with GSK R&D Shanghai, and with academia, for example with the University Piere et Marie Curie, and with key local groups such as the World President Organisation and Committee for Melbourne.

I commend and thank Professor Trevor Kilpatrick and his staff for their excellent work on behalf of University neuroscience over the last 3 years, and look forward to further outstanding successes in 2013.

Professor James A Angus AO

Dean, Faculty of Medicine, Dentistry and Health Sciences



*James Angus, Dean of the Faculty of
Medicine, Dentistry and Health Sciences*

Research

Music Mind and Wellbeing

The world-first Music, Mind & Wellbeing initiative (MMW) links neuroscience with music and social wellbeing through a unique set of collaborations spanning music, science, health, education, and industry. This bold research agenda involves a globally unique set of collaborations between researchers in music and science. The staff of MMW have been actively developing new scientific approaches to music that incorporate perspectives from multiple disciplines. These perspectives are complementary and their integration will generate a new theoretical framework for music that is both translational and transformative.

In 2012, MMW have framed their activities into two sections; neuroscience research and applied research programs:

Neuroscience research

New perspectives on cognition derived from models of brain plasticity associated with music training, including:

- New accounts of the brain networks associated with speech and singing,
- New cognitive and computational models of sound and speech recognition and segregation mechanisms including two new patented algorithms,
- New cognitive and computational models of pitch and dissonance perception based on extensive empirical findings, and
- New cognitive models of pervasive developmental and psychological disorders and methods of detection based on auditory perception and vocal behaviour.

Much of this work has been funded through successful ARC and NHMRC grant rounds in 2011. Commercialization of new algorithms has been supported by MNI research funds and State Government commercialization funding. We are now working with four Australian industry partners in the areas of music technology development, hearing bionics, hearing protection and security monitoring.

Applied research programs

Enhancing cognitive, social and health outcomes through music for:

- Children,
- Cochlea implant recipients,
- Individuals with special needs,
- Rehabilitation of language after stroke, and
- Healthy aging

Factors underlying engagement in music learning and performance in:

- Australian schools
- Students and professionals with music performance anxiety, and
- New pedagogical approaches including new instrument ensembles and notation systems.

Music in mental wellbeing and emotional regulation by:

- Connecting communities through enhanced music participation, and
- Understanding the use and abuse of music in adolescence.

We have partnerships and interest from a wide range of research and service providers in these programs (such as the Bionics Institute, The Australian Music Centre, the University's Centre for Early Childhood Development, and State and Federal Ministers for Education). We have developed a suite of new patented music technologies in a joint venture company with the University of Melbourne to support many of these initiatives.



Sarah Wilson, Director of Music Mind and Wellbeing

Stem Cells Australia

Stem Cells Australia (SCA) is a Special Research Initiative in stem cell sciences funded by the Australian Research Council that brings together leading researchers in this field from across the country. Led by Professor Martin Pera at the University of Melbourne, this collaboration includes scientists from the University of Queensland, the University of New South Wales, the Victor Chang Cardiac Research Institute in Sydney, the Walter and Eliza Hall Institute of Medical Research, FINMH, Monash University, and the CSIRO Material Science Division in Clayton.

During 2012, the foundations for interdisciplinary research into stem cell science were developed which included understanding the potential roles of stem cells in a range of intractable diseases arising from cell damage such as in Parkinson's disease, following the death of cardiac muscle cells due to interruption of their blood supply following occlusion of the coronary arteries as occurs in a heart attack, and damage to nerve cells in the spinal cord from traumatic injury as well as a host of other very real and debilitating diseases.

2012 saw the development of our core facilities, providing services to the scientific research community. These include:

- Stemformatics - a collaboration between the stem cell and bioinformatics communities based at the University of Queensland. Stemformatics provides a fast way for biologists to find and visualise interesting genes.
- StemCore laboratories, also based at the University of Queensland, provides support for pluripotent stem cell culture for our Queensland and NSW-based researchers.
- At the Melbourne Brain Centre - in the heart of Parkville's biological sciences precinct - Stem Cells Australia provides purpose-built core facilities in Flow Cytometry and pluripotent stem cell culture for use by our members and other interested researchers.

SCA core researchers secured \$1.5 million in international research funding in 2012. These efforts at building international collaboration were supported by:

- a Department of Foreign Affairs and Trade (DFAT) grant to foster collaborative workshops with Kyoto University's Institute for Integrated Cell-Material Sciences (iCeMS), and
- the initiation of a relationship with Canada's Centre for Commercialization of Regenerative Medicine (CCRM) via a Translation of Regenerative Medicine & Stem Cell Science Roundtable, co-hosted by Stem Cells Australia and the Canadian Trade Commission.

A category of affiliate memberships was also established in 2012, and further announcements of new affiliate memberships will be made over the coming year, as well as welcoming more visiting international fellows.

Stem cell science is an extremely fast moving field of research with new breakthroughs being reported on an almost daily basis. In a swiftly changing landscape, SCA places the Australian scientific community at the world's leading edge of research in this important field.

Stem cell research and regenerative medicine is a rapidly growing field that is now reaching application in the clinic, as new cell therapies enter early stage trials. Human stem cells are also coming into wide use as a key research platform for disease modelling, functional genomics, and drug discovery. Stem Cells Australia aims to keep Australian science at the forefront of this revolution in biomedicine.

Research in the Stem Cells Australia consortium focuses on four areas of stem cell biology:

- pluripotent stem cells, or stem cells that can turn into any tissue in the body,
- regeneration and repair in the brain,
- regeneration and repair in the heart, and
- the hematopoietic system, which generates the cells of the blood.

Coupled to these four biological themes are platform technologies in bioengineering, nanotechnology and material sciences, and bioinformatics, headed by international leaders in these fields. This multidisciplinary approach provides our researchers with powerful new approaches to tackle both the fundamental and practical challenges that we face in this field. SCA is now expanding its network of scientists through the appointment of Affiliate Members, who are experts currently collaborating with our investigators, or working in closely related fields. Through these interactions SCA plans to establish a new focus on morphogenesis (assembly of cells into organs) and tissue engineering, areas that are on the frontier of stem cell biology.

SCA held a workshop with the Center for Commercialization of Regenerative Medicine, an initiative of the Canadian Stem Cell Network, to explore collaborative opportunities for translation and commercialization. In particular, SCA also hosted a visit by representatives from the Institute for Integrated Cell Materials Science at the University of Kyoto and secured funding to support the development of a more formal collaboration.

In addition to research, SCA participates in a range of activities to advance stem cell science. Over 2012, Stem Cells Australia has fostered inter-institutional collaborations via theme workshops within our consortium. SCA held two Annual Retreats in 2012, highlighting the outstanding science across the network and helping to forge new partnerships across our member institutions.

Outreach is also a significant part of Stem Cells Australia's work. The therapeutic potential of stem cells continues to capture the attention of the public and there has been an extensive contribution by SCA's members during 2012 to media stories in print, television and - of course - online.

Stem Cells Australia has been active in analysing and commenting on regulatory policy related to the operation of clinics offering unproven stem cell therapies, a major area of concern for the field. SCA also made submissions to the Strategic Review of Medical Research (National Statement), and NHMRC advisory documents on human and animal research ethics.



Martin Pera, Program Leader of Stem Cells Australia

Centre for Neural Engineering

The Centre for Neural Engineering (CfNE) is an interdisciplinary centre, established to undertake research in neuroscience and neural diseases. The CfNE draws together leading neuroscientists, neurologists, psychiatrists, cell biologists, geneticists, electrophysiologists, chemists, physicists and engineers from the University of Melbourne and partner institutions including: FINMH, NICTA, Bionic Vision Australia, Bionics Institute, Royal Melbourne Hospital, Austin Health, St Vincent's Hospital and other Australian and overseas partner universities and industry.

In 2012, the CfNE has focused its research into four different key themes:

- Bionics looks at the integration of electronic systems in the body to replace or assist function by directly stimulating neurons. This has direct application to vision, hearing, epilepsy, Parkinson's disease and spinal injuries. The CfNE is contributing to the Bionic Vision Australia high acuity prosthesis device. During 2012 CfNE researchers produced the first prototype of the high acuity prosthesis incorporating 256 electrodes. The device is currently being tested before being used in clinical trials
- Computational Neurobiology is focused on bridging the gap from molecular structure to human behaviour. CfNE will use novel approaches for collecting data at different spatial and temporal scales to develop multi-scale models that help us understand brain function in health and diseases.
- Sensors & Imaging focuses on understanding the dynamics of neuronal networks to gain insight into the brain's information processing. By creating novel sensors of neural function, CfNE can detect the electrical and chemical states of neurons and neural ensembles that can be exploited for the creation of novel drug therapies. In 2012 scientists of the CfNE demonstrated what functionalised nanowire sensors can detect femto molar concentrations of chemical species. This work is being incorporated into a lab on chip platform to enable bedside genomic and diagnostic testing.
- The Stem Cells & Disease Models group looked at combining the expertise in human stem cell biology, neurobiology, and cell and tissue engineering to model diseases of the human brain. In particular, the group is using human neural and pluripotent stem cells to study illnesses such as schizophrenia, autism, epilepsy and stroke.

An Illustration of Interdisciplinarity

There is no doubt that technology and innovation in the physical and engineering sciences will play an increasing role in the life sciences. Navigating the complexities of establishing and executing interdisciplinary research programs is critical for life sciences to derive the full benefits of new technologies and, importantly, to inform and guide the creation of new approaches to meet emerging challenges in brain science. A prime example of this is the recent announcement of the US- backed human brain mapping initiative. This call at its core, is for interdisciplinary research. In particular, the amalgamation of nanoengineering and neuroscience to develop the technology to enable simultaneous measurement of the activity of thousands and then millions of neurons.

Deliberately vague on details because such mapping technology has yet to be conceived we founded the CfNE on a similar principle that amalgamation of nano-engineering and neuroscience must occur if we are to ever truly understand brain function. Within the CfNE, current initiatives include the design of novel drug screening technologies that create real-time hybrid models of cells and computer models that have already attracted the attention of the pharmaceutical industry, development of nano-scale materials to optically measure nerve function, miniaturization of high density wireless sensors to interrogate brain activity and novel electrical spectroscopic methods to provide new views into the material properties of brain matter. To facilitate this work, the barriers that separate faculties are being breached with engineers undertaking PhDs in "wet" labs at the Melbourne Brain Centre and neuroscientists being embedded with engineers at the CfNE labs.

True interdisciplinary research demands a departure from standard research paradigms and established funding and career development paths that often bewilders granting bodies and colleagues alike. Nurturing this nascent potential is an important role for CfNE Deputy Director Professor Steven Petrou with CfNE Director Stan Skafidas in the strategic development of the Centre and in their collaborative research efforts. As a neuroscientist and biophysicist Professor Petrou is working to create a common language between our disciplines such that talented engineers can fully comprehend the problems faced in the neurosciences. Likewise, for our best neuroscientists to understand and reap the benefits of developments from engineering, chemistry and physics.



Stan Skafidas, Director of the Centre for Neural Engineering



Centre for Neural Engineering

Melbourne Brain Centre Imaging Unit

The Melbourne Brain Centre Imaging Unit (MBCIU) at Parkville has been established as a consequence of the procurement of major funding via the Federal Government Education Investment Fund (EIF) and the Victorian State Government Victoria's Science Agenda (VSA) Investment Fund, together with funds provided by the University of Melbourne, FNI and MHRI. The MBIU is directed by Professor Roger Ordidge, Chair of Imaging Sciences.

During 2012, the Imaging Unit within the Melbourne Brain Centre at Parkville installed a state-of-the-art Siemens PET-CT scanner, which is being funded under the umbrella of a successful VSA bid submitted by the Victorian Biomedical Imaging Consortium (VBIC). A senior medical imaging technologist, Mr Rob Williams, was appointed. Clinical research trials of new radio-pharmaceutical tracers for the early detection of Alzheimer's disease are showing great potential for making a major impact on the management of this disease and will enable early therapeutic agents to be tested in the future.

The University of Melbourne is also a partner in a successful EIF3 application under the umbrella of the National Imaging Facility (NIF). The NIF is a national collaborative facility envisioned to provide openly accessible world-class facilities for basic imaging research, allowing Australia to remain at the forefront in imaging-related science. The lead agent for the bid is the University of Queensland. The participating partners, which include the University of Melbourne as a new addition, will expand the NIF into an integrated network across 5 states providing landmark capabilities in animal and ultra- high-field magnetic resonance imaging (MRI) and magnetoencephalography.

During 2013, the Siemens 7T whole body research MRI scanner will be installed on the ground floor of the Melbourne Brain Centre at Parkville. This scanner will enable unprecedented detail to be achieved in human brain scans utilizing novel tissue contrast that is only available at this high magnetic field strength.

Although the MBCIU is based around imaging machines, the consortium places emphasis on being engaged with the scientific community to enable appropriate use of the technologies. In combination, these advanced imaging technologies will lead to advances in the diagnosis and, hopefully, the eventual treatment of a wide range of neurological disorders. This necessitates close collaboration between University of Melbourne scientists and engineers and those in associated institutes, public teaching hospitals, and national and international centres of research excellence.



*Roger Ordidge,
Chair of Imaging Sciences*

Neurosciences and Behavioural Sciences Domain

Within the Faculty of Medicine, Dentistry and Health Sciences (FMDHS), research strengths have been grouped into eight Research Domains, one of which is the Neurosciences and Behavioural Sciences Domain, led by Associate Professor Ann Turnley of the Centre for Neuroscience Research and Department of Anatomy and Neuroscience, FMDHS.

The Neurosciences and Behavioural Sciences Research Domain can be broadly represented by four inter-related groups: Neurological Disorders; Behavioural Neurosciences/Psychology and Mental Health; Basic Neurosciences; and Advanced Technologies. Each of these groups is comprised of a number of subdomains, reflecting areas of specific research focus within the FMDHS.

In 2012, a number of activities were supported by the Domain. These included sponsorship of events of broad interest to neuroscientists at the University of Melbourne such as the Melbourne Brain Centre Neuroscience Symposium and two neuroscience student activities – the Students of Brain Research (SOBR) dinner, with presentations on the communication of science to the public, and the SOBR symposium. There were also more subdomain-specific events including the Epilepsy subdomain symposium Neuronal Networks and Seizure Generation, the Autonomic and Sensory Systems subdomain symposium Integrated control of visceral and vascular function – a tribute to Prof. John Furness (photo) and the Molecular and Cellular Neuroscience subdomain symposium Stem-Cell Derived Neurons: from Disease Models to Therapies. A/Prof Turnley also gave an MNI-sponsored Public Lecture on Neurosciences and Behavioural Sciences at the University of Melbourne.



Attendees at the Integrated control of visceral and vascular symposium.

Subdomain spotlight 2012 – Developmental Neurobiology

(Leader: Prof Heather Young)

Most vertebrates have a complex nervous system consisting of millions of neurons (trillions in humans) and a staggering number of connections. Developmental neurobiologists aim to understand how circuits arise during development, and the ways in which they are modified during maturation. A variety of aspects of nervous system development are being studied by investigators at the University of Melbourne, including:

- Dr Ben Emery who is studying the molecular bases of oligodendrocyte differentiation and myelination in the brain. Oligodendrocytes are the cells that create the myelin (insulating sheaths), which are essential for neural transmission.
- Prof Janet Keast who studies the development of the innervation of pelvic organs. Neurons play an important role in the function of pelvic organs, including the bladder and sexual organs.
- Prof Joel Bornstein who is examining the development of the circuits controlling motility in the bowel.
- A/Prof Colin Anderson who is researching the development of sympathetic ganglia, and how defects in the development of sympathetic ganglia lead to neuroblastoma, the most common solid extracranial cancer in children.
- Dr Jenny Gunnersen who is studying the molecular mechanisms that regulate dendrite growth and plasticity.
- Prof Heather Young who is researching how the nervous system within the gut (the enteric nervous system) develops.
- A/Prof Erica Fletcher who is examining the development of different types of neurons in the retina of postnatal normal and disease-model mice.



Dr Ben Emery's team within the Centre for Neuroscience Research

Knowledge Transfer

Education

The Neuroscience PhD Coursework Program was launched in 2012, based on a joint learning and teaching initiative between the FINMH and the University. The pilot course was developed in 2010 and refined in 2011. The coursework program has enabled graduate researchers from across various Faculties/Schools/Centres/Departments to interact with those based across affiliated Medical Research Institutes and public hospitals. This has provided fertile ground for the exchange of ideas, networking, sharing of experience and cross-disciplinary collaboration.

The structured program of coursework is taken as a series of one-week modules within the first 3 months of PhD provisional candidature and covers key areas of contemporary neuroscience research, teaches essential theoretical concepts, facilitates the understanding of specialised literature and more critical reading, as well as assisting in the development of advanced research skills. The 5 week coursework program attracted 52 new graduate researchers in 2012, who came from over 11 departments and schools ranging from the biomedical sciences to clinical neurosciences, through to psychology, engineering and allied health.

Over 70 expert researchers from a variety of disciplines and the University's Schools/Departments and affiliated independent medical research institutes deliver the coursework program. Their involvement ensures the PhD course content remains at the "cutting edge", which is a crucial ingredient for learning at this research-based level. This collaborative teaching also offers an opportunity for more junior research staff from the Institutes to build teaching experience and to develop their teaching skills under the guidance of the course developer. Collaborative teaching has become a vehicle for new research collaborations emerging both across the partner institutions and across departments, schools and faculties within the University, which have led to increased staff interaction, good-will and engagement.



Students and staff enjoy the world class facilities of the Melbourne Brain Centre

MNI Public Seminar Program

The year 2012 saw the launch of the MNI Public Seminar Series, which has featured a range of guest speakers that explore the connections between the community on the one hand and of neuroscience research and that of related disciplines on the other. In addition, the MNI has partnered with a number of secondary schools in Melbourne and has offered students, their parents and teachers the opportunity to participate in interactive ethics and educational workshops that complement the public seminar series. The seminar series features presentations by Trevor Kilpatrick, Roger Ordidge, John Furness, Stan Skafidas, Ann Turnley, Sarah Wilson and Martin Pera.

MNI International Guest Keynote Lecture

The 2012 MNI Public Seminar Series culminated with the inaugural MNI International Guest Keynote Lecture, from Baroness Professor Susan Greenfield. Professor Greenfield spoke on 'The Neuroscience of Consciousness'. Professor Greenfield's visit included a workshop for PhD students and meetings with key neuroscience researchers and leaders from the UoM to explore potential collaborations between the Oxford University Institute for the Future of the Mind and the MNI. The event concluded with a formal dinner for key UoM leaders.



Susan Greenfield Lecture Panel: James Angus, Rufus Black, Susan Greenfield, Trevor Kilpatrick, Loane Skene and Philip Smith

Student Engagement

The MNI continues to sponsor and support the Australian Brain Bee Challenge (ABBC), Australia's only neuroscience competition for secondary school students. Students from 25 schools across the state spent a day at the Melbourne Brain Centre for the Victorian final of the Brain Bee. Director of the Melbourne Neuroscience Institute, Professor Trevor Kilpatrick, opened the event, which saw participants complete individual and team quizzes about the brain.

The event was organised by Associate Professor Heather Young from the Department of Anatomy and Neuroscience and Dr Joanne Britto and Dr Chris Reid from FINMH. Brain Bee is sponsored by the Melbourne Neuroscience Institute, FINMH, Zeiss and ADInstruments. The 2012 Australian-New Zealand Brain Bee Challenge National Final was held on February 2-3 2013 in Melbourne at the Australian Neuroscience Society Annual Conference. The 2012 Australian Champion was Jackson Huang and the 2012 New Zealand Champion is Jiantao Shen.

This engagement is complemented through MNI coordinated presentations and booth presence at the UoM Open Day.

The MNI is also highly supportive of undergraduate students, with the provision of seminars and tours for the Chancellor's Scholars program, which saw 40 students attend a lecture entitled "So you want to be a biomedical researcher", which enabled the promotion and demonstration of research as a career to undergraduate students.

Work Experience

The MNI actively encourages secondary students to engage in a career in neuroscience and accomplishes this by our facilitation of work experience programs in the area of neuroscience for year 10 secondary school students. In 2012, MNI hosted eight work experience students and provided them with broad experience in the neurosciences and in doing so familiarised the students with opportunities available to students and staff in the Neurosciences at UoM.



Students participating in the 2012 Brain Bee

Committee for Melbourne

The MNI was pleased to host the Future Focus Group at the Melbourne Brain Centre. The Future Focus Group is the Committee for Melbourne's two year business leadership program for emerging leaders. It develops the leadership skills and commitment of our future corporate community leaders. The program provides access to senior business and civic leaders and a broad network of young leaders from a diversity of backgrounds. Participants have an opportunity to fulfil corporate social responsibilities and make a tangible and lasting contribution to Melbourne through hands-on social entrepreneurship. Practical leadership skills are also gained via an action-based, enduring learning experience of formulating a project idea, developing teams, creating a shared vision, managing differing personalities and overcoming hurdles, and generating the momentum to make the project successful.

The thirty-five attendees enjoyed talks and tours of the Melbourne Brain Centre to showcase the cutting-edge research occurring within the building and with our partners.



Trevor Kilpatrick welcomes attendees of the World Presidents Organisation

World Presidents Organisation

The MNI has hosted a number of networking functions to raise awareness of research focusing on a variety of neurological disorders. These events included the World Presidents Organisation dinner which focussed on Multiple Sclerosis and Alzheimer's disease, held on Tuesday 22 May 2012. In conjunction with Multiple Sclerosis Research Australia and the Mental Health Research Institute, MNI hosted a dinner as part of the WPO Educational Events, a series of formal events for WPO's members to be held here, at the Melbourne Brain Centre.

The WPO (World Presidents' Organization) is a global organization of more than 4,600 business leaders who are or have been chief executive officers of major companies and who are "graduates" of YPO (Young Presidents' Organization). Spanning more than 70 countries, WPO members combine corporate responsibility and personal public service to make significant contributions in their communities. Thirty-five of these entrepreneurs and their partners attended the dinner.

Melbourne Brain Symposium and Student Symposium

The Melbourne Brain Symposium is an annual event bringing together world-class scientists to highlight and discuss recent advances in neuroscience and mental health research.

The Symposium was held on Thursday 1 November and featured an excellent line up of international and national speakers covering a wide range of current issues in brain research.

Speaker	Presentation Title
Professor Barry Dickson	Wired for sex: the neurobiology of <i>Drosophila</i> courtship behaviour
Professor Janet Keast	Strategies for wiring and re-wiring autonomic nerve circuits
Professor Nick Spitzer	Novel synaptic plasticity: transmitter and receptor switching in the adult brain regulate responses to stress
Professor Mac Christie	Brain mechanisms of opioid dependence
Professor Bernard Zalc	Myelin: a success story; an evolutionary perspective
Professor Eliezer Masliah	Role of defective clearance in the inter-cellular transmission of aggregated proteins in Alzheimer's and Parkinson's Disease: implications for therapeutics

The 2012 Student Brain Symposium was hosted by the Melbourne-based Students of Brain Research (SOBR) network and was sponsored by MNI. SOBR is a new network for graduate research students from all Melbourne institutes and universities with an interest in brain, neuroscience and biomedical research. The aim of SOBR is to increase social and academic interactions between students at various events and online.

The 2012 Student Brain Symposium was the second ever brain-focused student symposium in Melbourne. The symposium was included in the program of the Melbourne Brain Symposium.

Student professional development played a key role in the motivation for organising a student symposium. The Symposium provides honours and research higher degree students with an opportunity to:

- Present their work in an oral or poster format, including answering questions from judges and peers;
- Win prizes of up to \$1000 in value for the best presentations;
- View the work of peers and provide feedback via questions and discussion;
- Network with other brain researchers from across Melbourne; and
- Have their abstract published in an abstract booklet.

The highest ranked student abstracts were selected for the opportunity to present their work in an oral format at the symposium. These included abstracts from Dominic Dwyer, Andrew Walker, Samantha Barton, Nastasia Lim, Bevan Main, Matthias Koenning, Orwa Dandash, Robert Smith and Susan Carey.



In Focus: Stem Cells Australia – Outreach activities

Stem cell science attracts considerable interest due to both the promise of innovative therapies, as well as concerns about the potential ethical and social impact of new discoveries on society.

Stem Cells Australia's Education, Ethics, Law and Community Awareness Unit has been established to address such concerns through contextualizing developments in this fast-paced field in SCA's public outreach activities. SCA seeks to foster multi-disciplinary research into associated ethical, legal and societal issues, with findings forming policy recommendations and the foundation for educational material and communication strategies.

During 2012 SCA's outreach program consisted of a series of targeted events held across Australia. The aim was to increase the audience's understanding of the promise of stem cell science, as well as the current limitations and challenges that the field faces.

SCA's events included dedicated workshops and public lectures that focused on highlighting developments in stem cell science for specific conditions such as Motor Neurone Disease, spinal cord injury, vision loss and multiple sclerosis. The workshops aimed to assist the audience to distinguish between hype promulgated in websites and media reports, and the reality of the progress that is actually being made in stem cell science.

Importantly, such progress may not directly result in cellular therapies but, by learning more about what's happening to the cells in a certain condition, allow scientists to identify new therapeutic targets. Patients, their family, friends, carers and interested medical and allied healthcare professional, attended each event. Events were co-hosted with key patient support groups in Adelaide, Brisbane, Sydney, Melbourne and Auckland.

The growing practice of selling unproven stem cell 'treatments' directly to patients was discussed at all events. Such treatments – which effectively by-pass the clinical trials framework - are often promoted as safe, and with claims of 'improvements', but with little pre-clinical or clinical evidence to support the claims. For patients and their loved ones desperate for any option, these clinics – overseas and in Australia - are understandably attractive. Our forums raised concern about such practices, recognized the complexity of distinguishing hype and hope from reality, and provided the audience with an opportunity to have their questions answered by experts in the field.

SCA also held a series of workshops for doctors - in conjunction with the NSW Stem Cell Network and sponsored by the Royal Australasian College of Physicians (RACP) – to provide an update on progress in the field. Additional educational material developed by SCA included an on-line resource hosted by RACP and articles in the Australian Doctor.

During 2012 National Science Week, and in conjunction with Quantum Victoria, SCA held a full-day workshop for high school students who were interested in gain a deeper understanding of how computer science is being applied to the field of biology and medicine. In particular, the workshop showcased the power of bioinformatics and how understanding gene expression helps stem cell biologists develop safer therapies. The workshop was delivered by University of Queensland's Professor Christine Wells and CSIRO's Dr Andrew Laslett. SCA also hosted 'Meet the Stem Cell Scientist' seminars to highlight the rich and varied career pathways undertaken by Stem Cells Australia members.

The launch of Stem Cells Australia's website has also been an invaluable means of connecting with the public. There have been over 22,000 visitors to the website and directly responded to almost 500 enquires.

Stem Cells Australia members have been invited to present at schools, Rotary, Probus and Lions Club meetings and numerous community forums, including Alfred Health Research Week, Melbourne Neuroscience Institute Public Seminar series and The Royal Children's Hospital Campus Research and Education Week.

Stem Cells Australia members have also featured prominently in print media as well as radio and television programs such as The Project, ABC Radio National's Health Report, Background Briefing and Science on Radio National Summer Series.

During 2012, the Education, Ethics, Law and Community Awareness Unit was also successful in attracting funding from the National Stem Cell Foundation of Australia, Department of Industry, Innovation, Science, Research and Tertiary Education and SpinalCure Australia to support the development of new educational resources and outreach activities. SCA were also able to secure a philanthropic donation to establish the Science in Society PhD scholarship. In total, we secured over \$120,000 during 2012.

Research & Policy

Understanding more about stem cell tourism, where Australians travel abroad for stem cell treatment, was also a significant research activity undertaken by SCA. Associate Professor Megan Munsie was part of an international team awarded a 2012 ARC Discovery grant - High hopes, high risk? A sociological study of stem cell tourism. This project, led by Monash's Prof Alan Petersen, seeks to examine the factors shaping Australians views and expectations of stem cell treatments offered abroad by capturing the experience of Australians who have travelled abroad or contemplated doing so. Insights from this study will be used to make policy recommendations and improve SCA's outreach activities and educational resources.

Stem Cells Australia provided briefings to Therapeutic Goods Administration; BioMelbourne Network; Therapeutic Innovations Australia; Victorian Government Department of Business and Innovation; GE Healthcare; and the Chinese Academy of Sciences. We also made submissions to:

- the 2012 Strategic Review of Medical Research;
- the Australian Health Ethics Committee's consultation on revisions to the National Statement on Ethical Conduct in Human Research;
- proposed revisions to the Australian code of practice for the care and use of animals for scientific purposes; and,
- the NHMRC consultation of draft documents for doctors and patients on stem cell treatments.



Shelley Hough, Stem Cells Australia

Partnerships/Linkage Creation

The MNI has fostered interactions with a number of external partners for mutual benefit. These partners include Neurosciences Victoria, GlaxoSmithKline (GSK), Vanderbilt University and CSIRO. The University of Melbourne is an active member of Neurosciences Victoria, and the CEO of Neurosciences Victoria, Dr Andrew Milner sits on our Advisory Board and provides opportunities for interactions with key stakeholders.

Prof Richard Head, who has been in charge of the CSIRO clinical flagships program, and who was a senior advisor to CSIRO, is a member of our Advisory Board. We are collectively exploring ways in which the University and CSIRO can optimise our interactions in particular in the field of biomarker-based research.

We are currently exploring a range of initiatives in the areas of computational neuroscience and translational research. The Director of MNI visited Vanderbilt University in September 2010 and has since had ongoing dialogue with Professor John Gore, from Vanderbilt, concerning potential collaborative interactions in advanced human imaging which will come to fruition in 2013 after the delivery of the 7T MRI to the MBC Imaging Unit.

The MNI is developing commercial links with GSK China, and in particular, the prospect of a preferred partnership with that company. The Senior Vice President of GSK China, Prof Jingwu Zang visited the University on 20 and 21 December 2012 to further these discussions.

In partnership with the Melbourne Research Office, MNI is scoping interactions with the Institut National de la Santé et de la Recherche Médicale (INSERM) and the University Pierre et Marie Curie. It is anticipated that this partnership will move forward in a series of workshops commencing in the middle of 2013.

The MNI is supporting an NSV based initiative that has targeted the establishment of clinical fellowships in the neurosciences to enhance future capacity in neuroscience based clinical research. MNI has also pursued potential linkages with Monash University to create a shared computational neuroscience leadership position as part of the Centre for Neural Engineering program.

Melbourne Brain Centre

The MNI coordinates the University's Melbourne Brain Centre Operations and Governance Committee, which has representation from the Faculty of Science and the Faculty of Medicine, Dentistry and Health Sciences. The committee serves to provide support and advice to the Director of the MNI, who is the University's representative on the Director's Coordination Forum (DCF) of the Melbourne Brain Centre, a collaborative forum for interaction between UoM and the FINMH.

Under this umbrella, the MNI actively facilitates and coordinates the University's involvement in the MBC partnership. This is effected through:

- shared strategic initiatives,
- development of operational plans,
- formulation and oversight of an operational budget,
- oversight of core services and platform technologies, coordination of funding initiatives and shared use of project funds.



Melbourne Brain Centre, Parkville node

Funding Initiatives

NHMRC Fellowship Awards

Up-and-coming MS researcher, Dr Scott Kolbe, has been awarded a highly competitive NHMRC fellowship. Dr Kolbe received an Early Career Fellowship worth close to \$300,000. Dr Kolbe will continue his previously MSRA (Multiple Sclerosis Research Australia) funded work on optic neuritis; examining the ability of neurons in the visual pathway to rewire and restore function in MS. The project is titled 'Investigating visual neuroplasticity in multiple sclerosis'.

Dr Andrew Zalesky received a Career Development Fellowship for his project 'Connectomics in health and disease'. Dr Zalesky is a former Melbourne Neuroscience Institute Fellow, and is based at the Melbourne Neuropsychiatry Centre, a centre in the Department of Psychiatry. Dr Zalesky's work in the field of connectomics has been touted as a potential breakthrough in providing novel and more meaningful insights into the neurobiological underpinnings associated with psychiatric diagnoses and symptoms.

Research Theme Grant Reports

1. Music, Mind and Wellbeing -

The development and piloting of a new approach to rehabilitation after CI implantation

CIs: Sarah Wilson and Neil McLachlan (Psychology), Frank Vetere (Information Systems) and Jeremy Marozeau (Bionic Institute, BI).

Summary: This project involves collaboration between leading researchers in Psychological Sciences, the Department of Information Systems and the BI, under the auspices of the Music, Mind and Wellbeing initiative sponsored by Melbourne Neuroscience Institute. In particular, we investigated whether auditory processing can be improved in CI recipients by daily music training using innovative, purpose designed instruments and interactive digital scores.

Outcomes:

- **The development of new music learning technologies**

This seed funding has enabled the development of a musical interactive computer program that employs visualization systems and real-time acoustic processing to represent musical information without the specialized symbols used in western notation. The program enables the user to compose rhythms intuitively and hear how they sound. The graphic language forms the basis of a generative grammar in which easily recognized shapes are reflected, rotated and assembled in lawful ways to create a wide variety of traditional and novel rhythms. This program has been demonstrated at a number of public events including the MNI lecture series, and the "Science in Action" display at the Queenscliff Music Festival sponsored by the Royal Institute. It has also been successfully trialled with primary school children and adults.

The use of the program for music training requires input from musical instruments with unambiguous pitch and that map physical location to pitch height. This mapping provides visual and motor feedback cues to train pitch networks and sharpen auditory frequency resolution. This has been enabled by the invention of a unique electro-acoustic pick up and its integration with an electrical circuit and prototype harmonic metalophone. This circuit will be powered by USB input to a tablet computer.

• Publications

The musical instrument designs have been featured in two recent international journal papers;

- N. M. McLachlan, R. Adams and C. Burvill (2012). Tuning natural modes of vibration by prestress in the design of a harmonic gong, *Journal of the Acoustical Society of America*, 131, 926-934.
- N. M. McLachlan (2011). The design of a harmonic percussion ensemble, *Journal of the Acoustical Society of America*, 129, 3441-3444.

The application of tuned percussion instruments in community music interventions has been described in the book chapter:

- N. M. McLachlan (2012). Educating amateurs: New technologies and models to enhance music participation in Western societies. In N. Rickards and K. McFerran (ed), *Lifelong engagement in music: Benefits for mental health and well-being*. Nova Science Publishers: Melbourne.

Our neurocognitive theory of musical pitch and harmony that supports the use of music to generate beneficial neuroplastic changes has been validated in an extensive empirical paper recently accepted for publication in the leading international journal of experimental psychology;

- McLachlan, N. M., Marco, D. J. T. & Wilson, S. J. (2012). Consonance and pitch, *Journal of Experimental Psychology: General*, in press.

Absolute pitch is a form of pitch perception that involves recognition mechanisms. It has been reconsidered in light of our Object-Attribute Model of auditory processing in one paper published this year, and another that is currently under review;

- Wilson, J. W., Lusher, D., Martin, C. L., Rayner, G. & McLachlan, N. M. (2012). Intersecting factors lead to absolute pitch acquisition that is maintained in a "fixed do" environment. *Music Perception*, 29, 285- 296.



MMW team: Gary McPherson, Kat McFerran, Margaret Osborne, Sarah Wilson, Neil McLachlan (not pictured)

2. Psychological Sciences –

The neural encoding of threshold decisions

Cls: Stefan Bode and David K. Sewell (Psychological Sciences), Carsten Murawski (Department of Finance) & Philip L. Smith (Psychological Sciences).

Summary: The funded project used simultaneous fMRI and EEG recordings while participants made simple perceptual decisions at and below perceptual threshold. We proposed to use multivariate pattern classification techniques for the prediction of choices from local, spatial fMRI activation patterns as well as from the temporal dynamics of EEG signals during decision-making with excellent resolution. This novel, comprehensive decoding approach provides a unique basis for linking neural mechanisms with computational decision models. To the best of our knowledge, this is the first time that simultaneous fMRI/EEG recording have been utilised in decision-making research and the first time that multivariate pattern classification has been applied to such a data set.

Outcomes: Project preparation and piloting started in May 2012. Data acquisition started in August 2012 and finished in November 2012. Due to the technically highly demanding nature of the project and initial problems with the EEG system at Monash Biomedical Imaging (MBI), we agreed on using the data set jointly and on making it available for further methodological work at MBI, establishing a research collaboration between our group and MBI. In November 2012 we started with data analysis, which will continue to mid-2013. To date, the fMRI analysis is in progress and the EEG data is pre-processed. Computational modelling will commence in January 2013.

Finally, this project already succeeded as one of the basic modules for the foundation and the development of our new interdisciplinary research group, the Decision Neuroscience Laboratory, co-headed by Dr Bode (MSPS) and Dr Murawski (FBE). We established this group in 2012, built further collaborative links with MBI and several overseas partner institutes, and will continue to expand this interdisciplinary research during the coming years.

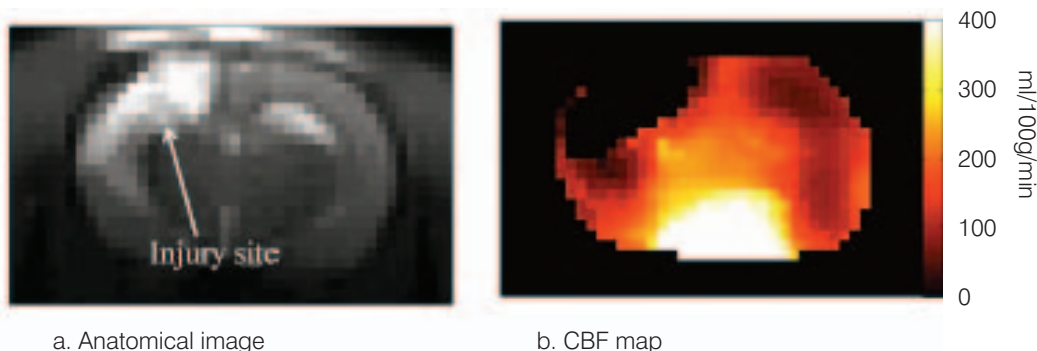
3. Melbourne Brain Centre Imaging Unit -

Arterial Spin Labeling for Measurement of Cerebral Blood Flow in Rat Brain by MRI

CI: Roger Ordidge (Imaging), Adrienne Campbell (UCL)

Summary: The seed funding was used to optimise arterial spin labelling (ASL) and analysis for in vivo mouse and rat brain imaging to assess the capacity of this new generation technique to measure cerebral blood flow (CBF) in future preclinical MRI studies. Adrienne Campbell, Prof. Roger Ordidge's PhD student spent two weeks at the University of Melbourne, and during this time worked with Mr. David Wright to optimise this technique.

Results: The results shown below were obtained in normal rat brain (Figure A.17) and in rat brain that had suffered a traumatic brain injury demonstrating that the injury site is clearly visible on the anatomical image (left) and that it results in a large perfusion deficit on the CBF map (right).



Outcomes: These preliminary data demonstrate that realistic perfusion data sets can be acquired in the rat and mouse, with minimal modification. The acquisition in the mouse brain was limited by the spatial constraints of the CryoProbe in the Bruker animal magnet. However, this was addressed by increasing inversion pulse power, and positioning the mouse further into the scanner. Further work will be undertaken to validate the ASL measurements in the mouse with this setup. A new coil arrangement is currently being tested with Bruker recently supplying the necessary software. This consists of a separate blood tagging RF coil which can be positioned over the animal's neck for tagging the carotid arteries. This could represent better and more robust solution for animal CBF measurements in the future.

4. Centre for Neural Engineering –

Role of glutamate receptor, metabotropic 5 (GRM5) in Autism Spectrum Disorder (ASD)

CI: Gursharan Chana (Engineering and Psychiatry), Stan Skafidas (Engineering)

Summary: With the seed funding we plan to assess whether the levels of the GRM5, a receptor involved with excitatory transmission in the brain is altered in individuals with Autism versus normal controls, and specifically in the frontal cortex, a key brain area implicated the functional deficits in Autism. Based on our preliminary findings we predict that individuals with Autism will have a decrease in the number of GRM5 receptors and that this decrease maybe related to harmful effects with regards to a reduced ability to regulate developmental inflammatory processes in the brain via reducing activity of the resident immune cells of the brain which are called microglia.

In addition we will also assess the presence of a genetic variation within the GRM5 gene within the brains of Autism versus controls. Our hypothesis was that increased microglial activity would be associated with the presence of one or more of our candidate SNPs within Autism cases.

Outcomes: Our genetic studies on large datasets (over 2000 Autism and cases and over 200 controls) have identified 8 genetic variants in 3 genes that had the greatest contribution to a diagnostic classifier for Autism. These were the genes for glutamate receptor, metabotropic 5 (GRM5), guanine nucleotide binding protein (G protein), alpha activating activity polypeptide O (GNAO1) and potassium large conductance calcium-activated channel, subfamily M, beta member 4 (KCNMB4). Considering the known involvement of these candidate genes for Autism and the glutamatergic system, we postulate that an interaction could exist between proteins encoded for by these genes at glutamatergic synapses (Figure 1), and that this interaction could be significantly disrupted in Autism. The association of GRM5 to ASD is potentially functionally important as increased activity of GRM5 has been shown to reduce microglial activity following exposure to the pro-inflammatory molecule lipopolysaccharide (LPS). This effect of GRM5 has the potential therefore to be able to decrease inflammation in the brain that may be present during brain development in order to correct adverse brain changes associated with this inflammation.

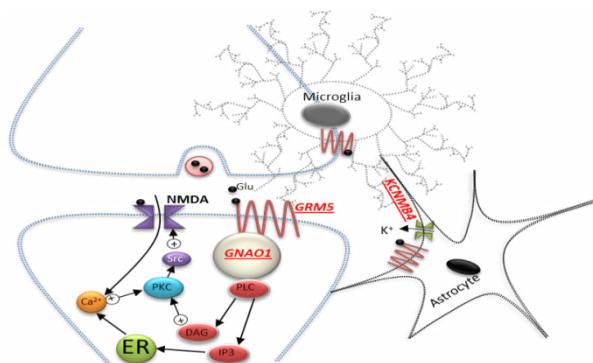


Figure 1. Postulated Interactions of Candidate Genes for ASD

Our preliminary analysis of GRM5 receptor levels in Autism versus controls has demonstrated that there is a qualitative reduction in GRM5 levels in Autism versus controls (Figure 2).

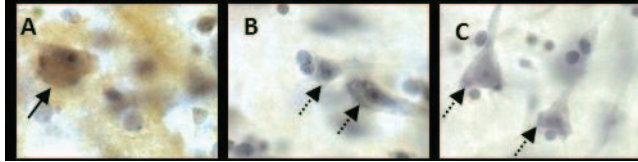


Figure 2: Demonstration of qualitative decrease in neuronal GRM5 immunostaining going from Control dLPFC [(A) to Autism dLPFC [(B) and negative control with no primary antibody (C)]. Black arrows indicate positive cytoplasmic staining, dashed arrows indicating negative/low level staining. Images taken at x100

Our observation that a reduction in GRM5 in ASD vs controls is in keeping with our hypothesis that within the brains of Autism patients GRM5 is reduced and relates to a reduced ability of individuals with Autism to regulate microglial activity hence leading to adverse consequences.

Our future work will also investigate the interaction of the three candidate genes in vitro and assess the neuronal functional outcome of altering their expression under normal, pathological and treatment-related conditions. It will utilise animal models and in vitro cell culture to further interrogate the mechanism associated with GRM5 regulating microglial activity.

functional outcome of altering their expression under normal, pathophysiological and treatment-related conditions.

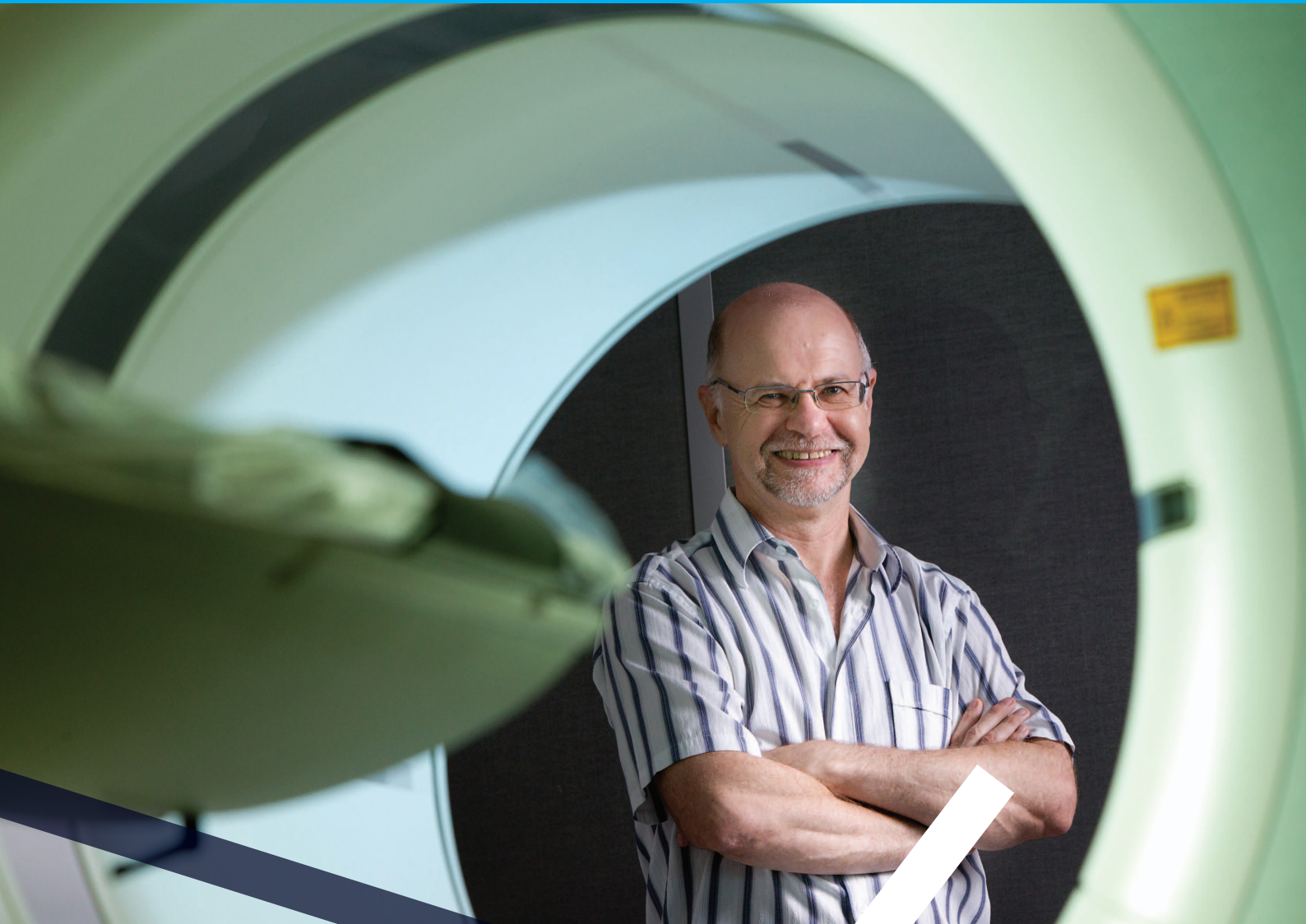
Interdisciplinary Seed Funding Grants

The Interdisciplinary Seed Funding scheme provides funding to address complex problems facing society with solutions that demand an interdisciplinary approach. The scheme seeks to support research activities that: will benefit from short-term seed-funding; will lead to new interdisciplinary collaborations; can identify strong opportunities for external funding; and are consistent with the broad research objectives of one or more of the Melbourne Research Institutes or designated emerging areas of focus.

Successful neuroscience-focused projects (commenced in 2012)

Coordinating investigator	\$ awarded by Melbourne Research	\$ top-up by MNI	Project Title
Butzkueven, Helmut	50,000		Epigenetic study of peripheral blood lymphocytes in Multiple Sclerosis: establishing principles to deconvolute epigenetic signals from DNA derived from unsorted blood leucocytes to give meaning to GWAS Helmut Butzkueven – MDHS; Trevor Kilpatrick – Centre for Neuroscience Research; Judith Field – FINMH; Gordon Smyth – WEHI; Simon Foote – Macquarie University; Jim Stankovich – University of Tasmania.
Hollenberg, Lloyd	50,000		First high resolution quantum imaging of neuronal activity Lloyd Hollenberg – Physics; Steven Petrou – Centre for Neuroscience Research; Stan Skafidas – Engineering.
Ordidge, Roger	50,000		MRI studies of Sodium in brain disease Roger Ordidge, Trevor Kilpatrick – Centre for Neuroscience Research; Patricia Desmond – Radiology.
Yucel, Murat		50,000	Addiction models: Are they relevant to problem gambling? Murat Yucel, Valentina Lorenzetti, George Youssef – Psychiatry; Alan Jackson, Nicki Dowling, Darren Christensen – Problem Gambling Research & Teaching Centre, MGSE; Wayne Hall, Adrian Carter – University of Queensland; Anneke Goudriaan – Amsterdam University.
Burkitt, Anthony		25,000	Speech from noise Anthony Burkitt, David Grayden – Biomedical Engineering; Neil McLachlan – Psychological Sciences.
Hughes, Richard		25,000	Studies towards novel BDNF mimetics as modulators of central and peripheral myelination Richard Hughes – Pharmacology; Simon Murray – Anatomy & Cell Biology; Craig Morton, Michael Parker – St Vincent's Institute of Medical Research; Martin Scanlon – Monash University.

Coordinating investigator	\$ awarded by Melbourne Research	\$ top-up by MNI	Project title
Kolbe, Scott	40,000		Investigating the genetic basis for neurodegeneration in multiple sclerosis using integrative and automated informatics Neil Killeen – MDHS and IT; Wei (Wilson) Liu – Centre for Neuroscience Research; Trevor Kilpatrick – Centre for Neuroscience Research; Jac Charlesworth – University of Tasmania; Bruce Taylor - University of Tasmania.
O'Brien, Terence	40,000		A pilot study of positron emission tomography with [F18]- PBR111 to image microglial activation in-vivo in patients having an acute relapse of multiple sclerosis. Trevor Kilpatrick – Centre for Neuroscience Research; Rodney Hicks – Peter McCallum Cancer Institute; Andrew Katsifis – Royal Prince Alfred Hospital; Roger Ordidge – MDHS; Christos Pantelis – MDHS; Rob Ware – Cyclotec and Peter McCallum Cancer Institute; David Krenus – Cyclotec.
Judd, Fiona		40000	Nurturing the vulnerable brain Penny Sheehan – MDHS; Ian Everall – MDHS; Chad Bousman – MDHS; Tram Nguyen – MDHS; Lex Doyle – MDHS; Padma Murthi – MDHS; Louise Newman – Monash University; Kylie Gray – Monash University.
McLachlan, Neil		31,000	Enhanced neuroplastic adaptation to cochlea implants through music training Sarah Wilson – MDHS; Richard Dowell – MDHS; Jeremy Marozeau – MDHS.



*Dr Neil Killeen, Research Technology Specialist (Bio-medical Imaging)
Jointly funded by Centre for Neuroscience Research and ITS Research*

MNI Fellowships

The 2012 MNI fellowships were awarded to Dr Sandy Shultz and Dr Lin Hung, whose projects focus on traumatic brain injury and Parkinson's disease, respectively. The fellowships provide an opportunity for the University to promote strategic areas of research; in this case, interdisciplinary research projects in the neurosciences.

Sandy Shultz

Dr Shultz's project, "Investigating the underlying mechanisms and treatment of traumatic brain injury", examines what occurs in the brain following injury, as well as the medical treatment of concussions. This is an emerging concern for individuals who are at risk of suffering multiple concussions, such as athletes and military personnel, as growing body of research indicates that repeated concussion can result in long-term neurological impairments and neurodegenerative disease.

Professor Terence O'Brien, James Stewart Chair of Medicine and Head of the Department of Medicine, said, "Dr Shultz is an outstanding post-doctoral behavioural neuroscientist who brings unique expertise and training that is not only novel to the University, but is rare worldwide. Traumatic brain injury and its related neurological disorders are increasingly being recognised as a priority area by funders internationally. Dr Shultz will apply state of the art in-vivo imaging techniques to investigate the long term consequences of traumatic brain injury in rats, and the impact of two novel therapeutic approaches".

Dr Shultz conducts research using animal models. To date this research has implicated hyperphosphorylated tau as a key pathogenic mechanism in the neurodegenerative effects of brain injury. Importantly, the research team has identified a treatment, sodium selenate that targets this mechanism and improves outcome. Given these positive results, Dr Shultz's team is now attempting to translate these findings into clinical trials (sodium selenate is already in clinical trials for Alzheimer's disease). Overall, the MNI fellowship awarded to Dr Shultz has enabled numerous collaborations, particularly with the Small animal imaging group (i.e. Leigh Johnston) at FINMH, and Chris Hovens at the Department of Surgery (Royal Melbourne Hospital) to be fostered for mutual benefit.

Lin Hung

Dr Hung's project focuses on Parkinson's disease. Current therapeutic strategies only give symptomatic relief of the motor impairment and its underlying cause(s) are still being debated with numerous hypotheses suggested. This ambiguity has hindered development of effective treatments that can target all aspects of disease, including the prospects for progressive neurodegeneration and the worsening clinical disability that ensues. Dr Hung's team and their collaborators have pioneered work on the use of compounds such as copper as therapeutics for Parkinson's and other neurodegenerative diseases.

Dr Hung's team has identified a novel post-translational modification of tau, a protein involved in neurodegenerative diseases. Dr Hung discovered that nitration of tau is elevated in PD as well as in ageing. The team has since identified that nitration of tau leads to disruption of the microtubules, a key facilitator of axonal transport within neurons. The impairment of transport leads to an accumulation of proteins leading to toxic effects. As part of this research, Dr Hung's research team has identified a compound that is able to reverse nitration of tau, leading to reversal of PD pathology in mice.

Key outcomes of Dr Hung's work include the discovery that nitrated tau is elevated in aged human brains as well as in mice, with the implication that excessive nitration of tau during ageing potentially represents a risk factor for PD. Nitration of tau leads to alteration of tubulin levels, the implication being that nitration of tau leads to disruption of microtubules. The accumulation of alpha-synuclein in the striatum of PD patients could be due to its impaired trafficking as a consequence of microtubular disruption.

Dr Hung has a number of important collaborations with key internal and external partners, including Ashley Bush, David Finkelstein, Paul Adlard, Colin Masters, Blaine Roberts, Peter Crouch, Anthony White and Robert Cherny, Andy Hill (Department of Biochemistry, The University of Melbourne) and Roberto Cappai (Department of Pathology, The University of Melbourne).

In 2013, The University's Melbourne Neuroscience Institute has awarded Fellowships to Ms Valentina Lorenzetti, from the Melbourne Neuropsychiatry Centre and Dr Toby Merson of the Florey Neuroscience Institutes, to promote the University's interdisciplinary research projects in the neurosciences.

Valentina's research project is titled 'Craving in problem gamblers: Does brain activity predict gambling later in life?' and Toby's research is on 'The oligodendrocyte plays an integral role in brain plasticity throughout life'.



MNI Fellows 2012: Lin Hung and Sandy Shultz

Strategic Research Australian Postgraduate Awards

The Strategic Research Australian Postgraduate Awards (STRAPAs) are allocated by the Deputy Vice-Chancellor (Research) to University of Melbourne research initiatives that are strategically advantageous to the research agenda of the University and align research and research training. The STRAPAs are designed to support research higher degree students participating in crossdisciplinary research programs involving more than one Faculty. In 2012, the MNI-based STRAPA was awarded to Jeremiah Lim from Department of Optometry

Jeremiah Lim

Jeremiah's project focuses on the point when nerves fail to transmit information due to changes in local pressure gradients (change in eye pressure or intracranial pressure) and the unresolved biophysical mystery of how much damage is caused by mechanical stress or by vascular stress. The literature abounds with studies attempting to isolate these mechanisms but to date none has successfully quantified the importance that these sources of stress play in the pathogenesis of eye and brain diseases. The eye presents a unique location to disentangle these underlying mechanisms through optical imaging. Imaging of the neural tissues in the eye may provide greater insight into the underlying mechanism governing neuronal function in the brain. Jeremiah's will be the first study of its kind to bring together ocular coherence imaging, real time blood flow imaging (high speed direct quantification of erythrocyte flow), blood vessel oximetry imaging (dual wavelength imaging of oxygenated and deoxygenated haemoglobin) as well as retinal function. These tools will be applied in a novel rodent model in which the balance between eye, blood and brain pressures can be systematically manipulated. In this way the dependence of neuronal function on mechanical and vascular sources of stress can be fully quantified. This project will lead to the development of novel imaging tools that are ready for clinical translation and what can inform our fundamental understanding of neuronal physiology.



Department of Optometry and Vision Sciences

Governance

Advisory Board

The Advisory Board aims to ensure the MNI is aligned with important trends and provide avenues for interaction with those who might wish to commission or undertake research through collaborative interaction in the Neurosciences and related disciplines of research at the University. Board members have strong credentials in the University, private, public and non-government sectors and act as advocates on behalf of the MNI.

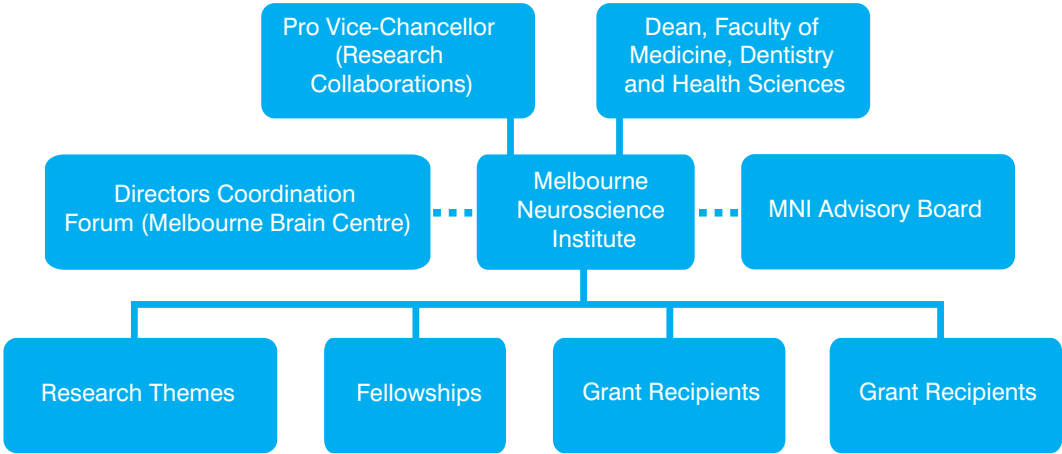
The MNI Advisory Board provides advice on:

- Research directions of themes and projects within MNI;
- Business strategies to ensure MNI operates consistent with industry best practice, for the benefit of MNI staff and researchers; and
- Stakeholder linkages and improvements to encourage participation and mutually beneficial outcomes for MNI researchers.

Members:

Representative	Title
Professor Liz Sonenberg (Chair)	Pro Vice-Chancellor (Research Collaboration)
Professor Trevor Kilpatrick	Director, Melbourne Neuroscience Institute
Professor James Angus	Dean, Faculty of Medicine, Dentistry & Health Sciences
Professor Greg Qiao	Assistant Dean (Research), Melbourne School of Engineering
Professor Rob Saint	Dean, Faculty of Science
Dr Andrew Milner	CEO, Neurosciences Victoria
Professor Richard Head	Director, Sansom Institute for Health Research, UniSA
Professor Glenn Bowes	Associate Dean (External Relations), Faculty of Medicine, Dentistry & Health Sciences

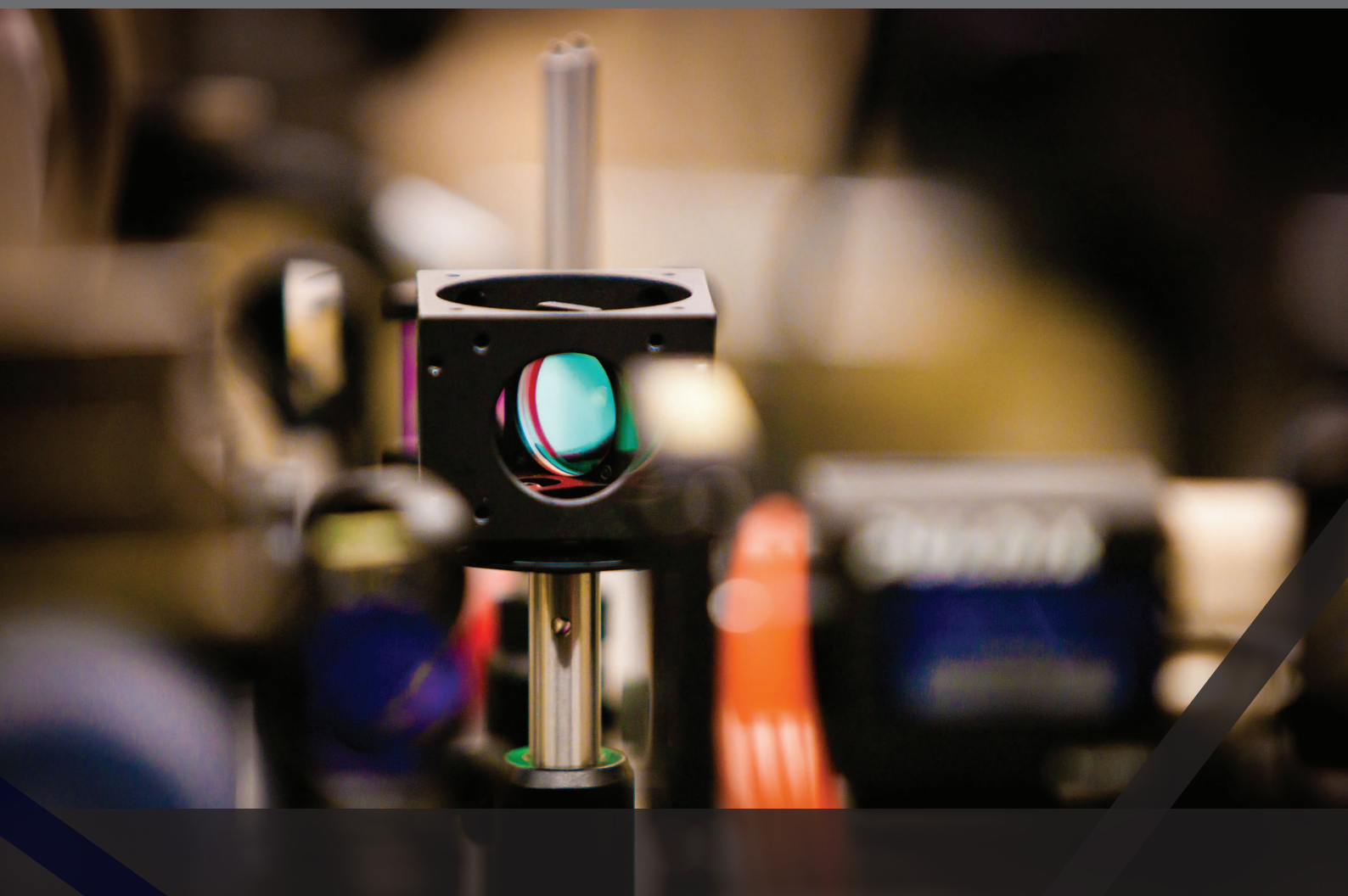
Structure



Finance

MNI receives core funding from the Deputy Vice-Chancellor (Research) each year to fund research-enabling activities such as seed funding, fellowships, scholarships and events for the research community and general public. Funding of the Directorate is also covered by core funding.

INCOME		
Core funding		992,250
Strategic funding (from DVC(R) strategic fund)		30,000
Sponsorship for Melbourne Brain Symposium		10,000
	TOTAL	1,032,250
EXPENDITURE		
Operating Expenditure		524,447
Salaries	491,769	
Admin & other costs	12,217	
Events and communications	20,461	
Research Enabling Expenditure		338,674
MNI Fellowships		100,000
Interdisciplinary seed funding		71,000
Funding for new Chair in Imaging		20,000
MNI research theme grants		100,000
Partnership development		16,235
PhD scholarships		16,414
Sponsorships & Donations		15,025
	TOTAL	863,121
Balance – for future research enabling activities		169,129



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