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DIRECTOR’S REPORT

2016 saw the Centre for Advanced Imaging (CAI) participate in its first septennial UQ Academic Board review resulting in extremely positive and constructive recommendations. The review committee of national and international experts were impressed with the Centre’s outstanding physical infrastructure, the University’s and the Centre’s leadership and our achievements in Discovery, Education and Imaging Service provision. The reviewers acknowledged that the Centre is unique in Australia and amongst a handful of international centres that have such an array of cutting-edge instruments. This positions the Centre and UQ extremely well for attracting world class researchers and to build strong national and international collaborations to best utilize CAI’s imaging technologies.

The Centre aims to meet the challenge to fulfil the recommendations for growth and recruitment of new research talent and to build on CAI’s strong platform for ‘bleeding edge’ research.

I would like to take this opportunity to thank the staff and students at CAI for their tireless work leading up to the review and, indeed for their many contributions since the Centre’s inception.

Professor David C. Reutens

Our Vision is to be a World Leader in the Development and Application of cutting edge Imaging Science and Technology through Innovation, Translation, Education and Collaboration.
Researchers at CAI have a number of programs to improve our understanding of a range of diseases and their treatment. We use a variety of imaging and spectroscopic techniques to further the development of early detection and identification of diseases, improved monitoring and evaluation of treatments and novel therapeutic development.

“Our researchers work on innovations in spectroscopic and imaging technology, imaging biomarker development and in biomedical research disciplines, frequently in collaboration with clinical research sites and other local, national, and international research institutes.”

RESEARCH THEME ONE
ADVANCED IMAGING OF STRUCTURE, FUNCTION & DISEASE
A/Prof McMahon’s research interests lie in understanding the neurobiology of language, learning and memory, and the genetic and environmental influences on brain structure and function. In 2016, her research generated 23 journal and 3 conference publications. Research highlights include:

**Head Motion and Inattention/Hyperactivity Share Common Genetic Influences**
Correcting for head motion is common when analysing functional brain imaging (fMRI), but what if the degree of motion is related to the trait you were trying to measure? The group investigated whether head motion shared a common genetic influence with inattentiveness and hyperactivity-impulsivity, in a study of 627 twins. Head movement was found to be moderately correlated with maternal reports of inattention and hyperactivity-impulsivity. This means that removing head motion as a nuisance variable will reduce power in neuroimaging within populations such as ADHD, and more robust ways of dealing with it were highlighted.

**Genome-wide association study of working memory brain activation**
A working memory task was used to investigate the degree of brain activity in 863 twins. The research identified 31 single nucleotide polymorphisms that were associated with signal changes in the brain with inattention and hyperactivity-impulsivity, in a study of 627 twins. Head movement was found to be moderately correlated with maternal reports of inattention and hyperactivity-impulsivity. This means that removing head motion as a nuisance variable will reduce power in neuroimaging within populations such as ADHD, and more robust ways of dealing with it were highlighted.

**An fMRI Study of Concreteness Effects during Spoken Word Recognition in Aging: Preservation or Attenuation?**
This research investigates the influence of healthy aging on language. Understanding the underlying neural mechanisms associated with the ability to preserve processing of concrete words (e.g. spoon) over abstract (e.g. justice), is important when trying to understand the best therapy after language is lost. By comparing the brain activation during fMRI of young and older healthy adults, the study found that spoken comprehension of concrete and abstract words appears relatively preserved for healthy older individuals. However, the neural substrates that underpin this preserved performance appear to vary as a function of age and may reflect compensatory age-related upregulation.

Research in the Reutens group focuses on neurological disorders, particularly epilepsy, and the development of novel imaging methods to better understand, diagnose and manage them. 2016 was an outstanding year for the Reutens group with a number of high profile papers published, several new grants, including a new ARC Discovery Project grant, novel IP submitted in patent applications and several new RHD students and post-doctoral fellows joining the group.

Research highlights include a project evaluating the effect of a well-established immunomodulatory treatment, intravenous immunoglobulin (IVIg), on the development of epilepsy in an experimental model of epileptogenesis. Our results show that treatment with IVIg attenuated acute inflammation and reduced the frequency and duration of spontaneous recurrent seizures. The finding of this study supports the novel application for IVIg, specifically its repurposing as a disease-modifying therapy in epilepsy.

The group’s research in ultra-low field nuclear magnetic resonance instrumentation continues to progress with recent results published in PLoS One. The study evaluated the feasibility of generating the variable magnetic fields required for ultra-low field nuclear magnetic resonance relaxometry with dynamically adjustable permanent magnets. Using the array, a pre-polarisation field nuclear magnetic resonance relaxometry with the variable magnetic fields required for ultra-low field nuclear magnetic resonance relaxometry with dynamically adjustable permanent magnets. Using the array, a pre-polarisation field above 100 mT and variable measurement fields ranging from 20–50 μT with 200 ppm was achieved. The results support the development of low-field MR, increasing system portability.

Imaging tracer development is another key area of research with new thiosemicarbazone ligands synthesized, and their coordination chemistry with gallium investigated. The reaction of the thiosemicarbazones with gallium chloride in alcohol solutions in the presence of a base yielded the corresponding penta-coordinated Ga-Cl metal complexes. Additionally, the positron-emitting isotope $^{18}$F was introduced in the structure of the diphenyl gallium thiosemicarbazone complex as a novel and simple method of radiolabelling. This method is the subject of a patent application as it opens opportunities for novel kit-based radiopharmaceuticals.
The research of A/Prof Margie Wright and her group encompasses the neurobiological causes and modifiers of brain function, and especially brain disorders. Brain imaging, neuropsychological tests, behavioural and molecular genetic approaches are used; and a vast dataset of imaging, clinical, and genetic information has been collected from people at different ages. The group investigates the genetic and environmental factors that lead to differences between individuals in the shape and size of brain structures, brain wiring and connectivity. Key aims are to understand differences in the healthy brain, to provide insights into deviations from normal development and ageing, and to increase the understanding of the biological processes at the core of illness risk for psychiatric and age-related brain disorders.

A highlight this year was her collaborative research on the heritability of the shape of subcortical brain structures in the general population. This work, published in Nature Communications, looked at the contribution of genetic factors to individual variation in the shape of seven bilateral subcortical structures including the nucleus accumbens, amygdala, caudate, hippocampus, pallidum, putamen and thalamus. The work found that in a general population of middle-aged and elderly individuals, the shapes of subcortical structures are under genetic control. The results were confirmed in an independent cohort of twins, suggesting that the genetic architecture of subcortical shapes is similar across populations, despite differences in the sample, the study design, scanner types and methods to compute the heritability. The factors driving individual variation could provide insight into brain development, healthy ageing and pathological states, but these remain largely unknown.

During 2016 one RHD student commenced in the Wright group. A/Prof Wright was awarded a grant from the Cerebral Palsy Alliance for a collaborative study to look at the relationships between genetic factors, brain structure and functional outcomes in children with the condition.

RESEARCH HIGHLIGHT

ARC Science of Learning Research Centre

Professor David Reutens, Dr Lars Marstaller and Associate Professor Hana Burianova

Fear and Safety Learning - implications for anxiety in the classroom

The ability to learn whether a situation is dangerous or not, is one of the most basic mechanisms by which animals and humans adapt to their environments. It allows us to adjust our behaviour to changes and respond appropriately to dangerous situations. It also allows us to feel relaxed in situations that might have been dangerous previously, but which are now safe. Anxiety has a negative effect on students’ learning outcomes. Malfunctioning brain networks that support fear and safety learning leads to anxiety disorders. In this research project, the research team investigated the brain networks that allow us to learn whether a situation is safe or dangerous, whether we can relax or need to engage in fight or flight.

Using advanced neuroimaging methods, the results of this research show that how we learn to differentiate between dangerous and safe situations is dependent on the interaction between two specific brain networks. These results constitute a significant advancement in our knowledge, which previously assumed that a single network was responsible for fear and safety learning. The findings have implications for the role of anxiety in the classroom and suggest new approaches that target the interaction between brain networks can reduce the negative effects of anxiety on learning and improve students’ academic success.

Heritability (h2) maps of shape measures of subcortical structures. Maps show a range of h2 across each of seven bilateral subcortical structures for shape measures of radial distance (adjusted for intracranial volume, sex, and age).

The two networks that interact during fear (ACQ) and safety (EXT) learning (see Marstaller et al., 2016, Neuroimage 134: 314-9).
Researchers apply spectroscopic and imaging instruments to characterise molecular structures and dynamics. Through active hardware and software development CAI researchers contribute significantly to the advancement of these core technologies. Multimodality correlative imaging, such as PET-MRI and PET-CT, combines the strengths of each modality to enable new tools for research and diagnostics.

RESEARCH THEME TWO
ADVANCED IMAGING, DIAGNOSTIC & SPECTROSCOPIC TECHNOLOGIES
Advances in diffusion MRI

Diffusion Tensor Imaging (DTI) is an MRI-based neuroimaging technique for estimating the location, orientation, and anisotropy of white matter tracts in the brain. The Barth group reported an optimal time-efficient acquisition protocol for DTI on an ultra-high field scanner operating at 7 Tesla (7T). This advance provides researchers with a versatile DTI protocol which is able to be used to study a range of neurological disorders that affect the myelin sheath, including multiple sclerosis and leukodystrophy.

High resolution atlas of the human brain

In other work, a very detailed atlas of brain microstructure was compiled using images acquired on CAI’s 7T MRI scanner. The atlas is publicly available as a resource to support further brain research. For further information, visit www.imagining.org.au/7T-Human and www.tissuestack.org.

New quantitative susceptibility mapping (QSM) brain imaging technique

The Barth group developed a new QSM brain imaging technique which may lead to improved diagnosis and treatment of neurodegenerative diseases such as Alzheimer’s or Parkinson’s disease. The new technique, called 3D Planes-on-a-Paddlewheel (POP) EPI, is a faster and more efficient way to characterise the brain’s tissue properties with a high image resolution. It allows researchers to map the tissue properties of the brain in less than 40 seconds, being seven times faster than established techniques. This accelerated technique reduces the effect of head movement during an MRI examination, thereby leading to higher quality images and improved diagnosis. Future focus of the work will maximize the impact on the early diagnosis of neurodegenerative diseases.

Research success in 2016 had significant contributions from post-doctoral research fellows, Dr Daniel Stäb, and Dr Steffen Bollmann, Dr Kieran O’Brien (Siemens Healthcare) and CAI’s facility staff Aiman Al Najar, Nicole Atcheson and Don Mailliet. The group continued and established successful collaborations with research groups at CAI, UQ and QIMR, which included the following PhD projects starting or continuing in 2016:

- The examination of small functional structures in the visual cortex (Anne Marge Maallo), with Prof Geoffrey Goodhill (QBI, UQ)
- Researching safety and image quality in the presence of metal implants (Aurelien Destruel) with Prof Stuart Crozier (EAIT, UQ)
- Two projects, examining microstructural models in the brain (Kiran Tapaliya, Surabhi Sood) with Dr Viktor Vegh (CAI)

The research activities in the Brereton group are linked by a common aim of developing methods for the improved understanding of the molecular basis of biological function and disease, and informing the development of new diagnostic imaging biomarkers, technologies and approaches to therapy. Highlights of research in 2016 included:

- MR imaging and spectroscopy tools for the characterisation of metabolism in cancer and neurodegenerative disease.
  - Multimodal MR/PET imaging methods and agents in cancer and neurodegenerative disease.
    - Development of universal cancer theranostics targeting the tumour endothelial marker TEM8. Protective antigen, from B.anthracis is a natural ligand of TEM8 and therefore a potential candidate for detection and management of tumour vasculature, metastasis and growth. Project led by Yas Tesiram, Mehdi Mobli, James Wells (UQD)and PhD student Theo Crawford.
    - Optimisation of PET/MR protocols to separate tissue delivery from cellular uptake of imaging agents, and multimodal imaging agent development for imaging of cancer, led by Gary Cowin. A collaboration with Clarity Pharmaceuticals culminated in a successful CRC-P application to develop protocols for novel copper-based radiopharmaceuticals. AusIndustry Research Connections and CRC-P grants.

NMR metabolomics: Characterisation of metabolic processes in biological systems.

A major program initiated in the use of NMR-based metabolomics as a diagnostic tool based on profiling biofluids and tissues in diseases such as prostate cancer, epilepsy, heart disease and diabetes, as well as characterisation of environmental impact on livestock production. In 2016, UQ Strategic Funding was awarded to establish a NMR-based Metabolomics Facility within CAI led by Horst Schirra.
To investigate potential therapies of non-alcoholic fatty liver disease (NAFLD) and non-alcoholic steatohepatitis (NASH) more easily the Brereton group at CAI have been developing an MRI imaging method for assessment. A non-invasive imaging tool could pave the path to better treatments and prevent the progression of comorbidities such as liver cancer.

In 2016, we generated an experimental model to study NAFLD and liver lipid metabolism disruption in rats using a diet deficient of choline and methionine (CDAA). We assessed the liver of the animals by MRI and found that the CDAA diet animals had elevated levels of liver fat as well as various other pathologies such as, mild fibrosis, hyperplastic nodules and adenomas.

Additional studies of this research will investigate the correlation of diet effect on comorbidities in this model and the establishment of a non-invasive MRI diagnostic method to distinguish NAFLD from NASH.

The EPR Spectroscopy and Imaging group, led by A/Prof Jeffrey Harmer, focuses on understanding the structure and function relationship of large biomolecular systems, and understanding the electronic structure and catalysis of metal complexes and enzymes.

The group’s research in structural biology makes extensive use of Double Electron Electron Resonance (DEER) spectroscopy, a technique involving spin labelling of biomolecules with paramagnetic spin probes, and then measuring the distance between the probes to a resolution of 15-100 Å.

During 2016, the group’s DEER research focused on applying the technique to understanding the molecular machinery of the family of Nonribosomal Peptide Synthetases (NRPS). This family of enzymes produce natural products, a selection of which are potent pharmaceuticals, including those with antibiotic, anti-cancer and immunosuppressive functions. The project goal is to understand the biosynthetic mechanism of the NRPS mega-enzymes, allowing the systems to then be re-engineered to produce new pharmaceuticals, and in particular new antibiotics. To aid in the DEER methodology development, research commenced on developing a set of generic tools to enable the distance constraints derived from the DEER data to be integrated seamlessly into molecular modelling approaches to characterise protein structure and hence elucidate structure-function properties. Joshua Harbort and Alina Motygullina are currently doing their PhD projects in this area.

A highlight in the field of catalysis was the careful characterisation of a Ruthenium complex in a series of oxidation states and its investigation as a catalyst. This work continues a long standing collaboration with Hansjörg Grützmacher from the Eidgenössische Technische Hochschule Zürich.
Research in design, production or isolation of synthetic compounds, natural products and biomolecules using NMR and EPR spectroscopy and CAI’s radiochemistry facilities.
The need for molecular imaging agents in modern healthcare is increasing with the advent of new diagnostic technologies such as Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT). These remarkably sensitive, non-invasive, imaging techniques provide valuable information at the cellular level. Molecular imaging agents, also known as radiopharmaceuticals, contain drug molecules labelled with radioisotopes and are widely used to diagnose neurological, oncological and cardiovascular diseases.

A/Prof Bhalla’s research group focuses on the development of new labelling strategies and chemistry for a wide range of radioisotopes, including fluorine$^{18}$, carbon$^{11}$, gallium$^{68}$, copper$^{64}$, zirconium$^{89}$ and technetium$^{99m}$. This radiolabelling research supports the synthesis of novel PET and SPECT diagnostic agents. A/Prof Bhalla currently supervises two radiochemistry research fellows and two PhD students.

In 2016, the Bhalla research group focused on developing new fluorine$^{18}$ and carbon$^{11}$ ligands for the aryl hydrocarbon receptor (gliomas) and for tau (Alzheimer’s disease). The team synthesised several tryptophan ligands and established a number of fluorine$^{18}$ synthons that have also been utilised by several research groups. Collaborations with the University of Southampton (UK) and GE Healthcare focused on developing new high affinity binders for fluorine$^{18}$ which have application to improved methods for labelling peptides.

The group now routinely produces a number of neurology imaging agents for research including those for amyloid, Gamma-Amino Butyric acid and neuroinflammation.

A/Prof Blakey’s research focuses on understanding how the structure of materials at different length scales relates to their properties. The application of this knowledge allows for the design and construction of new materials targeting properties which will improve performance for specific applications. Applications include developing a range novel materials for improving processes for the fabrication of integrated circuits, leading to more powerful and energy efficient computer chips. Aspects of this research were published in Macromolecules in 2016.

Other projects include developing materials to detect low levels of chemicals, which can be utilised in environmental monitoring or detection of disease markers. For example, in collaboration with A/Prof Caroline Gaus from the National Research Centre for Environmental Toxicology, research on the detection of ultra-low levels of persistent organic pollutants (POPs). Due to their resistance to environmental degradation, POPs can bioaccumulate which has significant impacts on human health and the environmental. A 2016 publication in Environmental Science and Technology Letters reported on innovative materials that have a tenfold improvement in performance over the current standard in the field.

Additional research focuses on optically based chemical sensors. Unlike many sensors found in devices like smart phones which are based on electronic signals, these novel sensors use light to interrogate nanostructured materials to allow selective and sensitive detection of chemicals. These materials have the potential to be used in remote sensing applications such as the waste streams of mining sites or used for the detection of disease metabolites.

A/Prof Blakey supervised six PhD students who work on projects that focused on development of novel nanomedicines, antibacterial surfaces, and improved materials for nanofabrication and polymerisation mechanisms.
The BioNMR group, headed by Dr Mehdi Mobli, is focused on investigating biomolecular structure and function. Research involving modulation of proteins associated with key biological processes will inform future development of therapeutic drugs and diagnostics and may also inform development of new agricultural products. More specifically, the group is interested in understanding the structural details of the function of voltage-gated ion channels and how this is perturbed by different ligands. These solution state studies of integral membrane proteins are at the cutting edge of this field therefore also requires the group to actively develop novel biochemical and biophysical tools to drive progress.

In 2016 the group expanded with the addition of two new PhD students, Mr Alan Zhang and Mr Tomas Miljenovic. The two candidates will strengthen the group in understanding ion channel function and modulation by ligands with applications in development of novel analgesics, and in development of cutting edge tools in NMR spectroscopy for studies of biomolecules. The addition of these researchers demonstrates the direction of the group in developing new NMR tools address difficult biological problems.
A/Prof Thurecht’s research group focuses on the development of polymer and nanoparticle-based devices for nanomedicine. The group works across the boundaries of chemistry and materials, biology and imaging science to probe how nanomaterial properties affect their function in living animals. In 2016, the group’s focus was on a number of projects investigating some fundamental questions in nanomedicine:

- Can we use molecular imaging to directly assess the contribution of targeting cellular proteins on the degree of accumulation of nanomedicines within tumour tissue? Is it really beneficial to use active tumour targeting?
- How do targeting ligands affect intra-tumour distribution and ultimate efficacy of imaging agent/therapeutic?
- Can we use molecular imaging as a tool to validate “efficacy” of a nanotherapeutic?

Using antibodies or other ligands to target tumour tissue is one of the driving factors for enhancing nanomedicine accumulation at the site of disease. However, there are many factors that complicate effective attachment of such ligands. Following on from a recent patent, A/Prof Thurecht and collaborators have further developed the use of bispecific antibodies as a viable approach for targeting nanotherapeutics (Howard et al. Advanced Healthcare Materials, 2016. 5(16), 2055). Such systems provide a facile and unique way to modify nanoparticle surfaces with proteins for targeting particular receptors on cells. This approach has also been applied to modifying surfaces for development of next generation biosensors (Raftery et al. Chem Commun. 2016. 52(33), 5730).

The group also worked closely with collaborators within the Australian Research Council (ARC) Centre of Excellence in Convergent BioNano Science and Technology to develop ways of interrogating how the physicochemical properties of nanoparticles affect their distribution within tumour microenvironments. While this can be done using conventional histological (immunohistochemistry) analysis, it is important to develop techniques to investigate this in living animals, in real time. A/Prof Thurecht and his group have been investigating whether optoacoustic tomography offers a route to achieve this aim. Using the multispectral optoacoustic tomography instrument at CAI. The work showed that polymeric nanomedicines appear to distribute heterogeneously throughout the tissue, in relation to the distribution of oxygenated hemoglobin. This work is ongoing and it is hoped these results will inform the improved design of next generation nanomedicines using the high resolution imaging data.

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Dr Howard joined the CAI in 2016 as a research fellow in the Thurecht group on a National Health and Medical Research Council (NHMRC) Project grant focused on the development of hybrid bio-nanomaterials for use in imaging diagnostics and treatment of prostate cancer. Dr Howard specialises in the discovery, design, expression and characterisation of recombinant proteins, such as antibody fragments, which can be used to actively target nanomaterials such as hyperbranched polymers to tumour sites.

His research interests are currently focused on the development of methods for generating targeted hybrid bio-nanomaterials and methods for analysis of these hybrid molecules.

Dr Howard, in collaboration with A/Prof Kris Thurecht and Professor Stephen Mahler (AIBN), has recently developed a method for generating targeted nanomaterials which utilises bispecific antibodies (BsAbs). One end of the antibody binds to the nanomaterials and the other end binds to cancer cell markers such as Epidermal Growth Factor Receptor (EGFR). This BsAb targeting method was recently published in ‘Advanced Healthcare Materials’, where BsAbs were demonstrated to effectively target PEGylated hyperbranched polymers to EGFR in breast cancer cells.

The advantage of this method is that it removes almost all of the post-modification requirements for attaching antibodies to nanomaterials, decreasing the chance for degradation of the protein or nanocarrier and leading to a stable conjugate. This technology will lead to improvements in cancer treatments by providing a vehicle that can specifically direct therapeutics to the site of the cancer and in cancer diagnosis by conjugating imaging tracers.
Seven students were placed in our Winter projects and another seven students joined projects during the Summer Program. Research projects in Cardiac MRI, Polymeric Nanoparticle Theranostics, and Radiofrequency pulse design for ultra-high field MRI which allowed students’ hands on access to the 7T MRI were popular. A number of CAI’s Master’s students returned over Summer to complete projects and a few applicants were students returning to complete their second project highlighting the interest and excitement surrounding the cutting-edge research performed at CAI.

**Research Honours Students**

- **Aiden Carey** (Dr Viktor Vegh)
- **Angelo Chan** (Dr Horst J. Schirra)
- **Phil Choi** (Dr Eivind Undheim)
- **Michael Maxwell** (Dr Mehdi Mobli)
- **Justin Vaughan** (Dr Mehdi Mobli)
- **Regina Yu** (A/Prof Kai-Hsiang Chuang)

**Doctor Eivind UNDHEIM**

**ARC DECRA Fellow**

Dr Eivind Undheim joined CAI in 2016 on an Australian Research Council Discovery Early Career Researcher Award. Dr Undheim’s research interests relate to the evolution of proteins and peptides, in particular the forces that drive and constrain their functional evolution. Venoms are excellent models to study this field as they consist largely of proteins and peptides involved in everyday physiological functions, which have evolved new functions as toxins. Evolution of new function is a hallmark of toxin recruitment and diversification. Venoms also play key ecological roles in the animals that harbour them, thereby providing a unique interface between ecological and molecular evolution. In addition, venoms have emerged independently in over 80 animal lineages, providing an opportunity to gain detailed insight into the processes of functional evolution through comparative studies of this extremely convergent trait. To harness this opportunity for comparative studies, 2016 research projects include a wide range of venomous animal lineages, including cnidarians, remipede crustaceans, assassin bugs, centipedes, hymenopterans, spiders, scorpions, glycerid polychaetes, snakes, and toad fish.

The functional evolution of proteins is not just affected by their stability or molecular interaction partners, but also the overall function of the organ in which they are a part. Dr Undheim’s research therefore aims at gaining a holistic understanding of the evolution of venoms: the evolution of organs and structures that produce and deliver venoms, the recruitment and molecular diversification of toxin gene families, as well as the structural and functional evolution of toxins. The wide scope of this research necessitates a highly multidisciplinary approach, and currently includes NMR, MRI, micro-computed-tomography (µCT), imaging mass spectrometry, transcriptomics, genomics, proteomics, immunohistochemistry and histology, transmission electron microscopy (TEM), recombinant peptide expression, and bioinformatics. This approach is providing new insight into the functional and structural evolution of proteins and their associated organs, as well as increasing the potential for developing toxins from animal venoms into molecular tools.

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**Research Higher Degree (RHD) Conferrals**

- **Aditya Ardana**
  Design of functional hyperbranched polymers for gene delivery

- **Liu Chen**
  Physiological Response to Polymeric Materials in Nanomedicine

- **Peter Lavrencic**
  The structural characterisation of proteins MAL and Sr33 involved in innate immunity

- **Pengfei Han**
  Neurological, biological and behavioural studies of how food flavour perceptions affect human appetite and food intake

- **Thomas Bennett**
  Polymer-Ionic Liquid Composites for Advanced Material and Solid Polymer Electrolyte Applications

- **Amanda Pearce**
  Development of a Hyperbranched Polymer Theranostic for Prostate Cancer

- **Jeiran Choupan**
  Brain Decoding using Natural Stimulus Functional MRI: Novel Methodologies
CAI offers a range of educational opportunities with both formal degrees and professional development courses. These courses benefit from the use of the state of the art facilities at CAI and the expertise of the Centre’s researchers teaching into the programs.

**Postgraduate Coursework**

**Master of Magnetic Resonance Technology**

The Master of Magnetic Resonance Technology (MRT) suite of programs are designed for radiographers, biomedical engineers and other health professionals working with Magnetic Resonance Imaging equipment; they were enhanced with two additions this year. A new course, Magnetic Resonance Clinical Practice 1, was approved and added into the MRT program. This course enhances practical training by providing clinical practice placements for three weeks. Students have the opportunity to be part of an MRI team, attend clinical meetings and present a case study to their peers. Mr Matt Meredith, a lecturer with many years of MRI experience, was appointed to enhance the teaching capabilities. Enrolments in MRT were strong, with over 140 active students.

**Master of Molecular Imaging**

Under the guidance of program coordinator Dr Viktor Vegh, the MMI program continues to develop. This program is offered either at UQ or externally with students using imaging equipment at their own institution. Those who take the opportunity to visit CAI for their research projects are able to use the cutting edge molecular imaging equipment housed in CAI.

**Graduate Certificate in Magnetic Resonance - Positron Emission Tomography (New)**

Approval was received for the new program Graduate Certificate in Magnetic Resonance-Positron Emission Tomography (GC MR-PET). This program was developed at the suggestion of industry stakeholders, reflecting the diverse range of skills required with the emergence of hybrid imaging technology. GC MR-PET will commence in semester one 2017.

**Massive Online Open Courses**

The 4th offering of the free, online Biomedical Imaging MOOC through UQx was delivered. This is a self-paced course, aimed at high school graduates and above, and covers the fundamentals and clinical applications of x-ray, computed tomography (CT), ultrasound (US), magnetic resonance imaging (MRI) and nuclear medicine.

**Professional Development Courses**

- Dr Gary Cowin led a three day short course in Spectroscopy, covering spin physics, spectroscopy fundamentals, optimising of spectra and clinical applications.

- Dr Marcus Gray led a three day short course in functional magnetic resonance imaging (fMRI). This course covered areas such as spin physics, optimising data acquisition, cognitive paradigm design and post processing.
CAI 3rd Annual Symposium

The CAI 3rd Annual Symposium, co-hosted with Singapore Bio-imaging Consortium (SBIC) was held in October.

The symposium brought together researchers across a range of interdisciplinary areas in spectroscopy and imaging, and provided a unique forum for discussion and collaboration in the field of imaging sciences. Presentations by leading researchers included A/Prof Nat Lenzo (Clinical Professor from University of Western Australia and Director of Theranostics Australia), Prof Malini Olivo (Singapore Bio-imaging Consortium), Prof Phil Blower (King’s College London) and Prof Christoph Hagemeyer (Monash University).

These were alongside presentations by staff and students from both SBIC and CAI which highlighted the breadth of research across the two research centres, allowing for the opportunity to identify new collaborations. The next joint symposium will be hosted by SBIC in Singapore in 2017-18.

The student poster awards went to Anna Gemmell, Best Student Talk (Thurecht Group) and Alina Motygullina, Best Poster (Harmer Group).

Small Animal Imaging Workshop

CAI co-hosted a full day imaging workshop with the ARC Centre of Excellence in Convergent Bio-Nano Science and Technology in August.

Organised by the Thurecht Group the workshop included special demonstrations by Dr Gary Cowin (PET-MR), Dr Karine Mardon (PET-CT), and PhD students Nicholas Westra Van Holthe and Anna Gemmell on the Multi-spectral Optoacoustic Tomography (MSOT).

The syllabus covered all aspects of designing and running a small animal imaging experiment such as models, ethics, materials design and different imaging...

Minister for Health and Chief Scientist visits

The Centre had the pleasure of hosting the Minister for Health and Aged Care and Minister for Sport, Hon Sussan Ley MP, and the Chief Scientist, Dr Alan Finkel AO, for tours of the Centre throughout the year.

Both visitors praised the research and cutting-edge imaging infrastructure and expertise housed within UQ’s Centre for Advanced Imaging.

The Centre is well-positioned to play a key role in driving the health reform and innovation agenda set by the Australian Government. In addition to bridging the gap between Australia’s health and medical research and the Australian health system, which is the objective of the recently established $20 billion Medical Research Future Fund.

Australian Society of Nuclear Medicine at CAI

The Queensland Branch of the Australian Society of Nuclear Medicine visited the Centre in November.

Thirty nuclear medicine technologists toured CAI’s cyclotron, 7T and pre-clinical PET-CT and MR-PET. The event included a networking session and presentation by Dr Gary Cowin on the Centre’s capabilities and the Society AGM.
CAI Student Association

The Student Association of CAI, STAC, promotes student engagement through social and professional activities to enhance their experience at UQ.

STAC held a number of social events, inter-institute competitions and seminars throughout the year including:
- Student networking evening, introducing new students to the Centre.
- Logo competition where students were asked to contribute to the branding of STAC.
- Various social events including; Games and Pizza Night, Halloween Inter-institute mixer, Strike Bowling, Ultimate Frisbee vs. AIBN Student Association, combined Institute Trivia Night and combined staff/student mixer with the CAI Social Committee.
- Students participated in a combined Matlab Course with AIBN and UQ Library Lecture “Where to publish”.
- The STAC Committee organised the Student Poster Night as part of the CAI 3rd Annual Symposium in October.

International Visitors and Speakers

**Dr Ben Babourina-Brooks**
Research Fellow, Institute of Cancer and Genomic Sciences, University of Birmingham, UK. Magnetic Resonance Spectroscopy a powerful technique for providing diagnosis and prognosis in paediatric brain tumour patients.

**Prof Lawrence J Berliner** (August)
Dept of Chemistry and Biochemistry, University of Denver. Alfred Nobel and the History of the Nobel Prize. Prof Berliner also worked on tackling the metal-dependent role of tachykinin neuropeptides in the brain, from neurodegeneration to reproduction with A/Prof Jeffrey Harmer.

**Dr Kim Frisch** (January - May)
Dept. of Nuclear Medicine & PET Centre, Aarhus University Hospital, Denmark. Working on project Flourine-18 labelling of Bile Acids for Positron Emission Tomography of Hepatic Excretory Function and Enterohepatic Circulation with A/Prof Rajiv Bhalla.

**Henrik Klitgaard**
Vice President, Research Fellow, Neuroscience Therapeutic Area, UCB, Belgium. Imaging synaptic density in the living human brain using the PET Tracer [11C]UCB-I.

**Professor Marc Tittgenmeyer**
Head of Research Group for Translational Neurocircuitry, Max Planck Institute for Metabolism Research (formerly MPI-NF), Cologne, Germany. Connectivity-based Brain Mapping.

**Dr Johan Van Der Meer**
Postdoctoral researcher at Otto-von-Guericke University Magdeburg Amsterdam. Methodological considerations with EEG/MRI/Neurofeedback and 7TfMRI/Neurofeedback.

**Professor David S. Wishart**
ANZMAG Lecturer 2016, Depts. of Biological Science and Computing Science, University of Alberta, Canada. Why NMR Matters in Metabolomics.

**Professor Ed X. Wu**
Lam Woo and Chair Professor of Biomedical Engineering, The University of Hong Kong, Hong Kong. fMRI Dissection of Auditory and Visual Cortical Descending Inputs to Midbrain Auditory Processing.

ExternaL Engagement & Strategic Partnerships

**Occupational Trainees**

- **Christoffer Gothgen** (Denmark)
  - Supervisor: Dr Andrew Janke
  - Project: Optimal contrast enhancement of blockface images for MRI guided reconstruction of mouse brain volumes. (August - December)

- **Catharina Holland** (Denmark)
  - Supervisor: Dr Daniel Stab
  - Project: Investigation of cardiac MRI methods at ultra-high field.

- **Christos Zoupis-Schoinas** (Denmark)
  - Supervisor: Dr Andrew Janke
  - Project: Optimal contrast enhancement of blockface images for MRI guided reconstruction of mouse brain volumes. (August - December)

- **Nina Jacobsen** (Denmark)
  - Supervisor: Dr Steffen Bollman
  - Project: Contrast matching of ultra-high resolution minimum deformation averaged MRI models to facilitate computation of a multi-modal model of the human brain. (August - December)

- **Julie Broni Monk** (Denmark)
  - Supervisor: Prof. Jeffrey Harmer
  - Project: Spin labelling of nanoparticles for EPR imaging and pulse EPR—understanding the catalytic mechanism of Acetohydroxyacid synthase. (March - September)
The National Imaging Facility (NIF) is a National Collaborative Research Infrastructure Strategy (NCRIS) project that provides state-of-the-art imaging capability of humans, animals, plants, and materials. NCRIS facilitates access to world-class research infrastructure that is critical to support high quality Research & Development activities and improve Australia’s overall innovation output.

Directed by Professor Graham Galloway, NIF has 10 nodes together with ANSTO, providing key advancements in imaging technologies, radiophysics and radiochemistry. The strength of NIF comes from the sharing of expertise and effective use of the imaging instrumentation. The year saw a number of revolutionary breakthroughs facilitated through NIF, such as the Bionic Spine made by Melbourne scientists which brings hope to patients paralysed by injury or illness. In addition, NIF has been working on the Roadmap for Research Infrastructure, led by the Chief Scientist, Dr Alan Finkel, which informs the federal government of the research infrastructure needs for the next decade and beyond.

The unique imaging facilities and expertise of NIF scientists at the Centre for Advanced Imaging (UQ Node) have contributed to a number of breakthrough projects and studies, including the following project that aims for a better understanding of cancer.

Enhanced MRI of Preclinical Prostate Cancer (UQ Node)

MRI is a useful imaging tool in prostate cancer management, however its utility is limited when detecting small tumours. The ability to accurately detect and locate small tumours is necessary for early detection of disease and for assessment of response to therapy in cancer patients. In recent years, the use of biomarker-targeted probes linked with nanoparticle-based contrast agents to enhance these imaging modalities has been a major area of research.

In a collaborative project with the Australian Prostate Cancer Research Centre, Ceramisphere Pty Ltd, and Ian Wark Institute, UQ Node scientists evaluated the potential of newly-developed, biocompatible iron oxide magnetic nanoparticles (MNPs) to enhance MRI of prostate cancer. The MNPs were conjugated with J591, an antibody to an extracellular epitope of prostate-specific membrane antigen (PSMA). The study in mice provided proof-of-concept data that PSMA-targeted MNPs can effectively enhance MRI of prostate cancer in a preclinical model of the disease. Based on their biocompatibility, stability, and their ability to enhance MRI, PSMA-targeting MNPs are promising contrast agents to improve the management of prostate cancer. The study is continuing, with the goal of ultimately translating the technology into the clinic.

For more information on the National Imaging Facility visit [www.anif.org.au](http://www.anif.org.au).

The Queensland Nuclear Magnetic Resonance Network (QNN) provides valuable access to a network of high field NMR equipment, supporting fundamental research, applied bioscience and the developing biotechnology industry in Queensland. Participant organisations in QNN are UQ, Griffith University (GU) and Queensland University of Technology. Facilities at participant Universities are utilised by a range of researcher and students and providing valuable infrastructure to a broad range of research fields.

Research highlights included:

- NHMRC funded project to Membrane-active antibiotics against multi-drug resistant Gram negative bacteria (Cooper, UQ)
- NHMRC funding for research into bacterial pathogens and host cells adherence interactions providing a new opportunity for strategies to treat and prevent disease. (Jennings, GU)
- A UQ Strategic Fund award was granted to undertake research in Targeting voltage sensing for drug development. (Mobli, UQ)
Community Engagement

Indooroopilly State High School ‘Lunch with a Scientist’

CAI PhD students Surabhi Sood, Josh Simpson and Nicholas Westra van Holthe attended Indooroopilly State High School’s ‘Lunch with a Scientist’ event in September. They gave a short presentation to Year 10, 11 and 12 students about their career path and why they are passionate about science.

Scientists in School

Dr Andrew Janke visited students in the Grade 7, 8 and 9 science academy classes at Cavendish Road State High School on several occasions during the year as part of the CSIRO Scientists in School Program www.scientistsinschools.edu.au.

Mt St Michael’s College Future Conference

Saskia Bollman, Shona Osborne, Nicole Atcheson and Anna Gemmell attended Mt St Michael’s College “The Science of Research” Future Conference to give their insights of a career in science and research to year 10 students.

School Visits to CAI

Redlands College

For the third year running, students and teachers visited CAI for an information session and tour of the 7T MRI, PET/CT, Ultrasound and Cyclotron facilities as part of the Year 12 Physics program.

Brisbane Church Grammar School

Senior Physics students visited CAI in July. Led by Dr Andrew Janke, students had a ‘hands on’ look at equipment and Q&A sessions with Dr Karine Mardon and Dr Gary Cowin (Molecular Imaging), Dr Rajiv Bhalla and Damion Stimson (Radiochemistry) and Nicole Atcheson and Professor Ian Brereton (MRI).

Cavendish Road State High School

In October the Centre was visited by a large group of students from Cavendish Road State High School, led by Dr Andrew Janke. The students toured the ultrasound, cyclotron, 7T human MRI and the PET/CT facilities. During these tours the students see first-hand the application of their coursework on radioactive isotopes is used in everyday practise and research.

QLD Academy of Science

The final visit for the year was students from the Queensland Academy of Science. The senior physics students took a tour of MRI, PET/CT and cyclotron facilities and were able to have Q&A sessions with each of the facility managers.

Science Challenge Day at Springwood Road State School

The Thurecht group co-hosted the first annual Science Challenge day at the Springwood Road State School in July. Four schools (Springwood Road State School, Springwood Central State School, Rochedale South State School, and Chatswood Hills State School) participated in the challenge with students aged between 8-10. The students participated in two challenges, one demonstration, and made ice cream using liquid nitrogen.

Supporting local events and charities

- The Centre was a sponsor of the Early Career Researcher Symposium “Bliss”.
- The Centre hosted an evening for the Australian Institute of Radiographers (AIR) during their conference in Brisbane as well as a sponsoring one of the event prizes.
- CAI staff and students supported a number of charities throughout the year such as the Brissie to Bay (raising funds for MS Queensland), Movember (supporting Men’s Health) and Variety Children’s Foundation.
Core Facilities Report

CAI’s core facilities continue to provide research services not only to UQ but also the broader research community. Our many external stakeholders, including commercial research organisations were able to take advantage of the unique combination of facilities at CAI to further their research and development work throughout the year.

Our facilities play an important part in a range of research fields including the development of new imaging technologies, analysis of molecular structure and the development of MRI and PET biomarkers targeting fundamental biological processes.

Our Facilities include:
- Animal Imaging
- Cyclotron and Radiochemistry
- Engineering development laboratory
- EPR Spectroscopy and Imaging
- High Resolution NMR Spectroscopy
- Human Imaging
- Molecular Imaging
- MR Micro Imaging
- NMR Based Metabolomics
- Physics support
- Solid State NMR

Upgrade of 3T MRI
A significant upgrade provided researchers with the latest MRI tools for research. Specifically, the Prisma has almost twice the gradient strength compared the Trio, which allows for higher temporal and spatial resolution acquisitions during scans. Fast gradient switching is necessary for advanced scanning such as Diffusing Tensor Imaging (DTI) which allows neurological researchers the advantage of further exploring brain functionality, morphometry, tissue metabolism, and quantitative MRI. The upgrade also provides a wide range of coils, software and peripheral equipment to support research studies in neurology, cardiology, angiography, oncology, orthopaedics, pediatrics and cognitive neuroscience.

Installation of Large bore PET CT Horizon Biograph
Funding from the Australian Cancer Research Foundation (ACRF) enabled the installation of the PET CT, which combines X-Ray Computed Tomography (CT) and Positron Emission Tomography (PET). The CT component produces cross-sectional images of the body and is capable of providing threedimensional images, while the PET scanner measures the distribution of PET radiopharmaceuticals for the purpose of determining various metabolic (molecular) and physiologic functions. The PET scanner is able to utilise the CT data for anatomical reference for the fused PET and CT images. This instrument will be key to the further development of molecular imaging and the comparative oncology initiative at CAI.

New 7T Imaging Capabilities
Imaging on the 7T MRI was enhanced with the commissioning of new hardware, facilitating in-vivo prostate and spine scanning, in addition to improved homogeneity for cardiac imaging.

MicroCT scanning
The usage of the microCT scanner has increased steadily during the year. A unique project involving the preparation of 3D virtual models to reveal hidden properties of organisms to aid diagnosis and visualise research data. The 3D virtual models of “real-life” biological structures have an enormous potential for utilization in education, putting a new dimension into student learning.

Decommissioning of the 4T MRI
The Centre’s 4T scanner began a new life in Switzerland this year as part of an experiment investigating the foundations of the universe.

Radiolabelling new compounds for research
The cyclotron and radiochemistry facilities were involved in a number of novel research projects. In addition to established radiolabelled compounds, the facility established a number of new tracers and “synthons” for PET imaging. In particular, [18F]PBR111, a tracer used to image the Translocator Protein (a biomarker of inflammation) is now manufactured routinely. Production of synthons including [18F]fluoromethyl tosylate and [18F]fluorobenzaldehyde have been established to support radiochemistry research.
STAFF

Director
Prof David Reutens

Director and Technology
Prof Ian Breereton

Deputy Director, Operations
Mrs Rebecca Osborne (until August)
Dr Celia Webby (from September)

Administrative Officers
Mrs Lesley Green
Ms Nina Moore
Mrs Alani Winter

Industry Engagement and Business Development Manager
Mrs Rebecca Osborne (from September)

Infrastructure and Operations Manager
Mr Alan Pringle

Engineers
Mr Carl Dixon (from October)
Mr Antony King (until May)
Mr Donald Maillet

Scientific Writer
Dr Shona Osborne (until November)

Research and RHD Administration
Dr Lorine Wilkinson

Occupational Health & Safety Manager
Dr Simon Nevin

Radiation Protection Advisor
Mrs Ping Liu

Finance Managers
Mrs Nancy Eluigwe (until October)
Mr Wayne Bahr

Human Resources Officer
Ms Julie Murphy

Information Technology Managers
Mr Alan Hockings
Mr David Butler

Head of Education
Mrs Gail Dorbridge

Lecturer
Mr Matt Meredith (from June)

Student Administration
Ms Elizabeth Georgiades (until October)

Facility Managers
Mr Nabil Al Najjar
Dr Nyman Kurniawan
Dr Karine Mardon
Dr Chris Noble
Dr Greg Pierers
Dr Damon Stimson
Dr Ekaterina Stroumina

Radiographer
Mrs Nicole Atcheson

Facility Staff
Ms Xin Song

National Imaging Facility Administration
Dr Saba Salehi
Dr Michelle McCleary (until September)

Professorial Research Fellow
Prof Graham Galloway

Associate Professor
A/Prof Rajiv Bhalla
A/Prof Idriss Blakey
A/Prof Kai-Hsiang Chiang (joint appointment)
A/Prof Katia McMahon
A/Prof Kris Thurecht
A/Prof Margaret Wright (joint appointment)

ARC Future Fellows
A/Prof Markus Barth
A/Prof Jeffrey Harmer
Dr Mohammad Mehdi Mobli

Senior Research Fellows
Dr Gary Cowin
Dr Marcus Gray
Dr Andrew Janke
Dr Quang Tieng

Research Fellows
Dr Hana Burianová (until June)
Dr Christopher Howard
Dr Horst Schirra
Dr Yasvir Tesiram
Dr Viktor Vegh
Dr Tarczad Venkatachalam

Postdoctoral Research Fellows
Dr Ishaas Aanya (from July)
Dr Reza Bonyadi (from February)
Dr Craig Bell
Dr Steffen Bollmann
Dr Simone Bossard (until September)
Dr Min Chen
Dr Nick Fletcher
Dr Zach Houston
Dr Xinying (Sally) Jia
Dr Lars Marstaller (until June)
Dr Daniel Ståb
Dr Hussein Sourour
Dr Esmond Undheim
Dr Michael Vogel
Dr Qiang Yu
Dr Maryam Ziaei (from February)

Research Officers
Ms Charmaine Jeffrey (from February)
Mr Aung Aung Kye Mye
Mr Hien Nguyen (until June)

Research Assistants
Mrs Kimberley Irwin
Mr Sam Fynes-Clinton
Ms Vy Truong (from July)
Mr Chhiraj Maskey (from October)

Adjunct Appointments
A/Prof Simon Benson
A/Prof Christian Hamilton-Craig
A/Prof William Wang
Dr Hanna Gauvin (from May)
Dr Arnold Ng
Dr Kieran O’ Brien
Dr Jeremy Ullmann
Dr Rod Straw (from December)

Affiliate Research Fellow
Dr Marta Garindo (from May)
Ms Kori Ramajoo
Dr Lena Goebrich (from September)

Honorary Professor
Prof Michael Kassiou (from December)
Prof Carolyn Mountford
Prof Pamela Russell
Prof Michelle Sterling

Honorary Senior Research Fellow
Dr Simon Conne

Honorary Research Fellow
Dr Christine Guo
STUDENTS

The following RHD students were principally or co-supervised by CAI staff in 2016 (by enrolling unit):

**Australian Institute of Bioengineering & Nanotechnology**
Amal J Sivaram
Anna Gemmell
Ao Chen
Anukuttu Ediriweera
Dewan Taslima Akhter
Gihan Ratnayake
Joshua Simpson
Lewis Charles Chambers
Mark Mathew
Nicholas Westra van Holthe
Samuel Richardson
Yongmei Zhao
Zhen Jiang

**School of Biological Sciences**
Saad Alzahrani

**Institute for Molecular Bioscience**
Ingrid Edwards
Alexander Mueller
Sassan Rahnama
Faculty of Medicine
Daniel Bobo
Gail Durbridge
Oyetunde Gbadeyan
Lisa Gillinder

Shi Yi Goo
Joseph Hanna
Tina Ha
Liang-Dar Hwang
Ada Lo
Sushil Luis
Hayley McDonald
Miles Lowell Seidel
Ji Hyun Julia Yang

**School of Chemistry and Molecular Biosciences**
Shermiyah Rienecker

**School of Health and Rehabilitation Sciences**
Megan Isaacs
Khalid Jaber
Marie-Pier McSween
Georgia Thomas
Alan Wan

**School of Information Tech & Electrical Engineering**
Aurelien Andre Vincent Destruel

**Queensland Brain Institute**
Sheeez Abdulla
Mufarreh Alazmi
Ahmad Alghamdi
Abdullah Ali M. Asiri
Saskia Bollmann
Gregory Brown
Pietro Caradonna
Theo Crawford
Ilvana Dzafic
Samuel Fynes-Clinton
Joshua Samuel Harbort
Shrinath Kadamangudi
A.S. M. Zahid Kausar
Anne Maallo
Tomas Miljenovic
Shahrzad Moeiniany Bagheri
Abdallah Mohamed
Alina Motygullina
Thu Van Nguyen
Ruben Pellicer Guridi
Zheng Qiao
Venkatraman Ramanujam
Li Sheng
Surabhi Sood
Lachlan Strike
Kiran Thapaliya
Javier Urriola Yaksic
Alan Zhang

OUTPUTS

Ahmad Alghamdi received a highly competitive Graduate School International Travel Award (GSITA) to visit the Connectivity and Network Development (CANDL) Group at Mark and Mary Stevens Neuroimaging and Informatics Institute at Keck School of Medicine at the University of Southern California (USC) in Los Angeles, California, and to attend the 25th International Society for Magnetic Resonance in Medicine (ISMRM) annual meeting in Honolulu, Hawaii in 2017.

Other travel awards included:
- Saskia Bollman (European Society for Magnetic Resonance in Medicine and Biology Conference)
- Steffen Bollman (CAI Travel Award)
- Daniel Stäb (CAI Travel Award)

The Thurecht research group secured all of the prizes for presentations and publications at the ARC Centre of Excellence meeting in December (inset):
- Gayathri Ediriweera: Best poster presentation
- Nick Fletcher: Best oral presentation
- Chris Howard: Best publication of the year

Other conference awards included:
- Steffen Bollman (ISMRM)
- Saskia Bollman (ISMRM)
- Kiran Thapaliya (ISMRM)
- Saskia Bollman (HBM)

PhD Student Marie McSween won best presentation at the UQ School of Health and Rehabilitation Sciences’ Postgraduate Conference in October.

PhD student Javier Urriola was the Winner and People’s Choice of the Centre’s 3-Minute-Thesis competition for One-Third. Fellow student Nicholas Westra Van Holthe was the Runner Up for Using Light and Sound To Treat and Image Cancer.

Research Fellow Dr Horst J. Schirra was this year’s recipient of the “Sentinel of Science 2016” Publons award: Top Australian Reviewer for Biochemistry, Genetics and Molecular Biology in 2016.
**RESEARCH GRANTS**

**Australian Research Council**

**Discovery Projects**

**David C. Reutens.** Towards direct imaging of neuronal currents with MRI. 2015-2017, $452k

**Katie L. McMahon, G. de Zubicaray, and Markus Meiner.** Concepts and control in speech production (administered by Queensland University of Technology) 2015-2017, $286k

**LIEF**


**Linkage**


**National Health and Medical Research Council**

**Project Grant**

Gail A. Robinson, G. de Zubicaray, David A. Copland, Katie L. McMahon, K. Drummond, C. Goh. A prospective study of language impairment and recovery following surgery for brain tumours (administered by Queensland University of Technology) 2015-2018, $823 663

Marcus Meiner, David A. Copland, Katie L. McMahon, G. de Zubicaray. Neural mechanisms of language facilitation in aphasia due to transcranial direct current stimulation. 2015-2018, $502 111

Ross Cunningham, C. Windschuerger, & Markus Barth. High-resolution brain imaging of basal ganglia function. 2015-2017, $570 364

Christina Schroeder, Sonia Troeira Henriques and Mohammadmehdi Mobli. Understanding how toxins interact with lipid membranes and ion channels. 2015-2017, $579k

**Margaret J. Wright, G. de Zubicaray, Katie L. McMahon and P. Thompson.** Neurodevelopment during Adolescence: A Longitudinal imaging Study. 2015-2019, $1.664M

Centre for Research Excellence


Cancer Council QLD

Gail A. Robinson, G. de Zubicaray, David A. Copland, and Katie L. McMahon. A prospective study of language function following surgical resection of left hemisphere primary brain tumours (administered by Queensland University of Technology). 2015-2016, $200k

Cure Brain Foundation


UQ Postdoctoral Research Fellowship

**Steffen Bollmann, Markus Barth, Hana Burianova and Christine Guo.** Integrating high resolution anatomy, structural and functional connectivity with EEG at 7T: Towards biomarkers for neurodegenerative diseases. 2015-2017, $324k

**Xinying Jia** and **Mohammadmehdi Mobli.** Targeting bacterial transcription for the development of a new class of antibiotics. 2015-2017, $346k

Various Australian Biotechnology Companies

$715k for a variety of research projects within the Centre.

**Editorial Participation**

**Markus Barth**

Frontiers in Biomedical Physics (Editorial Board)

Magnetic Resonance Materials in Physics, Biology and Medicine (Guest Editor)

Tomography (Editorial Board)

**Kai-Hsiang Chuang**

Neuroimage (Editorial Board)

Scientific Reports (Editorial Board)

**Editorial Presentations**

**M. Barth.** High-resolution MRI at ultra-high field to map small-scale brain features. 3rd International Symposium on Brainnetome Meets Genome, Haikou (China), Nov 4-6.

**M. Barth.** Simultaneous MultiSlice Imaging. ISMRM Workshop on Ultra High Field MRI: Technological Advances and Clinical Applications, Heidelberg (Germany), March 6-9.


**J. Harmer.** Continuous Wave and Pulse EPR Spectroscopy to Study Paramagnetic Molecules - How Good Is the Resolution? 8th Asian Biological Inorganic Chemistry Conference (AsBIC8), Auckland, December 4-9.

**Z. Houston.** The tumour microenvironment and approaches to promote tumour delivery. Crossing Biological Barriers Workshop, Australian Controlled Release Society, Melbourne, Apr.


**K. Thurecht.** Development of polymer and nanoparticle-based devices for nanomedicine. Molecular Imaging Meeting 2016 (University Hospital Coventry and Warwickshire UK), 15 Jul.


PROFESSIONAL PRESENTATIONS CONT.

Oral


S. Bollmann, A. Puckett, R. Cunnington, M. Barth. Rational design of polymeric nanomaterials for photo-induced molecular imaging and therapeutic function. 36th Australasian Polymer Symposium (APS), Lorne (Victoria), Nov 20-23.

Poster


Vieth, H., McMahon, K. & de Zubicaray, G. (2016) Let’s not miss the forest for the trees: A reply to


