LA TROBE UNIVERSITY

LA TROBE INSTITUTE FOR MOLECULAR SCIENCE

# LIMS ANNUAL REPORT 2018

La Trobe Institute for Molecular Science


latrobe.edu.au/lims

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# **TRANSLATABLE** MOLECULAR DISCOVERIES

LAUNCHED IN 2009, THE LA TROBE INSTITUTE FOR MOLECULAR SCIENCE (LIMS) BRINGS TOGETHER LA TROBE UNIVERSITY'S LEADING RESEARCHERS TO WORK ON SOME OF THE MOST CRITICAL PROBLEMS FACING OUR WORLD TODAY.

The Institute's vision is achieved through excellence in six thematic areas of research strength: Cancer, Infection and Immunity, Neurobiology, Molecular Design, Molecular Imaging and Molecular Sensing.

The research agenda of LIMS is supported by a state-of-the-art facility where scientists in different disciplines work together in well equipped, shared work-spaces to achieve outcomes that would not be possible in traditional academic settings.

LIMS also has two embedded biotech companies: Hexima Limited, which is developing plant-derived proteins and peptides for applications such as human therapeutics and the genetic modification of crops; and AdAlta Limited, which is developing the next generation antibody platform, the i-body, to deliver high affinity and specific biologics against a variety of therapeutic and diagnostic targets.

LIMS has outstanding links with the Australian Synchrotron. Several of the Institute's physicists design and build synchrotron components.

Game-changing partnerships also enhance the Institute's efforts to raise its research capabilities to new levels of national and international significance. An important collaboration with the Olivia Newton-John Cancer Research Institute facilitates the sharing of knowledge, skills, training and facilities.

# LIMS
# AT A GLANCE

**>400**
ACADEMIC STAFF AND POSTGRADUATE STUDENTS

**>60**
LABORATORY HEADS

**5**
ARC FUTURE FELLOWS
2 DECRA FELLOWS

**4**
NHMRC FELLOWS

**247**
WEB OF SCIENCE PUBLICATIONS (2017)

**1.56**
SCOPUS FIELD WEIGHTED CITATION IMPACT

**ERA RANKINGS:**

**5**
BIOCHEMISTRY AND CELL BIOLOGY; ANALYTICAL CHEMISTRY; OPTICAL PHYSICS; CONDENSED MATTER PHYSICS

**4**
GENETICS; MEDICAL AND BIOMOLECULAR CHEMISTRY; INORGANIC CHEMISTRY

**>$41M**
EQUIPMENT ACROSS 3 CAMPUSES

**>900**
INDIVIDUAL PIECES OF EQUIPMENT

**LIMS RESEARCH THEMES:**
CANCER
INFECTION AND IMMUNITY
NEUROBIOLOGY

MOLECULAR DESIGN
MOLECULAR IMAGING
MOLECULAR SENSING

**FACILITIES:**
HISTOLOGY FACILITY
COMPREHENSIVE PROTEOMICS PLATFORM

BIOIMAGING PLATFORM
PHYSICS WORKSHOP
STORE

**RESEARCH CENTRES:**
MATERIALS AND SURFACE SCIENCE
MOLECULAR CANCER PREVENTION

EXTRACELLULAR VESICLES
BIOMEDICAL AND ENVIRONMENTAL SENSOR TECHNOLOGY

**EMBEDDED BIOTECHNOLOGY COMPANIES:**
HEXIMA LTD

ADALTA LTD

**INDUSTRY PARTNERSHIPS:**

**3**
SIEF FELLOWSHIPS (ANATARA, HEXIMA, ADALTA)

**$3.6M/YR**
RESEARCH CONTRACTS

# **DIRECTOR'S** REPORT

LIMS HAS AN INNOVATIVE AND BROAD-RANGING RESEARCH PORTFOLIO THAT SPANS BIOCHEMISTRY, CHEMISTRY, GENETICS, PHYSICS AND PHARMACY.

In 2018, LIMS researchers led successful bids to establish two new La Trobe University research centres. Professor Patrick Humbert heads the Research Centre for Molecular Cancer Prevention to target the earliest cellular events in cancer. Dr Conor Hogan heads the Biomedical and Environmental Sensor Technology Centre to develop chemical sensors for application in medical diagnostics and environmental monitoring.

Professor Marilyn Anderson and Professor John Moses will contribute their scientific expertise to the La Trobe-led Australian Research Council (ARC) Industry Transformation Research Hub for Medicinal Agriculture.

LIMS scientists were recognised for their research excellence and innovation, and for making discoveries of global importance.

Dr Megan Maher and Professor Suresh Mathivanan were awarded prestigious Future Fellowships by the ARC. Dr Maher will investigate the structural biology of trace metal trafficking across membranes while Dr Mathivanan will explore how exosomes, or cell particles, are made in human cells.

Dr Belinda Parker received support from the Victorian Medical Research Acceleration Fund to lead a pilot clinical trial using new immunotherapeutic approaches in triple negative breast cancer.

Dr Yuning Hong was awarded the Royal Australian Chemical Institute's (RACI) Rita Cornforth lectureship, providing an early career chemist with the opportunity to achieve broader recognition of their research and achievements.

Dr Jason Dutton was awarded the RACI's Organometallic Chemistry Award, recognising contributions to the field by chemists with less than 12 years' professional experience.

Dr Brian Abbey, Dr Belinda Parker, Dr Eugeniu Balaur and Dr Caroline Bathje won a $2.5K Bendigo Inventor Award and a $10K Medtronic Award and at MedTech's Got Talent for their NanoMSlide project: a microscope slide that identifies cell components at a high level of contrast without the use of traditional staining techniques.

Dr Ivan Poon was awarded the Australian Society for Medical Research Peter Doherty Leading Light Award, recognising the outstanding work of mid-career researchers.

Dr Tatiana Soares da Costa was awarded the Federation of Asian and Oceanian Biochemists and Molecular Biologists Young Scientist Award for outstanding research contribution by an early career researcher.

Our grant results from the ARC were outstanding.

Dr Tatiana Soares da Costa received a $419,854 Discovery Early Career Researcher Award to investigate strategies to combat herbicide resistant weeds.

Professor Patrick Humbert received a $507,000 Discovery Grant to investigate how red blood cells lose their nucleus.

Dr Marc Kvansakul, together with Dr Mark Hulett, received a $412,000 Discovery Grant. Their project will investigate how plant proteins called defensins attack membranes to cause cells to burst and die.

Dr Erinna Lee, together with Dr John Mariadason and Dr Doug Fairlie, received a $400,000 Discovery Grant. Their project will focus on whether Beclin 1 has an alternative job of mediating trafficking within a cell.

Dr Maria Kaparakis-Liasksos and I received a $375,000 Discovery Grant to investigate the mechanisms that regulate the production of bacterial membrane vesicles.

LIMS scientists also received funding from the National Health and Medical Research Council (NHMRC).

Dr Helena Richardson, together with Professor Patrick Humbert, received a $789,984 Project Grant to investigate the mechanism by which cell shape protein regulates tissue growth and prevents tumour formation in cancer.

Dr Doug Fairlie received a $463,058 Project Grant to conduct further testing of a potential new treatment option for patients with malignant mesothelioma.

We appointed one LIMS Fellow. Dr Donna Whelan, an expert in biophysics, became a Bruce Stone Fellow in Chemical Biology. Dr Mihwa Lee was awarded one of the inaugural Tracey Banivanua Mar Fellowships from La Trobe University.

Finally, our two embedded biotech companies moved closer to translational outcomes. After raising $10M in its initial public offering in 2016, AdAlta Limited continued to work on its candidate drug, AD-114, designed to treat idiopathic pulmonary fibrosis (IPF). AD-114 shows strong therapeutic promise in preclinical studies, not only for IPF, but for other types of fibrosis like that caused by macular degeneration in the eye. In 2018, AdAlta Limited received the Medtech and Pharma Award and third place in the Company of the Year Award at the Australian Technologies Competition.

Hexima Limited announced positive results from part 1 of its Phase 1/2, a clinical trial for a new topical treatment for fungal nail infections. Hexima's goal is to develop a topical fungal nail (onychomycosis) treatment with a superior cure rate, shorter treatment time and fewer side effects than existing oral and topical options.

Professor Andrew Hill
Director

# **LEADERSHIP**
TEAM

LIMS IS LED BY AN EXPERIENCED TEAM THAT UNDERSTANDS THE IMPORTANCE OF SCIENTIFIC INNOVATION AND TRANSLATABLE RESEARCH OUTCOMES.

### Professor Andrew Hill

Professor Hill is Director of LIMS and Director of the Research Centre for Extracellular Vesicles.

Professor Hill obtained his PhD at Imperial College London in 1998. He held postdoctoral positions in the MRC Prion Unit (London) and the Department of Pathology at the University of Melbourne as a Wellcome Trust Prize Travelling Research Fellow. Professor Hill joined the Department of Biochemistry and Molecular Biology at the University of Melbourne in 2002 and moved his laboratory into the Bio21 Institute when it opened in 2005. He served as Biosciences Domain Coordinator (2011-14) and Associate Director (Structural and Cellular Biology) of the Bio21 Institute. In 2015, Professor Hill was appointed Head of the Department of Biochemistry and Genetics at La Trobe University and Director of the University's Research Focus Area, Understanding Disease.

In 2016, he was elected President of the International Society for Extracellular Vesicles.

Professor Hill's research team uses *in vitro* and *in vivo* models to look at how abnormal proteins and RNA travel from cell to cell and are involved in neurodegenerative diseases. His laboratory also works on the biology of small noncoding RNA and their potential use as diagnostics in neurological and infectious diseases. He has published over 170 research papers and edited three books.

### Professor Brian Smith

Professor Smith is Head of the School of Molecular Sciences.

Professor Smith obtained his PhD in Chemistry at the University of Melbourne. He held a postdoctoral position at the Research School of Chemistry in Canberra before returning to Melbourne in 1991 to join the Biomolecular Research Institute (BRI) as a research scientist. After the demise of the BRI in 2000, he moved to the Walter and Eliza Hall Institute of Medical Research as a founding member of the Structural Biology division. In 2011, he moved to La Trobe University, where he was appointed the inaugural LIMS Principal Research Fellow. In 2015, he became Head of the Department of Chemistry and Physics, and then Head of the School of Molecular Sciences in 2017.

Professor Smith is a Fellow of the Royal Australian Chemical Institute and a Fellow of the Royal Society of Chemistry. He is skilled in the determination of protein structure by X-ray crystallography, in the analysis of protein structure, and in the design of protein mimetics and small-molecule inhibitors of protein function. He has published over 150 research papers.

### Dr Mark Hulett

Dr Hulett is Deputy Director of LIMS.

He also serves on the Executive Committee of La Trobe University's Understanding Disease Research Focus Area. He is a past national president of the Australian Society for Medical Research. Dr Hulett's research interests include mechanisms of innate immunity and the tumour microenvironment.

### Dr Michael Angove

Dr Michael Angove is Head of the Department of Pharmacy and Biomedical Sciences, and Academic Director of Transnational Education for PSB Academy, a partner institution delivering La Trobe University courses in Singapore.

Dr Angove specialises in environmental chemistry, with a particular focus on soils impacted by human activity and bushfires.

### Dr Narelle Brack

Dr Brack is Head of the Department of Chemistry and Physics.

Dr Brack specialises in materials and surface chemistry. She has developed surface modification strategies for a range of material systems including next generation aircraft materials, carbon nanomaterials and electrospun nanofibres.

### Professor Robyn Murphy

Professor Murphy is Head of the Department of Biochemistry and Genetics.

Professor Murphy also serves on the Executive Committee of La Trobe University's Sport, Exercise and Rehabilitation Research Focus Area. She specialises in skeletal muscle in health and disease, with a particular focus on exercise and its effects on ageing and metabolic diseases.

# LIMS **ADVISORY BOARD**

THE LIMS ADVISORY BOARD PROVIDES STRATEGIC ADVICE ON THE INSTITUTE'S RESEARCH AGENDA.

### Professor Marilyn Anderson AO

Professor Anderson AO is Professor of Biochemistry at La Trobe University and the Chief Scientist of Hexima Limited. She is a Fellow of the Australian Academy of Science and the Australian Academy of Technological Sciences and Engineering. She was awarded the Lemberg Medal from the Australian Society of Biochemistry and Molecular Biology in 2014.

### Professor Matthias Ernst

Professor Ernst is the Head of the School of Cancer Medicine at La Trobe University and the Scientific Director of the Olivia Newton-John Cancer Research Institute. He obtained his PhD from the ETH Zurich (Switzerland), is a member of the Ludwig Institute for Cancer Research and a Principal Research Fellow of the NHMRC.

### Professor Andrew Hill

Professor Hill is Director of LIMS and Director of the Research Centre for Extracellular Vesicles at La Trobe University. He is currently serving a second term as elected President of the International Society of Extracellular Vesicles (2018-2020). He was awarded the Merck Research Excellence Medal from the Australian Society for Biochemistry and Molecular Biology in 2010.

### Professor Keith Nugent

Professor Nugent is Deputy Vice-Chancellor (Research) at La Trobe University. He is a Fellow of the Australian Academy of Science, the Australian Institute of Physics and the American Physical Society. He is a recipient of the 2004 Victoria Prize, the Pawsey Medal from the Australian Academy of Science and the Boas Medal from the Australian Institute of Physics.

### Professor Andrew Peele

Professor Peele is the Director of ANSTO's Australian Synchrotron. He is an adjunct Professor of Physics at La Trobe University and was seconded to the Australian Synchrotron from La Trobe University in 2011. He is a Fellow of the Australian Academy of Technological Sciences and Engineering and a past president of the Australian Institute of Physics. His research improves the versatility and quality of x-ray imaging and he has published over 100 research papers with applications ranging from improving advanced materials to cellular imaging.

### Professor Robert Pike

Professor Pike is Pro Vice-Chancellor of the College of Science, Health and Engineering at La Trobe University. He has over 10 years' experience in academic and research leadership roles. Professor Pike is a biochemist specialising in enzymes. He has published over 100 research papers and supervised over 20 PhD students to completion.

### Dr Tony Radford AO

Dr Radford AO is a Director of Ellume Limited and ASX listed Genetic Signatures Ltd. He was previously Director of Nucleus Networks and CEO of ASX listed Cellestis, from its founding until its acquisition by QIAGEN NV in 2011. For his contributions to tuberculosis diagnosis and enterprise, he received the Clunies Ross Award for the application of technology and is a Distinguished Alumnus of La Trobe University.

### Dr Nick Samaras

Dr Samaras is Director of AGRF Pty Ltd and MuriGen Therapeutics, Chairman of ASX listed Genetic Signatures Ltd and Adjunct Professor at La Trobe University. He has over 25 years' experience in the science industry, and has worked in senior roles with global life science companies including Applied Biosystems and Perkin Elmer.

# LIMS **FELLOWS**

THE LIMS ENDOWMENT FUND WAS ESTABLISHED TO CREATE NEW AND SUSTAINABLE OPPORTUNITIES FOR SCIENTISTS WITH OUTSTANDING POTENTIAL.

The inaugural Bruce Stone Fellowship in Chemical Biology and Nicholas Hoogenraad Fellowship in Molecular Sciences were awarded in 2015.

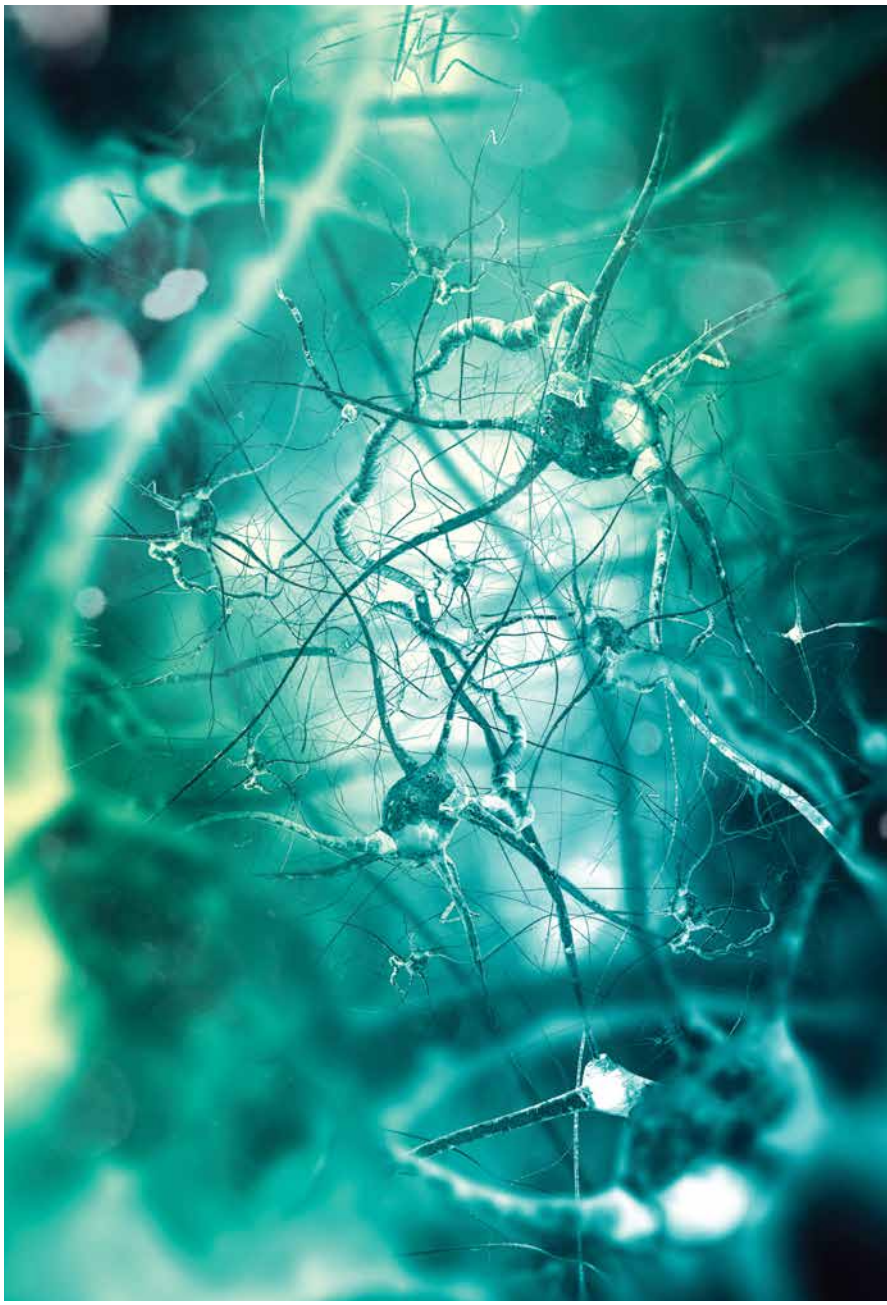
Both fellowships are named after two long-serving leaders: Professor Bruce Stone was the foundation professor of Biochemistry from 1972-1989, succeeded by Professor Nicholas Hoogenraad, who later became the first Director of LIMS. Professor Hoogenraad AO retired in 2014.

## Bruce Stone Fellowship in Chemical Biology

### Dr Donna Whelan

Dr Donna Whelan graduated with a PhD in Physical Chemistry in 2015 and completed her postdoctoral training at the New York University School of Medicine. Her research spans physics to biology, with a focus on applying advanced fluorescence techniques to understand the basis of disease.

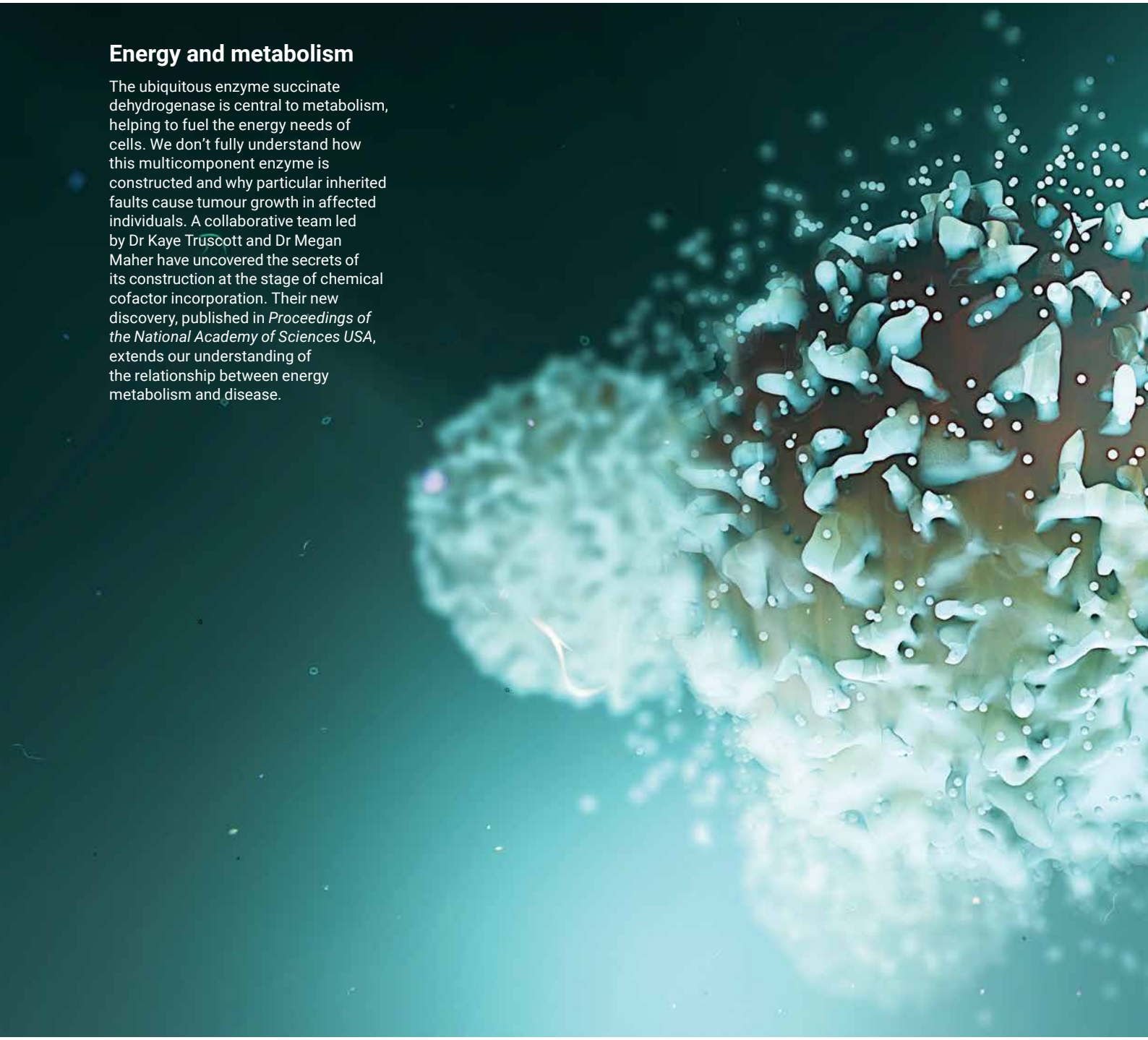
Dr Whelan has published 18 research papers (nine first author, one senior author, >400 citations) in high-impact interdisciplinary journals including *Nature Communications*, *Nucleic Acids Research* and *Physical Chemistry Letters*. She joined LIMS in 2018 and was awarded a large philanthropic donation to build a bespoke single molecule microscope for studying DNA damage and repair.



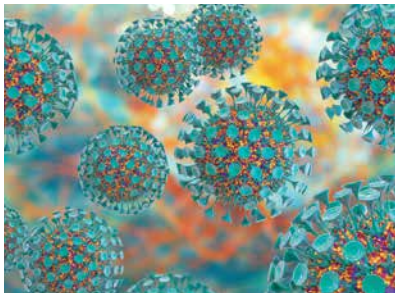
# DISCOVERY **HIGHLIGHTS**

## Energy and metabolism

The ubiquitous enzyme succinate dehydrogenase is central to metabolism, helping to fuel the energy needs of cells. We don't fully understand how this multicomponent enzyme is constructed and why particular inherited faults cause tumour growth in affected individuals. A collaborative team led by Dr Kaye Truscott and Dr Megan Maher have uncovered the secrets of its construction at the stage of chemical cofactor incorporation. Their new discovery, published in *Proceedings of the National Academy of Sciences USA*, extends our understanding of the relationship between energy metabolism and disease.



LIMS RESEARCHERS PUBLISH IN HIGH IMPACT JOURNALS INCLUDING *NATURE*, *SCIENCE*, *CELL* AND *NATURE COMMUNICATIONS*.

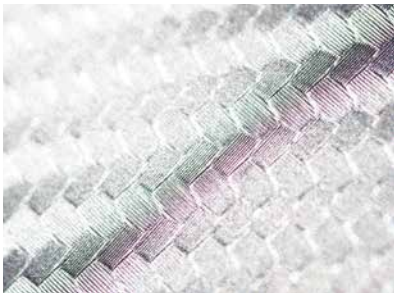


## Next generation drugs

Bacteria are becoming increasingly resistant to antibiotics. This is particularly the case for drug-resistant *Neisseria gonorrhoeae*. Dr Begoña Heras and collaborators identified a key protein that is required for the survival of *Neisseria* pathogens. Their findings, published in the *Journal of Biological Chemistry*, may lead to a new generation of *anti-Neisserial* drugs.

## Gene regulation

Abnormal tissue growth can lead to cancer. Dr Helena Richardson, Dr Marta Portela and Dr Xia Li, together with colleagues from the Peter MacCallum Cancer Centre and the University of Massachusetts, discovered how the lethal-giant larvae gene regulates tissue communication, growth and structure. Their findings, published in *Science Signaling*, may lead to new treatment options for cancer.

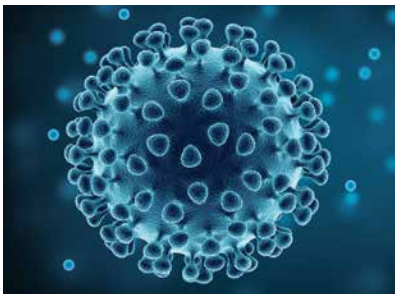


## New materials and devices

Dr Andrew Barrow, Professor John Moses, Dr Anders Barlow and collaborators modified the surface of carbon fibers using SuFEx Chemistry for the first time. Their findings, published in *ChemPhysChem*, will enable surface modification, which is important for the future development of new materials and devices.

## Hydrogen bonds

Hydrogen bonds hold DNA structures together and give water its solvent capabilities, but how strong are they really? In a paper published in *Physical Chemistry Chemical Physics*, Dr Patrick Robertson, Dr Evan Robertson and colleagues probed the strength of particular hydrogen bonds using lasers.



## Personalising medicine

Dr Joseph Tucci and collaborators discovered that people from Papua New Guinea carry higher rates of specific genetic polymorphisms which predispose them to potentially life threatening side effects from HIV/AIDS medications. Their findings, published in *Pharmacogenetics and Genomics*, may lead to the personalisation of HIV/AIDS medication regimes.

## Environmental monitoring

Researchers from Dr Brian Abbey's group, together with colleagues from RMIT, developed a device that analyses trace amounts of chemicals using visible light. It can be used for a range of sensing applications including monitoring water pollutants and inspecting soil quality.

# CANCER

**THE CANCER THEME INVESTIGATES THE MECHANISMS OF CANCER INITIATION AND PROGRESSION, THE CROSSTALK BETWEEN CANCER CELLS AND THE SURROUNDING ENVIRONMENT, AND THE POTENTIAL OF THERAPEUTIC APPROACHES FOR COMBATING DISEASE.**

## Theme leaders

### Patrick Humbert
Professor of Cancer Biology

**Cancer biology, cell polarity and tissue architecture**
Determines how cell asymmetry and tissue organisation can regulate cancer initiation, progression and metastasis. Examines how the cell polarity genetic program may be involved in tissue regeneration as well as developmental processes such as blood cell production and function.

### Belinda Parker
Associate Professor

**Cancer microenvironment and immunology**
Determines the properties of tumour cells and interacting cells in the surrounding tissue that promote metastatic spread in clinically relevant models of breast and other cancers. Designs new anti-metastatic therapies that block the invasion and growth of cancer cells in distant tissues.

## Members

### Suzanne Cutts
Senior Research Fellow

**Cellular responses to anticancer drugs**
Develops new therapeutic strategies for cancer treatment. Examines the mechanism of action in anticancer drugs doxorubicin and mitoxantrone. Works to restrict the killing properties of these drugs to cancerous cell types to minimise their toxic side effects.

### Doug Fairlie
Senior Research Fellow

**Apoptosis, autophagy, cancer, drug development and peptides**
Uses biochemical, cell biology, structural biology and medicinal chemistry approaches to understand the molecular mechanisms that control apoptosis. Develops new reagents, including drugs that could target and inhibit the actions of the key pro-survival proteins that keep cancers alive.

### David Greening
Senior Research Fellow

**Extracellular vesicles, exosomes, proteomics, cancer biology and uterine biology**
Develops and applies quantitative proteomic techniques to study the molecular function of secreted factors and extracellular vesicles, and undertakes the quantitative analysis of dynamic protein changes of normal physiology and disease-perturbed signaling networks.

### Adam Hart
Lecturer

**Molecular regulation of stem cells and cancer**
Studies the key genes and molecular pathways that regulate stem cells during normal growth and development. Works to identify how these genes are re-activated in the adult to cause cancer. Focuses on breast cancer, myeloid leukaemia and germ cell cancers.

### Christine Hawkins
Associate Professor

**Cell death regulation in cancer and viral infection**
Studies apoptotic regulation in normal, cancerous and virally-infected cells. Explores the potential for drugs that directly induce apoptosis to successfully treat cancers without causing DNA damage to prevent cancer survivors from developing new, therapy-related cancers.

### Nick Hoogenraad AO
Emeritus Professor

**Development of therapeutic antibodies against cachexia**
Specialises in cancer cachexia, a complication of cancer that affects up to 80% of patients with solid tumours and is responsible for around 25% of cancer deaths. Produces monoclonal antibodies that block cachexia, giving rise to the prospect of a treatment for this condition.

**Mark Hulett**
Senior Lecturer

Inflammation and tumour progression
Investigates molecular regulators of cell invasion in tumour progression and inflammation. Focuses on the enzyme heparanase and serum protein histidine-rich glycoprotein in these processes to develop new targeted therapies for treating cancer and inflammatory disease.

**Erinna Lee**
ARC Future Fellow

Apoptosis, autophagy, cancer, cell and structural biology, and drug discovery
Examines the molecular mechanisms underlying cell fate decisions dictated by the processes of apoptosis and autophagy using biochemistry, cell biology and structural biology approaches. Identifies novel factors that enable crosstalk between these two biological processes.

**Suresh Mathivanan**
Associate Professor

Exosomes, secretome and systems biology
Explores the role of extracellular matrix components (soluble secreted proteins and extracellular vesicles) in cancer and intercellular communication using proteomic, genomic and bioinformatics methodologies. Undertakes basic science projects including the biogenesis of exosomes and the role of exosomes in intercellular communication.

**Julian Pakay**
Lecturer

Signal transduction, cancer biology and bioenergetics
Studies signal transduction and cancer biology, particularly where these intersect with cellular and mitochondrial bioenergetics. Specialises in teaching and education scholarship with a focus on quantitative literacy. Developing an environmental metagenomic database for undergraduate programs.

**Helena Richardson**
Associate Professor

Cell polarity, cell signalling and cancer
Uses the vinegar fly, *Drosophila*, to determine how regulators of cell shape (polarity) and the cell skeleton (actin cytoskeleton) impact cell signalling and cancer development. Identifies novel pathways that cooperate with the Ras oncogene in cancer.

**Richard Simpson**
Professor

Extracellular vesicles, exosomes and cancer biology
Uses an integrated proteomic, RNA profiling, bioinformatics and live-cell imaging strategy to understand the seminal role of extracellular vesicles in cell-cell communication in the extracellular environment during cancer progression and cancer plasticity.

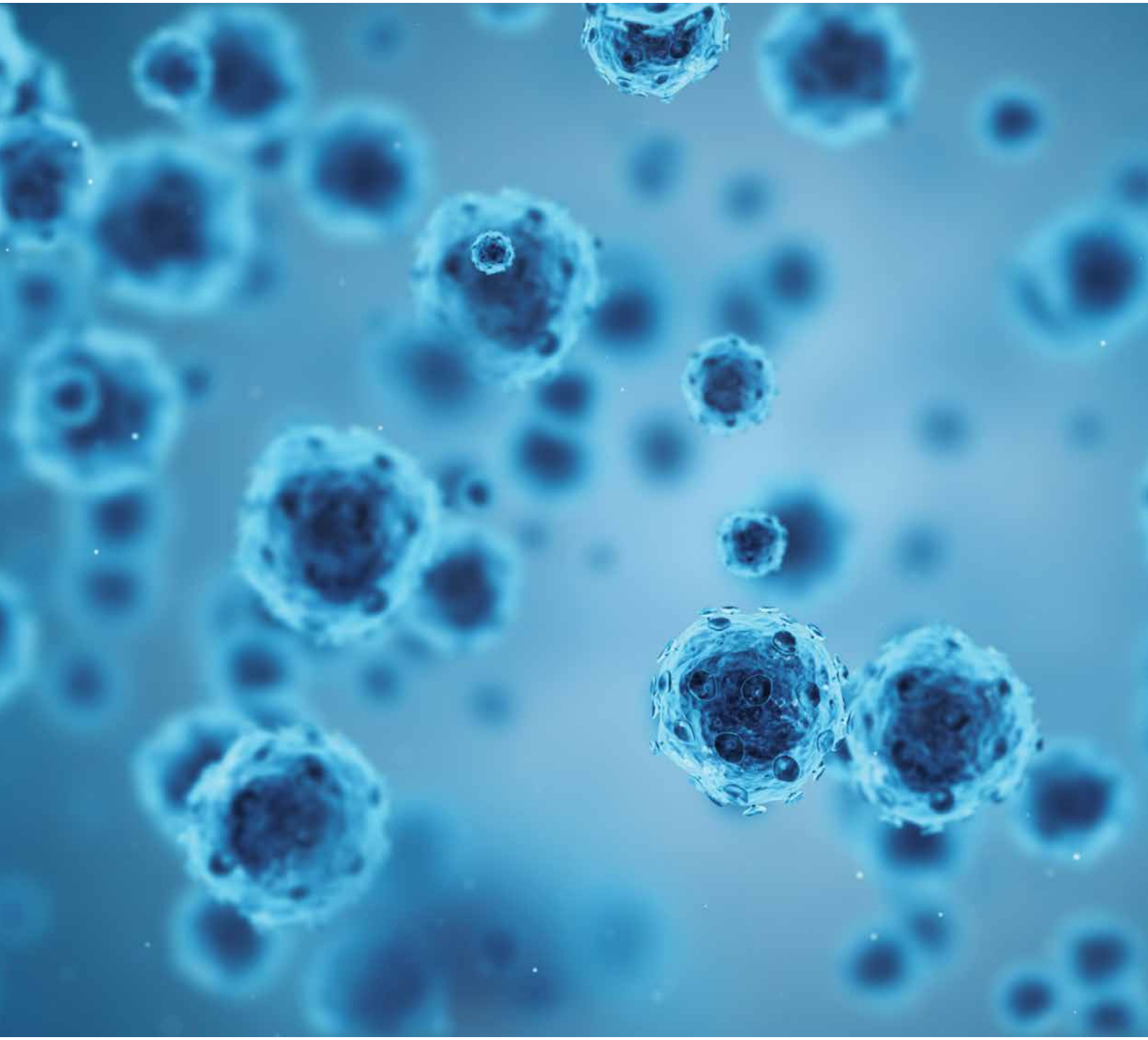
**Chanh Tran**
Lecturer

Interactions of X-rays with matter, optical coherence and X-ray imaging
Researches various forms of propagation-based X-ray imaging. With collaborators, developed the X-ray Extended Range Technique to quantify the interaction cross-sections between X-rays and a range of elements and compounds. Develops quantitative full field imaging techniques using polychromatic X-ray sources.

**Donna Whelan**
Bruce Stone Fellow in Chemical Biology

Biophysics, DNA damage, fluorescence, single molecule imaging
Applies state-of-the-art techniques to biological questions. Uses microscopic and spectroscopic methods to visualize the compositions and ultrastructures of individual cells and their subcomponents.

# INFECTION AND IMMUNITY



THE INFECTION AND IMMUNITY THEME STUDIES THE MOLECULES USED BY VIRUSES, BACTERIA, PARASITES AND FUNGI TO INFECT HUMANS, ANIMALS AND PLANTS, AND THE IMMUNE RESPONSE ASSOCIATED WITH THIS.

## Theme leaders

### Weisan Chen
Professor

Cellular immunity to Influenza A virus
Specialises in CD8+ T cell biology and antigen processing and presentation in the development of cross-protective immune responses to the influenza virus. Investigates interactions between T cells and antigen-presenting cells, macrophages and monocytes and their impact on influenza-induced lung pathogenesis.

### Begoña Heras
Senior Lecturer

Bacterial virulence factors
Studies the molecular mechanisms underlying Gram-negative bacterial infections. Uses a multidisciplinary approach combining X-ray crystallography, molecular biology and biochemistry to investigate the structure-function relationships in proteins involved in bacterial pathogenesis and develop antibacterial drugs with novel modes of action.

## Members

### Marilyn Anderson AO
Charles La Trobe Professor

Plant innate immunity proteins
Specialises in the protection of humans and crops from pathogens by studying the natural defences of plants and the biology of the pathogens themselves. Identifies insecticidal and antifungal molecules in Australian native plants for commercial applications in crop protection and human antifungal therapeutics.

### David Dougan
Senior Research Fellow

Protein homeostasis in health and disease
Studies large ATP-dependent multi-subunit machines that are responsible for the regulated removal of unwanted proteins in bacterial cells and eukaryotic organelles. Identifies new components that control these machines and novel chemicals that dysregulate them.

### Mick Foley
Associate Professor

Use of single domain antibodies as therapeutics in fibrosis and other chronic diseases
Uses a library of single domain antibodies derived from sharks to identify antibodies that bind and block the function of proteins shown to be involved in human pathological conditions such as fibrosis of the lung, kidney and eye as potential therapies for these diseases.

### Helen Irving
Professor and Director of Understanding Disease Research Focus Area

Proteins in the innate immune system
Studies unusual mechanisms that proteins in the innate immune system use to signal processes in cells to control inflammatory responses. Uses a multidisciplinary approach involving protein molecular, cell biology and protein chemistry supplemented by bioinformatics and systems approaches.

### Cristina Keightley
Senior Lecturer

Biomedical science
Seeks to discover and understand molecular pathways regulating blood cells in development and disease. Adopts a multi-disciplinary approach integrating molecular genetics, biochemistry, genomics and proteomics. Knowledge of these pathways can inform the design of pharmaceuticals, including stem cell therapies.

### Ivan Poon
NHMRC Career Development Fellow

Apoptotic cell disassembly and clearance
Studies the machinery that controls how dying cells can disassemble into smaller pieces. Specialises in the importance of cell disassembly in disease settings, such as influenza A infection and atherosclerosis to identify new drugs to control this process.

### Hamsa Puthalakath
Associate Professor

Regulation of apoptosis by Bcl-2 family proteins
Studies apoptosis regulation by Bcl-2 family proteins in different patho-physiologies using *in vitro* and *in vivo* models. This includes death of immune cells during polymicrobial sepsis leading to immune paralysis, and the death of heart muscle cells leading to cardiomyopathy and heart failure.

### Tatiana Soares da Costa
NHMRC Early Career Fellow

Antibiotic and herbicide discovery
Examines the structure, function and regulation of essential proteins in bacteria and plants to guide the development of novel classes of antibiotics and herbicides. Specialises in identifying targets involved in cell wall and protein syntheses.

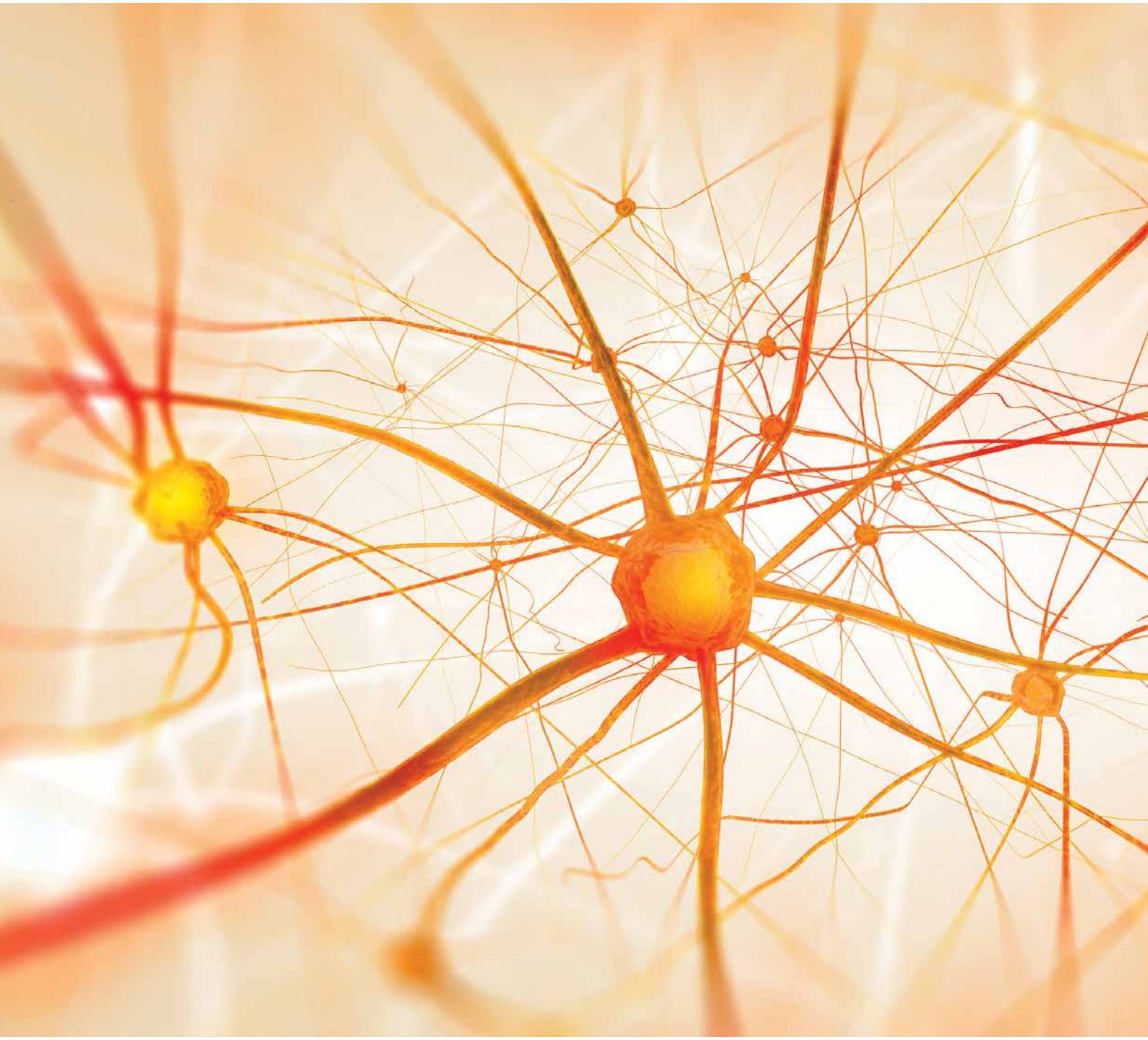
### Joseph Tucci
Associate Professor

Bacteriophage as alternatives to antibiotics, pharmacogenomics and pharmacy practice
Examines the personalisation of medicine to fit a patient's genetic profile, particularly in traditional and Indigenous populations. Studies the use of bacteriophage as an alternative to antibiotics and how these can be delivered clinically.

### Lakshmi Wijeyewickrema
Research Fellow

Proteases, inhibitors and receptors: relationship to disease states
Researches enzymes, called proteases, which operate at the interface between a host, such as a human being, and microbes that cause disease. Studies the biology of enzymes, from bacteria and humans, to develop compounds to protect against diseases.

# NEUROBIOLOGY



THE NEUROBIOLOGY THEME INVESTIGATES THE BIOLOGY AND DISEASES ASSOCIATED WITH THE NERVOUS AND MUSCULOSKELETAL SYSTEMS.

## Theme leaders

### Rod Green
Associate Professor

**Clinical anatomy**
Pioneers techniques to insert intramuscular electrodes into hip and shoulder muscles to understand their role in the human body. Develops targeted rehabilitation programs to improve quality of life for individuals with chronic musculoskeletal illness.

### Robyn Murphy
Professor and Head of Biochemistry and Genetics

**Skeletal muscle biochemistry, responses to exercise, disease and ageing**
Studies the various aspects of skeletal muscle biochemistry in health and disease. Examines how changes in abundance of protein from exercise, disease and ageing can affect the ability of muscle to produce force and confer strength and stability.

## Members

### Andrew Hill
Professor and Director of LIMS

**Neurodegenerative diseases, extracellular vesicles and noncoding RNAs**
Investigates neurodegenerative diseases such as Alzheimer's, prion and Parkinson's diseases. Studies exosomes and microvesicles as vehicles for the transfer of misfolded proteins between cells.

### Di Hughes
Lecturer

**Oxidative stress, erythrocyte morphology and haemorheology**
Researches peripheral oxidative stress in Parkinson's disease and rheumatoid arthritis. Studies erythrocyte morphology and haemorheology parameters to mark peripheral oxidative stress and whole blood antioxidant capacity.

### Christine Kettle
Lecturer

**Autonomic and central nervous system regulation of metabolism**
Examines the physiology of metabolism to find novel drug targets that activate brown adipose tissue (BAT) thermogenesis. Activation of BAT is a possible pathway to target obesity.

### Jacqueline Orian
Senior Research Fellow

**Neurodegenerative diseases**
Investigates mechanisms underlying blood brain barrier damage and neuronal loss in Multiple Sclerosis (MS). Uses the experimental autoimmune encephalomyelitis MS model to generate proof of concept for pathological and molecular neurodegenerative mechanisms. The long-term view is to develop novel therapeutics which will delay entry into progressive MS.

### Matthew Perugini
Associate Professor

**Rational drug design targeting infection and age-related diseases**
Studies the structure, function, regulation and inhibition of essential oligomeric enzymes such as dihydrodipicolinate synthase from the lysine biosynthesis pathway of bacteria. Characterises the role of apolipoprotein E in cardiovascular and Alzheimer's diseases.

### Kaye Truscott
Senior Lecturer

**Mitochondrial protein homeostasis**
Studies the function of proteins engaged in the biogenesis and maintenance of mitochondria, the cell's power plant and manufacturer of essential biomolecules. Investigates strategies to modulate mitochondrial function for the prevention of mitochondrial disorders and neurodegenerative diseases including Parkinson's disease.

### Anita Zacharias
Lecturer

**Gross anatomy, histology and embryology**
Analyses hip stabiliser muscle function in a population with hip osteoarthritis using magnetic resonance imaging and intramuscular electromyography techniques. Greater understanding of these muscles could lead to the development of improved rehabilitation programs targeting specific muscle segments within the hip stabilisers.

# **CUTTING-EDGE SCIENCE** IN BENDIGO

NEW MICROSCOPE MAY UNLOCK SECRETS TO DNA-DAMAGING DISEASES.

La Trobe University Bendigo is now home to one of the most powerful fluorescence microscopes in Australia, due to a pioneering scientist and a $300,000 philanthropic donation from a local family.

Biophysicist, Dr Donna Whelan, built the highly specialised microscope out of components from all over the world, including a one-tonne table, five state-of-the-art lasers, and a $60,000 camera.

Dr Whelan spent several months building the microscope, which is 1,000 times more powerful than a regular fluorescence microscope, to assist with her research into fundamental biology and DNA damaging diseases such as cancer.

"You can't buy a microscope like this off the shelf – one that will give you this kind of power, flexibility and functionality," she said. "I can see an incredible level of detail inside cells, right down to individual molecules, which regular microscopes don't allow; the sharpness and clarity is beyond compare."

"This kind of super-sensitive imaging is vital in biomedical research, as it helps us to see exactly what cellular changes and damage occur at the onset of disease."

Funds for the microscope came from a Bendigo family, who wish to remain anonymous, through La Trobe's Bendigo Tertiary Education Anniversary Foundation (BTEAF).

Head of Campus, Mr Robert Stephenson, thanked the family for their substantial donation, and said it would help make Bendigo a world-class centre for scientific research and education.

"This microscope will help educate the next generation of scientists, as well as cement La Trobe's reputation for excellence in scientific research and discovery," he said. "It will be a valuable resource for not only La Trobe academics and students, but potentially scientists from all over the country."

Chair of BTEAF, Dr Penny Davies, said the microscope is the largest single item purchased by the Foundation since it was established in 1998. "This is a wonderful example of the generosity of a local family making a tangible difference in Bendigo, which then has flow-on effects throughout the world," she said.

# **POTENT PEPTIDE** SHOWS PROMISE IN TRIAL

A POWERFUL NEW ANTIFUNGAL TREATMENT IS A STEP CLOSER TO BECOMING AVAILABLE TO PATIENTS FOLLOWING THE FIRST HUMAN TRIAL.

Hexima Limited, a biotechnology company embedded in LIMS, has announced promising results for its potent plant defensin peptide, HXP124.

Hexima CEO, Dr Nicole van der Weerden, said the clinical trial involved a group of Australians with onychomycosis or fungal nail infections and found HXP124 to be safe, effective and far superior to existing therapies for the condition.

"Around 12 per cent of the global population suffers from fungal nail infections, and unfortunately, many of these are not treated because current available drugs work poorly and are expensive," Dr van der Weerden said. "Onychomycosis affects a range of people from runners and surfers to the elderly and diabetics. Left untreated, patients can suffer pain and discomfort and can have difficulty walking."

"We have shown that HXP124 can substantially reduce the area of infection and can do so up to four times faster than other available treatments. Our treatment penetrates the nail and kills the fungus that causes the infection. Although regulatory requirements mean we could only test a small group of patients, the results are very encouraging."

Hexima's antifungal plant defensin platform developed from research started by Professor Marilyn Anderson in the late 1990s when she was searching for molecules that protect flowers from fungal disease.

Since then, Professor Anderson, who is now Hexima's Chief Science Officer, and her team have identified hundreds of plant-derived antifungal molecules that are effective against a wide range of fungal diseases.

"These molecules are exciting because they kill fungus via a novel mechanism and are active against fungal pathogens that are resistant to current drugs," Professor Anderson said. "The HXP124 peptide was first isolated from a shrub called Bitterbush which grows in warm climates. It's personally very rewarding to see our years of research being translated into a potential new treatment for fungal infections in humans."

The second stage of the trial, testing the drug in a larger cohort of patients, is currently underway with results expected in 2019.

# GIANT LEAP IN **MOLECULAR IMAGING**

CAPTURING ULTRA FAST IMAGES OF MOLECULAR STRUCTURE.

LIMS scientists have used the world's most powerful X-ray laser to help capture ultra-fast images of molecular structure, demonstrating data collection frequencies of more than a million shots per second are now possible.

Dr Brian Abbey and Professor Keith Nugent, also members of the ARC Centre of Excellence for Advanced Molecular Imaging, collaborated with the Deutsches Elektronen-Synchrotron and the Center for Free-Electron Laser Science in Germany on the first-ever megahertz crystallography experiments. The collaboration involved more than 120 scientists based at 35 different universities located all over the world.

Using the world's most powerful X-ray laser at the European XFEL facility in Hamburg, which generates up to 27,000 X-ray shots per second in short bursts of over 1 megahertz (equivalent to one million shots per second), the scientists were able to construct 3D models of biomolecules.

Their findings, published in the prestigious journal *Nature Communications*, could lead to a better understanding of diseases and aid in the development of new drugs.

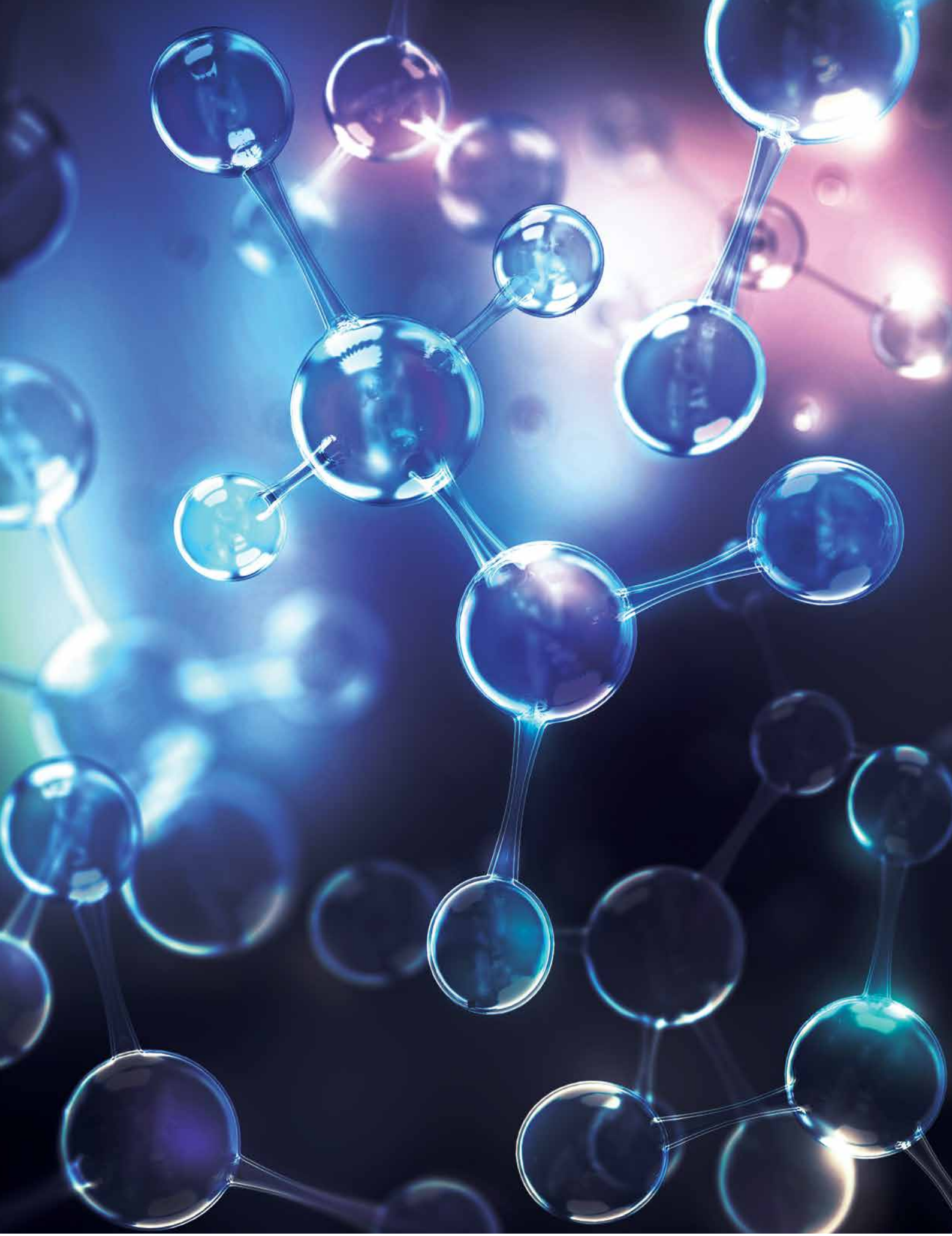
"This is a giant leap forward for molecular imaging and the result of one of the largest international collaborations in X-ray science," Dr Abbey said. "Before the Euro XFEL opened last September, the best that was possible for X-ray lasers was 120 images per second."

"Being able to collect over 200 times more images per second than before will be a massive boost to researchers trying to create real-time molecular movies. Actually seeing molecules in motion provides us with new insights into how they function and has enormous potential benefits for many areas of science."

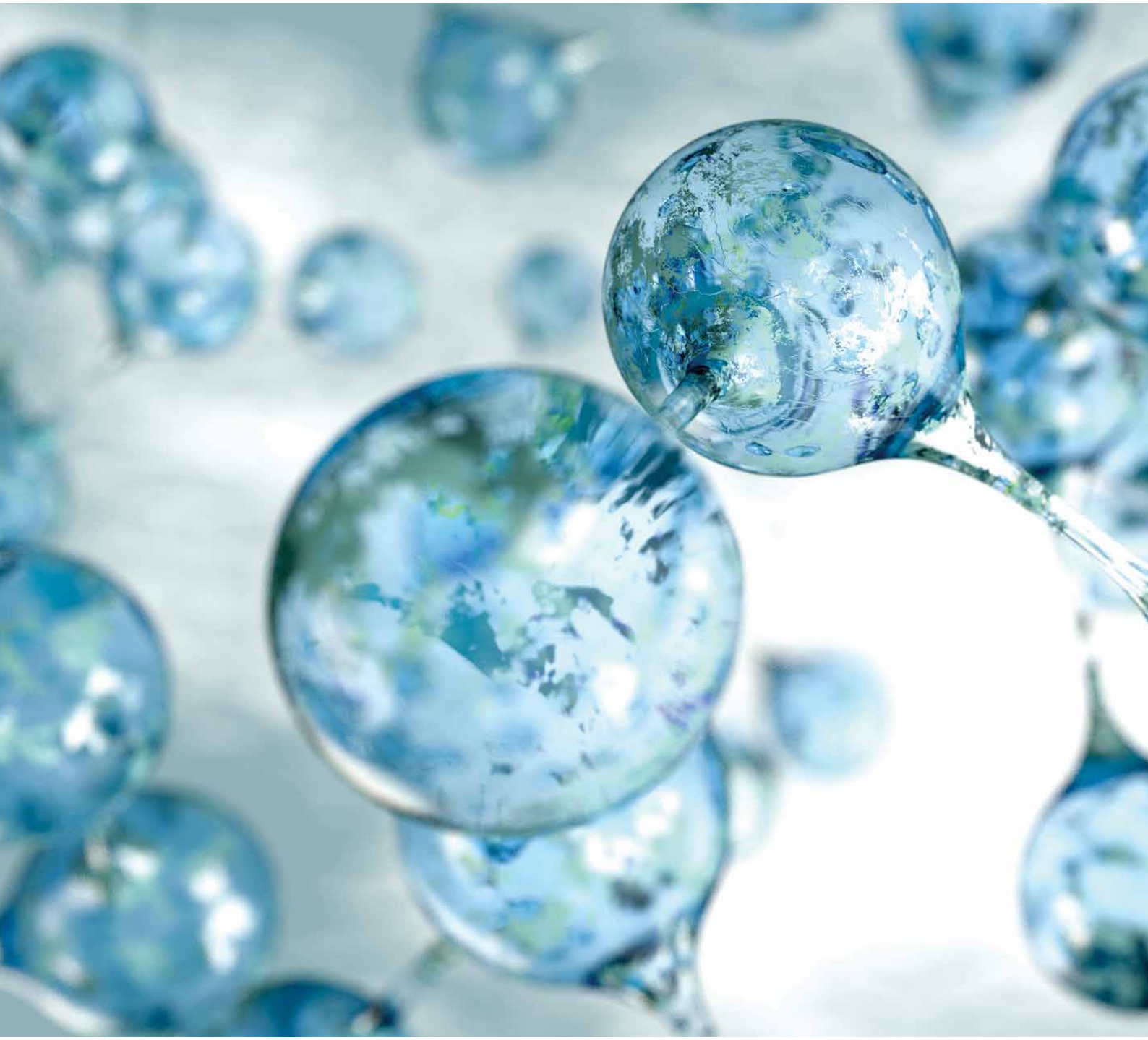
Professor Nugent said La Trobe was the only Australian university to be involved in the experiments.

"It's been an enormous privilege to have been among the very first scientists in the world to have access to Euro XFEL's cutting-edge technology," Professor Nugent said. "It's exciting for our team to work alongside the world's best molecular scientists, as well as a number of our students who are now based at Euro XFEL. This is innovative science and arguably the biggest science project in the world right now."

"La Trobe's involvement has helped cement Australia's reputation as a major science player."



# MOLECULAR **DESIGN**



THE MOLECULAR DESIGN THEME USES MOLECULES TO SOLVE REAL-WORLD PROBLEMS FROM COMPUTATIONAL STUDIES ON THE INTERACTION OF DRUGS WITH PROTEINS TO MOLECULAR SYNTHESIS, AND SURFACE AND MATERIAL SCIENCE.

## Theme leaders

### Belinda Abbott
Senior Lecturer

**Medicinal chemistry and synthetic organic chemistry**
Uses synthetic organic chemistry to make novel compounds for testing in biological assays in order to study the structure-activity relationships of how the compounds interact with the target. Develops treatments for bacterial infection, malaria, cardiomyopathy and motor neurone disease.

### Peter Barnard
Senior Lecturer

**Synthetic organic and inorganic chemistry**
Synthesises coordination complexes for diagnostic imaging applications and sensor development. Specialises in small molecule organic and inorganic synthesis in combination with analytical techniques for the generation and characterisation of new compounds.

## Members

### Carmel Abrahams
Lecturer

**Supramolecular chemistry and single crystal X-ray diffraction characterisation of small molecules**
Investigates the design, synthesis and characterisation of supramolecular systems. Studies the use of the biodegradable porous compound Zn saccharate and its ability to act as a host for molecules such as small aromatic hydrocarbons.

### Jasim Al-Rawi
Senior Lecturer

**Heterocyclic compounds such as PNA-PK, PI3K PDE3 inhibitors for cancer treatment**
Synthesis of novel 8-aryl and/or 7,8-substituted-2-orpholino-1, 3-benzoxazines as DNA-PK, PI3K inhibitors for more effective treatment of cancer. Studies PI3K isoform selectivity as well as DNA-PK selectivity over PI3K. Uses molecular modelling to explain drug- receptor optimum interaction.

### Jason Dutton
Associate Professor and ARC Future Fellow

**Organic, organometallic and inorganic chemistry from synthetic and theoretical perspectives**
Examines the fundamental chemistry of a wide variety of systems (literally spanning the periodic table from beryllium to iodine) using both synthetic and computational approaches. Discovers new structures, bonding and reactivity for a variety of elements.

### Yuning Hong
Bruce Stone Fellow in Chemical Biology and ARC DECRA Fellow

**Fluorescent probes, cell imaging, protein misfolding and neurodegenerative diseases**
Develops fluorescence-based tools for understanding and manipulating fundamental biological processes. Designs and synthesises new luminescent molecules in combination with advanced fluorescence spectroscopy and microscopy for monitoring protein conformational transitions associated with neurodegenerative diseases.

### Adam Mechler
Associate Professor

**Bioinspired self-assembling nanostructures**
Studies the principles of spontaneous organisation in lipid membranes, antimicrobial peptide-membrane interactions and metallosupramolecular assemblies. Applies these design rules in the development of biomimetic membrane platforms, novel peptide antibiotics and oligoamide-based metamaterials.

### John Moses
Professor and ARC Future Fellow

**Design and synthesis of new functional molecular entities**
Designs and synthesises new functional molecular entities and develops new methodologies for challenging and useful chemical reactions/transformations. Specialises in click chemistry, natural product synthesis and chemical biology.

### Brian Smith
Professor and Head of the School of Molecular Sciences

**Modelling molecular interactions**
Uses quantum-mechanical methods to understand enzyme mechanism, molecular mechanical methods to explore the dynamics of proteins, and a variety of tools to predict how molecules interact. Uses X-ray crystallography to determine the structures of complexes of proteins, polypeptides and small molecules.

### David Wilson
Associate Professor

**Computational chemistry and quantum chemistry**
Uses computational quantum chemistry to model molecular structures, properties and spectroscopies, as well as the energetics of reactions. Focuses on understanding the fundamental properties of chemical bonding and electronic structure in the design of new chemistry and new materials.

### David Winkler
Professor

**Computational molecular design**
Uses computational methods to study the interaction of molecules and complex materials. Expertise in the application of AI, machine learning and evolutionary computational methods to design bespoke materials with novel properties. Designs small molecules and peptides as drug leads, novel 2D and porous materials for energy applications, and biomaterials for regenerative medicine.

### Pallavi Sharma
Senior Lecturer

**Synthetic organic chemistry**
Develops new synthetic methodology that delivers structurally diverse and complex chemical entities via rapid fusion of short lived reactive species. Using under-represented reagents, explores their latent reactivity for heterocycles, spirocycles, natural products and analogue synthesis.

# MOLECULAR **IMAGING**

THE MOLECULAR IMAGING THEME USES A BROAD RANGE OF METHODS TO CHARACTERISE MOLECULAR STRUCTURE AND FUNCTION.

## Theme leaders

**Brian Abbey**
Associate Professor and ARC Future Fellow

Coherent X-ray science and materials characterisation
Combines elements of optics, nanofabrication, synchrotron science and X-ray free-electron lasers to develop new approaches to imaging materials and structures at the atomic, molecular and cellular level. Develops techniques for interpreting patterns of coherently scattered light.

**Mihwa Lee**
ARC DECRA Fellow and Tracey Banivanua Mar Fellow

Structural biology in gene regulation and DNA damage repair pathway
Uses a multidisciplinary approach (combining molecular biology, protein chemistry, cell biology and X-ray crystallography) to characterise the macromolecular complexes (protein-protein and protein-nucleic acid complexes) in the nucleus to understand their fundamental roles in gene regulation and the DNA damage repair pathway.

## Members

**Shanshan Kou**
Lecturer

Bio-imaging and bio-photonics, optical micro- and nano-scopy, and biomedical instrumentation
Studies the interactions between light and biological matter to explore and discover the complex mechanisms behind cellular and sub-cellular events and processes. Develops novel bio-imaging modalities and instrumentation to be used in new diagnostic and therapeutic tools.

**Marc Kvansakul**
Associate Professor

Structural biology of cell death and host pathogen interactions
Examines how viruses hijack cellular defence systems to ensure their own proliferation and survival. Understands the role of small proteins that act as a first line of defence against microbial targets, and the mechanisms they use to destroy target cell membranes.

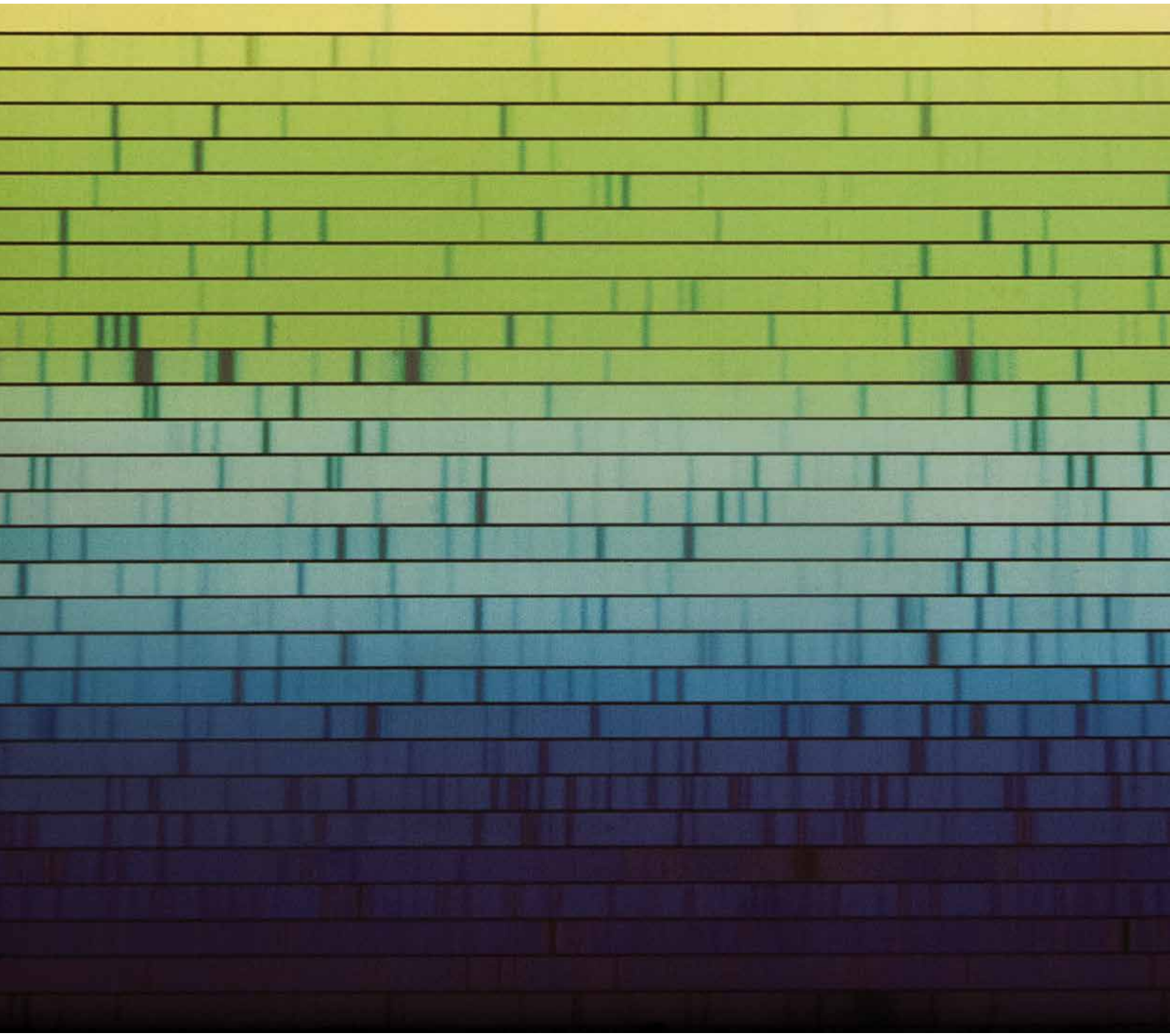
**Megan Maher**
Associate Professor

Metallobiology
Studies the mechanisms by which trace metals are regulated within biological systems. This regulation relies on proteins that fulfil specific roles within the cell. Examines the functions of these proteins by defining their three-dimensional architectures by X-ray crystallography.

**Grant van Riessen**
Lecturer

Experimental condensed matter and materials physics, and coherent X-ray imaging development
Develops novel methods of probing condensed matter and material properties using coherent X-ray imaging methods, electron spectroscopy, and nanofabricated devices. Develops synchrotron instrumentation and high-performance computing methods for reconstructing quantitative images from very large datasets.

# MOLECULAR **SENSING**



THE MOLECULAR SENSING THEME COMBINES CHEMISTRY, PHYSICS AND BIOLOGY TO IDENTIFY AND QUANTITATE KEY CHEMICAL AND BIOCHEMICAL SPECIES IN THE ENVIRONMENT AND IN THE HUMAN BODY.

## Theme leaders

### Conor Hogan
Associate Professor

**Electrochemistry, photochemistry, chemical sensing and biosensing**
Conducts fundamental and applied research to expand the bounds of analytical science. A world leader in the application of electrochemiluminescence (ECL) detection to mobile-phone-readable paper microfluidic sensors, and the development of potential resolved multi-coloured ECL or 3D ECL.

## Members

### Michael Angove
Associate Professor, and Head of Pharmacy and Biomedical Sciences

**Colloid, environmental and pharmaceutical science**
Uses colloid chemistry to research environmental and agricultural soil systems so that we are better placed to manage soil environments, and even rehabilitate damaged or contaminated soils. Studies pharmaceutical products that utilise colloidal particles and systems.

### Narelle Brack
Senior Lecturer and Head of Chemistry and Physics

**Surface modification and characterisation of advanced materials**
Creates materials at the nanometer scale. Explores chemical and molecular properties and processes at surfaces and at interfaces. Develops surface modification strategies for material systems including next generation aircraft materials, carbon nanomaterials and electrospun nanofibres.

### Courtney Ennis
ARC DECRA Fellow

**Spectroscopy of planetary and interstellar environments**
Uses advanced infrared techniques to trace chemical reactions observed throughout our solar system and beyond into interstellar space. Develops our understanding of the Earth's chemical origins and improves sensing methods for biologically significant molecules that may remain undetected in space.

### David Hoxley
Lecturer

**Biosensing applications of wide bandgap semiconductors**
Studies the surfaces of semiconductor crystals, particularly diamond, and how they react to the world around and within us. Researches ways of making coaching possible in the tertiary education system, primarily through combining modern educational psychology with information technology.

### Chris Pakes
Professor

**Quantum materials for electronics, spintronics and biosensing**
Examines functionalisation of technologically interesting materials via the chemical modification of the surface and surface transfer doping. Focuses on diamond surfaces at the atomic-scale to engineer two-dimensional devices with applications in quantum electronics and biosensing.

### Paul Pigram
Associate Professor

**Interactions at surfaces**
Creates, understands and controls materials at the nanometer scale. Focuses on surface science, in particular exploring chemical and molecular properties and processes at surfaces and at interfaces, understanding molecular interactions at surfaces, and bio-surface characterisation.

### Ian Potter
Senior Lecturer

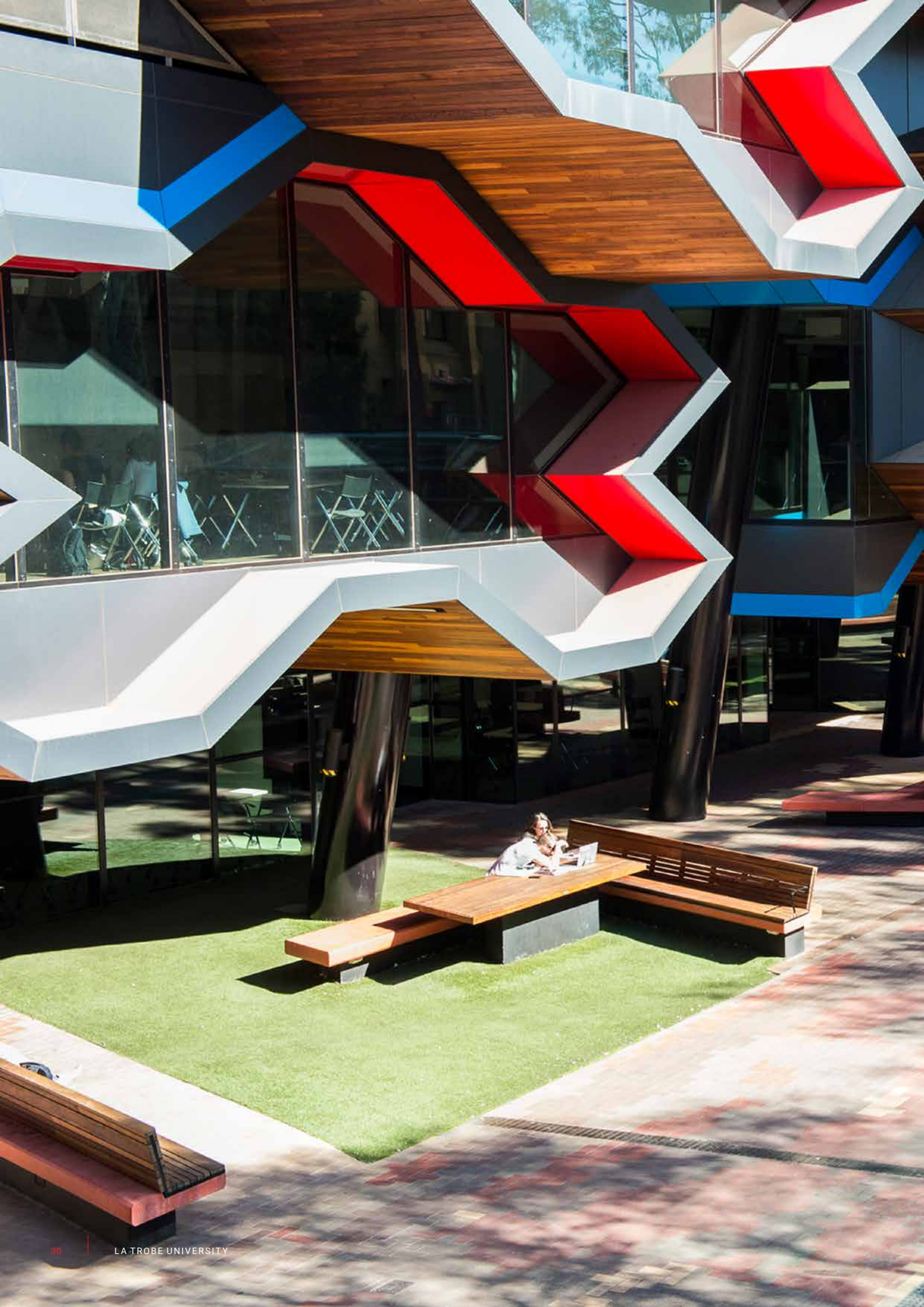
**Analytical and environmental chemistry**
Prepares polymer inclusion membranes and polymer-based microspheres for use as small-scale chemical reactors and sensors for biological, environmental and industrial applications. Develops methods to analyse plant biomarkers. Develops forensic analysis methods to determine the production method and source of dangerous chemicals.

### Dongchen Qi
Lecturer and ARC Future Fellow

**Nanophysics and quantum materials**
Creates and understands the surfaces and interfaces of functional materials at the molecular scale to develop new technologies and material platforms for next-generation devices. Uses advanced spectroscopic techniques, based on synchrotron radiation, to examine surface and interface phenomena and physics essential to device operation.

### Evan Robertson
Senior Lecturer

**Optical spectroscopy of atmospheric and biological molecules**
Uses powerful light sources, such as lasers and the Australian Synchrotron's infrared beamline, to study the shape of neurotransmitter molecules relevant to pharmaceuticals, greenhouse gas molecules, ice cloud particles and even molecules in the interstellar medium.



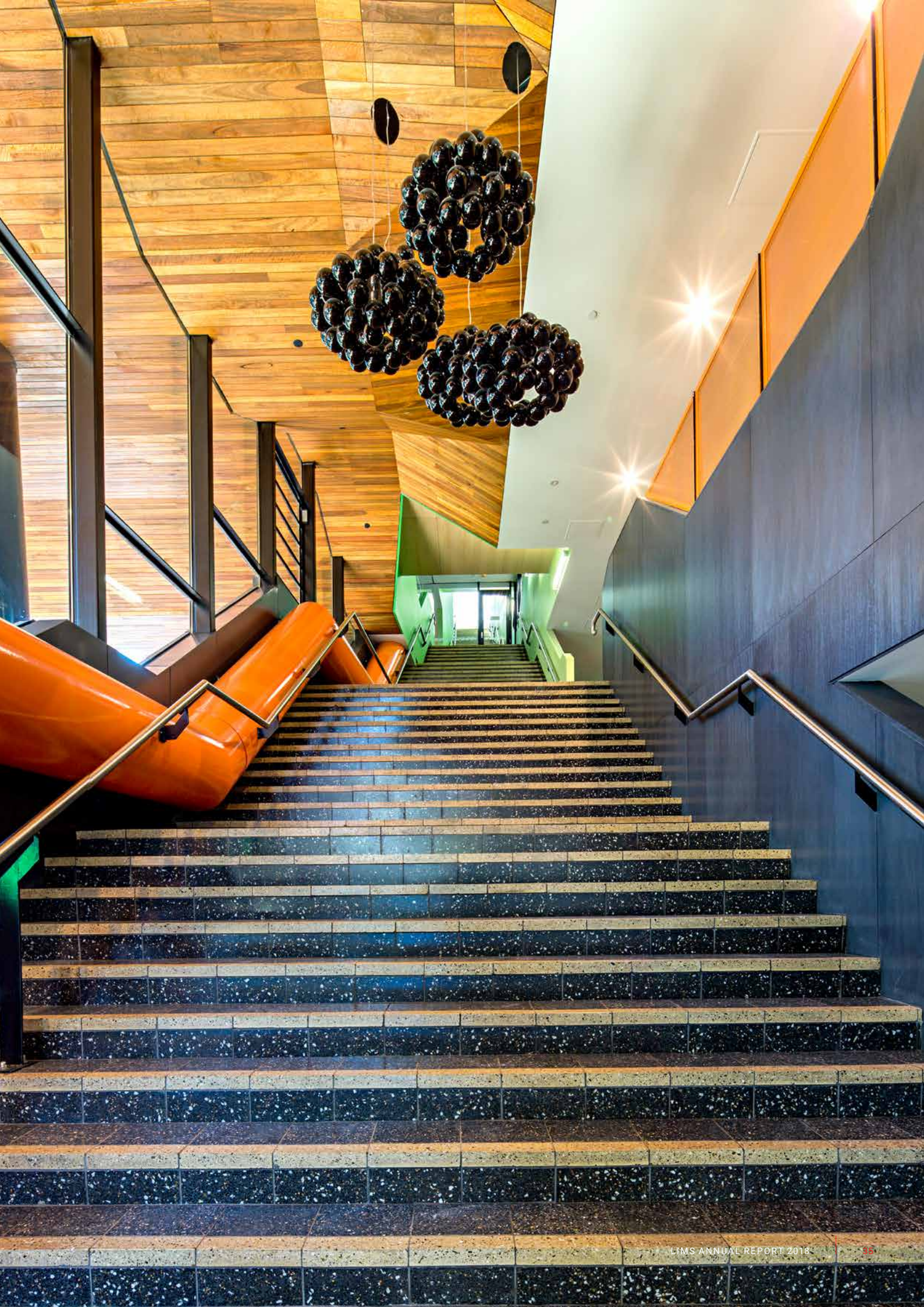
# EXTERNAL **FUNDING**

| Project | Total 2018 |
|---|---|
| **AdAlta** | **563,786.73** |
| Development of human single-domain antibodies for use in inflammation and fibrosis (Michael Foley ) | 563,786.73 |
| **Australian Research Council** | **2,000,689.15** |
| Molecular reporters for measuring proteostasis capacity in cells (Yuning Hong) | 129,919.58 |
| Crosstalk between cell survival and cell death pathways (Erinna Lee) | 192,268.41 |
| Multi-colour electrogenerated chemiluminescence (Conor Hogan) | 40,387.00 |
| Cell wall structure and dynamics in emerging fungal pathogens of crops (Marilyn Anderson) | 66,310.50 |
| Determining the mechanism and function of dying cell disassembly (Ivan Poon) | 127,824.11 |
| Discovering new organic chemistry using an inorganic touch (Jason Dutton) | 211,421.59 |
| Understanding how protein and RNA cargo are sorted into exosomes (Andrew Hill) | 126,776.37 |
| Atomic scale imaging with high coherence electrons and ions (Keith Nugent) | 75,750.00 |
| Control of cell competition by cell shape regulators in tissue development (Helena Richardson) | 158,732.39 |
| ARC Training Centre for Portable Analytical Separation Technologies (Conor Hogan) | 34,000.00 |
| Developing next generation click chemistry (John Moses) | 242,102.84 |
| How autotransporter proteins mediate bacterial interactions (Begoña Heras) | 166,896.42 |
| High through-put facility for measurement of quantum materials and devices (Christopher Pakes) | 205,000.00 |
| The structural biology of trace metal trafficking across membranes (Megan Maher) | 111,649.97 |
| Understanding the biogenesis of exosomes (Suresh Mathivanan) | 111,649.97 |
| **Australian Research Council Centre of Excellence** | **978,874.18** |
| ARC Centre of Excellence in Advanced Molecular Imaging (Brian Abbey) | 978,874.18 |
| **Hexima** | **2,646,514.33** |
| Antifungal activity implant defensins; discovery of novel insecticidal proteins; interaction between matriptase and proteinase inhibitors (Marilyn Anderson) | 2,646,514.33 |
| **National Health and Medical Research Council** | **2,617,845.90** |
| Limiting the impact of influenza (Weisan Chen) | 394,000.00 |
| Broad spectrum inhibition of an enzyme antibiotic target (Tatiana Soares da Costa) | 81,798.76 |
| Deciphering the role of Scribble in development and disease (Patrick Humbert) | 45,352.30 |
| Deciphering the role of Scribble in development and disease (Marc Kvansakul) | 108,070.67 |
| Disorderly conduct and disturbing the peace: how loss of cell polarity and tissue architecture drives cancer progression (Patrick Humbert) | 129,834.78 |
| Cellular and molecular characterization of erythroid enucleation (Patrick Humbert) | 219,621.74 |
| DsbA inhibitors: from hits to leads (Begoña Heras) | 90,000.00 |
| Elucidating the mechanism and function of cell disassembly during apoptosis (Ivan Poon) | 109,258.17 |
| Cancer cachexia therapeutics (Nick Hoogenraad) | 304,181.50 |
| Characterising the tumour suppressive function of myoepithelial cell stefin A in ductal carcinoma *in situ* (Belinda Parker) | 164,456.66 |
| Reappraisal of the mechanisms underlying implantation success or failure (David Greening) | 111,038.00 |

| Project | Total 2018 |
|---|---|
| Dissecting the pathogenic triad of enteric pathogens: assembly, structure and function of autotransporter proteases (Lakshmi Wijeyewickrema and Robert Pike) | 57,071.80 |
| Biomarkers to aid clinical trials for neurodegenerative disease (Andrew Hill) | 426,088.40 |
| DsbA foldases from multidrug resistant pathogens as targets for new antimicrobials (Begoña Heras) | 50,728.50 |
| Conologues: Ultra-fast-acting therapeutic insulins based on cone snail venom insulin principles (Brian Smith) | 68,164.00 |
| Defining the molecular regulators of apoptotic cell disassembly and their role in cell clearance and lupus-like autoimmune disease (Ivan Poon) | 258,180.62 |
| **Other** | **4,723,776.13** |
| Australian National Fabrication Facility (ANFF) - Victoria Node (Paul Pigram) | 125,000.00 |
| A fast soft X-ray detector system for advanced biological and materials imaging (Grant van Riessen) | 165,187.52 |
| Prostate cancer bone metastasis (ProMis) (Belinda Parker) | 417,774.00 |
| Testing the efficacy and safety of SM-164 for osteosarcoma treatment (Christine Hawkins) | 25,000.00 |
| Research services for Robert Bosch (Australia) Pty Ltd (Paul Pigram) | 3,600.00 |
| Exploring better and safer treatments for osteosarcoma (Christine Hawkins) | 191,356.00 |
| Joint La Trobe Australian Synchrotron Fellowship (Brian Abbey) | 128,274.50 |
| Research services for Amcor AFAP Moorabbin (Paul Pigram) | 3,000.00 |
| Control of medically important candidemias and Candida-based biofilms (Marilyn Anderson) | 88,363.64 |
| Regulation of cell polarity and tumourigenesis by Tetraspanin 6 (Helena Richardson) | 99,999.99 |
| Type I interferon regulators as prognostic markers and predictors of therapeutic response in triple negative breast cancer (Belinda Parker) | 97,778.00 |
| Using immune markers to individualise therapy for patients with triple negative breast cancer (Belinda Parker) | 150,000.00 |
| *F.graminearum* cell wall (Marilyn Anderson) | 29,716.00 |
| Screening of AdAlta's proprietary i-body library on a fibrosis-related GPCR target (Christopher Hosking) | 52,500.00 |
| Characterisation of pineapple cysteine proteases with therapeutic potential (Lakshmi Wijeyewickrema) | 235,806.00 |
| Far- and mid-infrared spectroscopy of astrochemical species and aerosols (Courtney Ennis) | 6,250.00 |
| Research services for X-ray Vision Australia Pty Ltd (Paul Pigram) | 2,120.00 |
| Preclinical testing of TLR agonists in triple negative breast cancer models: critical timing, targets and combination strategies (Belinda Parker) | 72,802.95 |
| Research services for ExcelPlas Pty Ltd (Paul Pigram) | 1,200.00 |
| Secondment of postdoctoral fellow on SAXS/WAXS (Marc Kvansakul) | 25,000.00 |
| Research services for RMIT (Paul Pigram) | 840.00 |
| Elucidating the mechanism and function of extracellular vesicle formation during cell death (Amy Baxter) | 81,798.33 |
| Tour de Cure/La Trobe University Preclinical Centre for Breast Cancer Prevention (Patrick Humbert) | 149,693.00 |
| Controlling a novel catalytic center within an innate immune system protein to dampen or heighten the immune response (Helen Irving) | 95,311.93 |
| A novel cardioprotective doxorubicin-based treatment for metastatic breast cancer (Suzanne Cutts) | 131,236.00 |
| Genetic manipulation of bacteriophage for the targeting of bacteria causing periodontitis (Joseph Tucci) | 60,000.00 |
| Novel insights into the molecular mechanisms of manganese recognition and acquisition by pathogenic bacteria (Megan Maher) | 111,472.99 |

# EXTERNAL **FUNDING**

| Project | Total 2018 |
|---|---|
| Research services for Murdoch University (Paul Pigram) | 1,260.00 |
| Dissecting the pathogenic triad of enteric pathogens: assembly, structure and function of autotransporter proteases (Begoña Heras) | 162,434.86 |
| Research services for Gekko Systems Pty Ltd (Paul Pigram) | 4,800.00 |
| The prognostic and functional role of myoepithelial stefin A in the ductal carcinoma in situ to invasive carcinoma transition (Belinda Parker) | 75,738.01 |
| Growing Tall Poppies Program: a science experience for year 10 students (Eroia Barone-Nugent) | 42,000.00 |
| Neuroinflammation - New insight into PTM dynamics and roles of EV (Andrew Hill) | 10,892.50 |
| Seeking new biomarkers for early diagnosis of Motor Neuron Disease and Huntington's Disease (Yuning Hong) | 50,000.00 |
| Research services for CSL Behring (Paul Pigram) | 4,425.00 |
| Targeting a newly discovered cell death process as a novel therapeutic approach for viral infections (Ivan Poon) | 47,000.00 |
| Pre-clinical evaluation of IAP antagonists for osteosarcoma treatment (Christine Hawkins) | 92,766.01 |
| Novel therapeutics targeting neuronal transport pathways in MND (Belinda Abbott) | 307,376.00 |
| Synthesis of the water-soluble derivative 15K (John Moses) | 2,727.27 |
| Enabling exosome therapy: developing an advanced manufacturing process (Andrew Hill) | 289,534.22 |
| Commercialisation of a treatment for cancer cachexia (Nick Hoogenraad) | 500,000.00 |
| Time-resolved SFX (Majid Hejazian) | 3,419.58 |
| "The Sound of Cancer" podcast (Patrick Humbert) | 10,000.00 |
| Discovering novel players in mechanisms of extracellular vesicle release, cargo loading, and early pathogenesis of late-onset Alzheimer's disease (Andrew Hill) | 29,735.64 |
| Super resolution fluorescence microscope and cell biology facilities (Helen Irving) | 300,000.00 |
| Understanding the molecular basis of autoimmune disease Ankylosing Spondylitis (Weisan Chen) | 40,636.35 |
| Research services for Deakin University (Paul Pigram) | 16,260.00 |
| Targeting diaminopimelate biosynthesis enzymes for new herbicide development (Matthew Perugini) | 65,051.20 |
| Barwon South West Pharmacist Early Intervention Pilot (Joseph Tucci) | 20,000.00 |
| Defining the sensitivity of sarcomas to novel anti-cancer drugs (Christine Hawkins) | 1,800.00 |
| The impact of beam-energy and crystal size on radiation damage rates in macromolecular crystallography (Connie Darmanin) | 6,800.00 |
| Mechanism of antimicrobial peptide-membrane interactions (Adam Mechler) | 1,651.82 |
| Supramolecular self-assembly of unnatural peptides (Adam Mechler) | 1,651.82 |
| Exploring RNA loading into exosomes (Lesley Cheng) | 5,500.00 |
| Research services for the University of Canterbury (Paul Pigram) | 3,100.00 |
| Research Services for the University of Wollongong (Paul Pigram) | 5,985.00 |
| Diagnosing Alzheimer's disease using miRNA from serum extracellular vesicles (Lesley Cheng) | 70,150.00 |
| **Victorian Cancer Agency** | **466,000.00** |
| Understanding the biological basis of cancer cachexia (Nick Hoogenraad) | 466,000.00 |



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Afzali N, Tangestaninejad S, Moghadam M, Mirkhani V, Mechler A, Mohammadpoor-Baltork I, Kardanpour R and Zadehahmadi F (2018) Oxidation reactions catalysed by molybdenum(VI) complexes grafted on UiO-66 metal–organic framework as an elegant nanoreactor, ***Appl Organomet Chem***., 32(1): e3958. [MD]

Agatonovic-Kustrin S, Kettle C and Morton DW (2018) A molecular approach in drug development for Alzheimer's disease, ***Biomed Pharmacother***., 106: 553-565. [N]

Agatonovic-Kustrin S, Kustrin E, Angove M and Morton D (2018) A screening method for cardiovascular active compounds in marine algae, ***J Chromatogr A***, 1550: 57-62. [MS, N]

Agatonovic-Kustrin S, Kustrin E and Morton DW (2018) Phenolic acids contribution to antioxidant activities and comparative assessment of phenolic content in mango pulp and peel, ***S Afr J Bot***., 116: 158-163. [MS]

Agatonovic-Kustrin S and Morton DW (2018) HPTLC – bioautographic methods for selective detection of the antioxidant and α-amylase inhibitory activity in plant extracts, *MethodsX*, 5: 797-802. [MS]

Kustrin S and Morton DW (2018) Quantification of polyphenolic antioxidants and free radical scavengers in marine algae, ***J Appl Phycol***., 30: 113-120. [MS]

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La Trobe University acknowledges that our campuses are located on the lands of many Traditional Custodians in Victoria and New South Wales. We recognise their ongoing connection to the land and value their unique contribution to the University and wider Australian society.

La Trobe University is committed to providing opportunities for Aboriginal and Torres Strait Islander people, both as individuals and communities, through teaching and learning, research and community partnerships across all our campuses.

The wedge-tailed eagle (Aquila audax) is one of the world's largest, and the Wurundjeri people – Traditional Owners of the land where our Melbourne campuses are located – know the wedge-tailed eagle as Bunjil, the creator spirit of the Kulin Nations.

There is a special synergy between Bunjil and the La Trobe University logo of an eagle. The symbolism and significance for both La Trobe and for Aboriginal people challenges us all to gamagoen yarrbat – to soar.

## General enquiries

La Trobe Institute
for Molecular Science
La Trobe University
VIC 3086
Australia

**T** +61 3 9479 2160
**F** +61 3 9479 1266
**E** LIMSEnquiries@latrobe.edu.au

latrobe.edu.au/lims

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