LA TROBE UNIVERSITY

LA TROBE INSTITUTE FOR MOLECULAR SCIENCE

LIMS ANNUAL REPORT 2017

La Trobe Institute for Molecular Science

latrobe.edu.au/lims

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Published by La Trobe University, September 2018. La Trobe University is a registered provider under the Commonwealth Register of Institutions and Courses for Overseas Students (CRICOS). CRICOS Provider 00115M.

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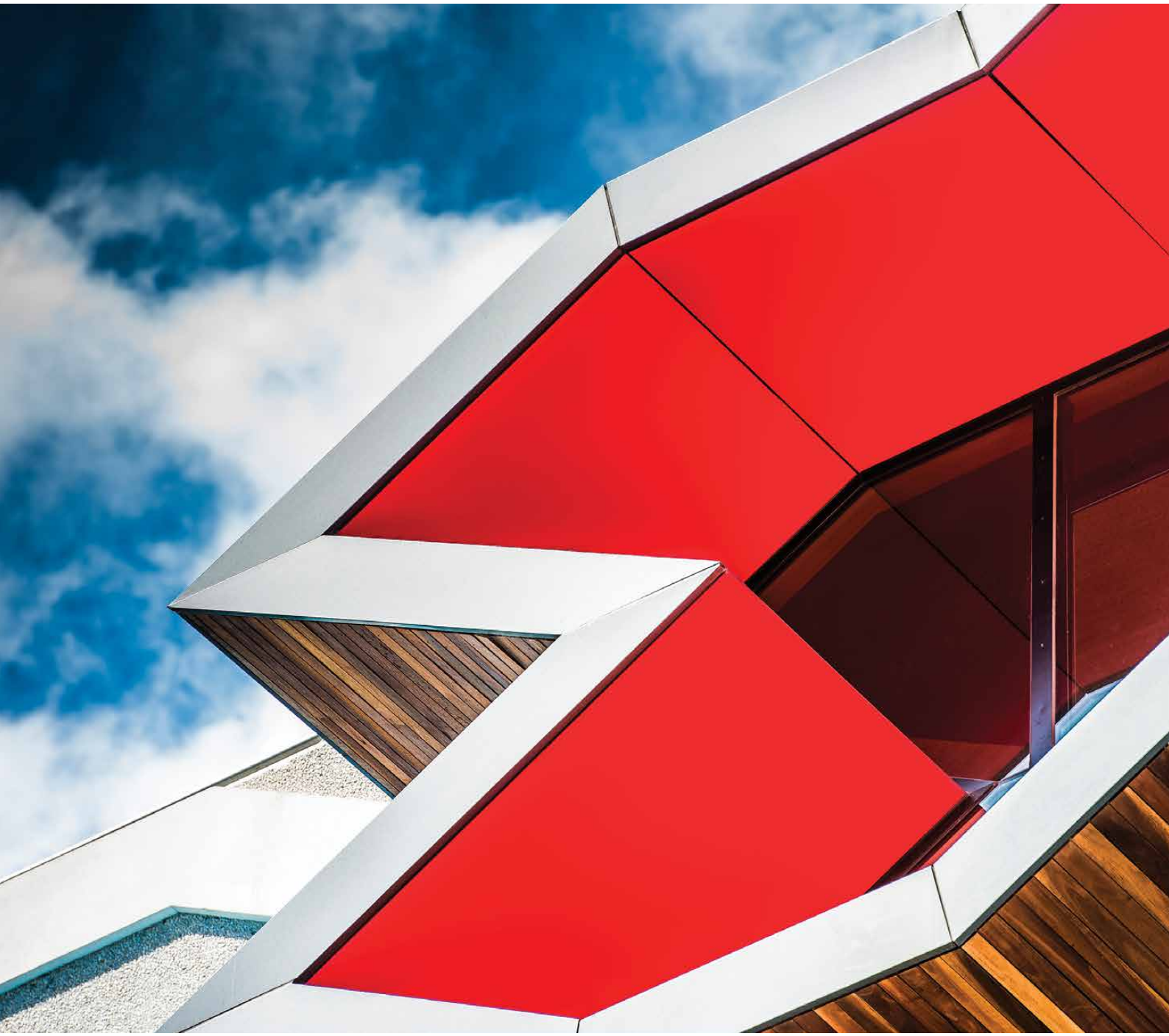
TRANSLATABLE MOLECULAR DISCOVERIES



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 AT THE INTERFACE OF HEALTH AND SCIENCE.

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, who are developing plant-derived proteins and peptides for application as human therapeutics and the genetic modification of crops; and AdAlta Limited, who are 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.

DIRECTOR'S REPORT

LIMS USES BASIC RESEARCH TO CONNECT THE MULTIDISCIPLINARY DOTS AT THE INTERFACE OF HEALTH AND SCIENCE. IT HAS AN INNOVATIVE AND BROAD-RANGING RESEARCH PORTFOLIO THAT SPANS BIOCHEMISTRY, CHEMISTRY, GENETICS, PHYSICS AND PHARMACY.

In 2017, our research themes continued to evolve, facilitated by a program of workshops, seminars and other activities. Theme leaders presented their group's research to the LIMS Advisory Board and cross-theme activities were also established to encourage greater collaboration between researchers. We continued with our strategic plan of theme-based recruitment and retention activities.

LIMS also led a university bid to establish the Research Centre for Extracellular Vesicles. La Trobe has a critical mass – unparalleled in Australia – of multidisciplinary, internationally recognised researchers who specialise in examining the role of extracellular vesicles in neuroscience, food and nutrition, reproductive biology, cancer and infectious diseases. The Centre will harness this research expertise across schools in the College of Science, Health and Engineering.

In 2017, John Moses became our new Professor of Organic Chemistry. He oversees a research team that specialises in click chemistry, biomimetic synthesis, anticancer and antibiotic drug discovery, chemical biology and new synthetic methodology. Helen Irving was appointed our new Professor of Biomedical Science. Her research focuses on proteins and genetic systems that are involved in human health.

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

A research team led by Emeritus Professor Nick Hoogenraad AO, were among 13 groups to receive inaugural funding from the Victorian Medical Research Acceleration Fund. The team will use the $500,000 grant to fast track research on cachexia – a condition that results in significant weight loss in 80 per cent of cancer patients and accounts for 20 per cent of all cancer deaths.

Professor John Moses received four years' funding through the Australian Research Council's prestigious Future Fellowships scheme. Professor Moses will develop new click chemistry, a method that helps to discover and develop biologically active molecules in the fight against cancer and antibiotic resistance.

Dr Belinda Parker received a Victorian Cancer Agency Mid-Career Fellowship to identify ways to individualise therapy for patients with triple negative breast cancer.

LIMS also received three Commonwealth Scientific and Industrial Research Organisation (CSIRO) Science and Industry Endowment Fund (SIEF) Fellowships. Dr James McKenna will work with Hexima Limited (under the supervision of Professor Marilyn Anderson AO) on a project investigating the treatment of medically important *candidemias* and *candida*-based biofilms. Dr Tang Yongqing will work with Anatara Lifesciences Limited (under the supervision of Dr Lakshmi Wijeyewickrema) on a project investigating pineapple cysteine proteases with therapeutic potential.

Dr Chris Hosking will work with AdAlta Limited (under the supervision of Dr Michael Foley), to identify and develop potential treatments for a range of human diseases using the company's novel class of drugs, known as i-bodies. SIEF Fellowships enable small and medium-sized businesses to undertake projects with early-career scientists from Australian research organisations.

Professor David Winkler received the Herman Skolnik Award from the American Chemical Society for his outstanding contribution to the development of optimally sparse, robust machine learning methods for quantitative structure-activity relationship models.

Dr Megan Maher received the Georgina Sweet Award to promote and support female scientists who demonstrate excellence in the area of quantitative biomedical science.

Dr David Greening was awarded the ROYAN International Research Award on Reproductive Biomedicine for his work on early embryo implantation and regulation involving extracellular vesicles.

Professor Marilyn Anderson AO was awarded the Leach Lecture Medal at the Lorne Conference on Protein Structure and Function.

2017 marked La Trobe University's 50th Anniversary. Biochemistry and Genetics, and Chemistry celebrated the occasion with symposia and dinners featuring our leading scientists from the past five decades.

Professor Andrew Hill
Director

LEADERSHIP
TEAM

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

Professor Andrew Hill

Professor Andrew Hill is Director of LIMS, Director of La Trobe University's Research Focus Area Understanding Disease 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. At the University of Melbourne he was the Biosciences Domain Coordinator (2011-14) and Associate Director (Structural and Cellular Biology) of the Bio21 Institute (2013-15). In 2015, Professor Hill was appointed Head 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 (ISEV).

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 160 research papers and edited three books.

Professor Brian Smith

Professor Brian 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 was Head of the Department of Chemistry and Physics, prior to becoming Head of the School of Molecular Sciences in 2017.

Professor Smith is a Fellow of the Royal Australian Chemical Institute, and is the current president of the Association of Molecular Modellers of Australasia. 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 authored over 150 research papers.

Dr Mark Hulett

Dr Mark Hulett is Deputy Director of LIMS and an executive committee member 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 Applied Science. He also serves as 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 Narelle Brack is Head of the Department of Chemistry and Physics. Her research interests lie in the area of materials and surface chemistry. Dr Brack has developed surface modification strategies for a diverse range of material systems including next generation aircraft materials, carbon nanomaterials and electrospun nanofibres.

Dr Robyn Murphy

Dr Robyn Murphy is Associate Professor and Head of the Department of Biochemistry and Genetics. She also serves on the Executive Committee of the Sport, Exercise and Rehabilitation Research Focus Area of the University. Dr Murphy 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, CHAIRED BY PROFESSOR FRANCES SHANNON, PROVIDES STRATEGIC ADVICE ON THE INSTITUTE'S RESEARCH AGENDA.

Professor Frances Shannon

Professor Shannon is Deputy Vice-Chancellor (Research) at the University of Canberra. She was previously Director of the John Curtin School of Medical Research at the Australian National University. Her leadership at the University of Canberra has seen it enter world rankings for the first time and achieve well above world standard in a number of fields in Excellence in Research for Australia 2015.

Professor Marilyn Anderson AO

Professor Anderson AO is Professor of Biochemistry at La Trobe University and the Chief Scientist of Hexima Ltd. 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 Andrew Hill

Professor Hill is Director of LIMS, Director of the University's Research Focus Area Understanding Disease and Director of the Research Centre for Extracellular Vesicles at La Trobe University. He is currently president of the International Society of Extracellular Vesicles. He was awarded the 2010 Merck Research Excellence Medal from the Australian Society for Biochemistry and Molecular Biology.

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 Director of the Australian Synchrotron. He is Professor of Physics at La Trobe University and was seconded to the Australian Synchrotron as Head of Science in 2011. He is a Principal Investigator in the ARC Centre of Excellence for Advanced Molecular Imaging and has published over 100 research papers.

Professor Robert Pike

Professor Pike is Pro Vice-Chancellor of the College of Science, Health and Engineering. 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 CEO of Nucleus Networks and 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 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.

Dr Alan Watkinson

Dr Watkinson is La Trobe University's inaugural Chief Advancement Officer. He has presented around the world on various aspects of fundraising and philanthropy, and now heads a team with a simple but vital mission: to serve the University, enrich the lives of our alumni and engage the community in support of the aspirations of La Trobe University.

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 retired in 2014.

Nicholas Hoogenraad Fellow in Molecular Sciences

Dr Ivan Poon

Dr Ivan Poon has over 11 years' experience in the field of cell death and clearance.

Dr Poon has published 48 research papers (15 first author, 11 senior author, >2200 citations) in high impact journals including *Nature, Nature Reviews Immunology, Nature Communications, Nature Protocols, eLife* and *Blood*. He has made several significant discoveries including the mechanism of cell fragmentation during cell death, viral protein-induced cell death, antimicrobial peptide-mediated cell lysis, and dying cell uptake via pattern recognition molecules. Dr Poon was awarded the 2016 Victorian Young Tall Poppy Award.

Bruce Stone Fellows in Chemical Biology

Dr David Greening

Dr Greening's research focuses on the functional role of the secretome in cancer biology and embryo implantation, with significant discoveries in defining purification and characterisation of distinct types of extracellular vesicles and functional mechanisms promoting remodelling in these distinct environments.

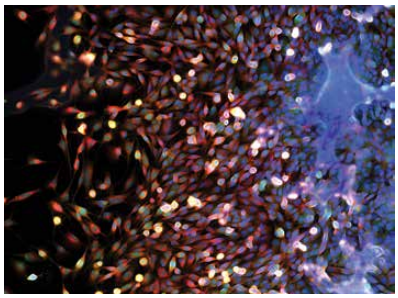
Dr Greening has 53 publications (23 first author, 19 corresponding/senior author, >2400 citations), and is lead editor on seminal proteomic textbooks. Dr Greening's research has been published in prestigious journals including *Molecular Cellular Proteomics, Nature Review Clinical Oncology* and *Biology of Reproduction*. He has received several awards including the ROYAN International Research Award (2017), International Hans Neurath Outstanding Promise Award (2016) and Protein Science International Young Investigator Award (2016).

Dr Yuning Hong

Dr Yuning Hong develops new methods to visualise the protein lifecycle in cells and identify biomarkers for early diagnosis of neurodegenerative diseases.

Dr Hong has over 80 publications (>9000 citations and a H-index of 39) and nine US patents. Her research focuses on building novel fluorescent molecules that allow scientists to visualise the dynamic motions of biomolecules and the related biological events. In particular, she has developed new biosensors to monitor the folding of G-quadruplex DNA, the key indicator of heart disease, and a range of photostable cell imaging agents for visualising cell structures and their environment.

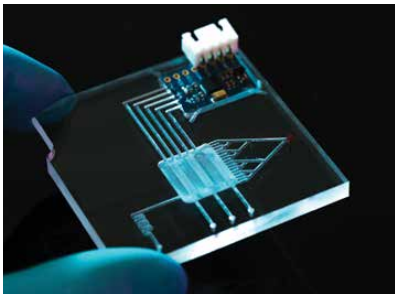
DISCOVERY **HIGHLIGHTS**



Natural cancer fighters

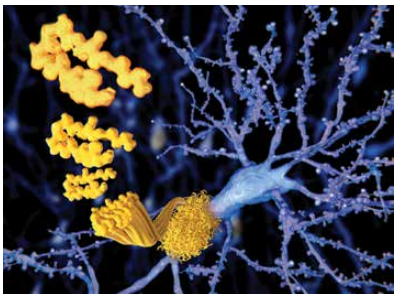
Natural killer cells fight cancer: they play a critical role in controlling tumour growth and metastasis. To do this they have to break through a tissue barrier, known as the extracellular matrix.

PhD student Alyce Mayfosh and Dr Mark Hulett, together with colleagues from LIMS and QIMR Berghofer Medical Research Institute, have discovered that heparanase, an enzyme that degrades the extracellular matrix, is critical to this process. Their findings, published in the *Journal of Clinical Investigation*, may help scientists to identify new ways to activate the immune system to fight cancer.



Enhancing optical systems

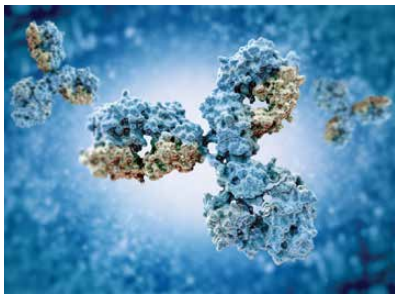
In the future, our means of communication and data storage will be governed by optical systems. Dr Shanshan Kou, together with collaborators from the University of Melbourne, RMIT and Nanyang Technological University (Singapore), is working on this cutting-edge technology, developing an ultra-thin film that enables the coding of light at the nanoscale. Their findings, published in *Nature Communications*, will applications in optical storage, data transfer and bio-sensing, and pave the way toward commercialisation of optical communications technology.



Developing drug discovery tools

The conversion of soluble proteins into amyloid fibril deposits has been recognised as a hallmark for many neurodegenerative diseases including Parkinson's disease. Dr Yuning Hong, together with collaborators from The Australian National University and University of Wollongong, has developed a small chemical probe that allows scientists to follow the conversion process and study effects of potential inhibitors for amyloid fibrillation. Their findings, published in *Analytical Chemistry*, may lead to new drug discovery and diagnostics for neurodegenerative diseases.

LIMS CONDUCTS HIGH QUALITY RESEARCH AT THE INTERFACE OF HEALTH AND SCIENCE. OUR RESEARCHERS PUBLISH IN HIGH IMPACT JOURNALS INCLUDING *NATURE, SCIENCE, CELL* AND *NATURE COMMUNICATIONS*.



New generation diagnostics

Antibodies fight infection. Their presence in our blood has allowed scientists to develop diagnostic tests for viruses like HIV and hepatitis. The orientation of the antibodies in the sample, however, is critical to the accuracy of the test. PhD student Nicholas Welch and Dr Paul Pigram, together with collaborators from CSIRO, have developed a surface that improves antibody orientation and enhances the sensitivity of disease detection in blood tests. Their findings, published in *Biointerphases*, may lead to a new generation of diagnostics.

Exercise recovery

When muscles are activated, they shorten and lengthen to generate force. It's the lengthening part that causes muscle damage. Using world-first techniques developed at La Trobe, PhD student Stefan Wette, Professor Graham Lamb and Dr Robyn Murphy discovered that a key muscle protein thought to relocate during stretch is free to move around the cell. Their findings, published in the *American Journal of Physiology – Cell Physiology*, will be used to examine the role of this protein during recovery after damaging exercise.

Malaria mechanics

In 2015, over 210 million people contracted malaria, a mosquito-borne disease characterised by fever and chills. The actin protein – a molecule that sits inside the cell and allows it to move – plays a key role in the process of infection. Professor Brian Smith and PhD student Swapna Johnson are part of an international team that have developed a compound that inhibits actin motility in a closely related parasite. Their findings, published in the *Journal of Medicinal Chemistry*, may lead to new treatments for the disease.

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 NOVEL 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

Senior Research Fellow and Victorian Cancer Agency Fellow

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

Christopher Bradley

Lecturer

Cancer chemotherapy

Explores the ways in which tumours repair their DNA and resist cell death. Identifies targets for small molecules to sensitise tumour cells to the effects of radiation and cytotoxic drugs, to minimise side effects and impact on normal tissues and organs.

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 (an anthracycline) and mitoxantrone (an anthracenedione). 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

Bruce Stone Fellow in Chemical Biology

Extracellular vesicles, exosomes, cancer biology and uterine biology

Uses an integrated system biology approach to understand how cellular fragments called vesicles (exosomes), as well as secreted molecules (the secretome) in the extracellular environment influence cancer progression and uterine biology.

Adam Hart

Lecturer

Molecular regulation of stem cells and cancer

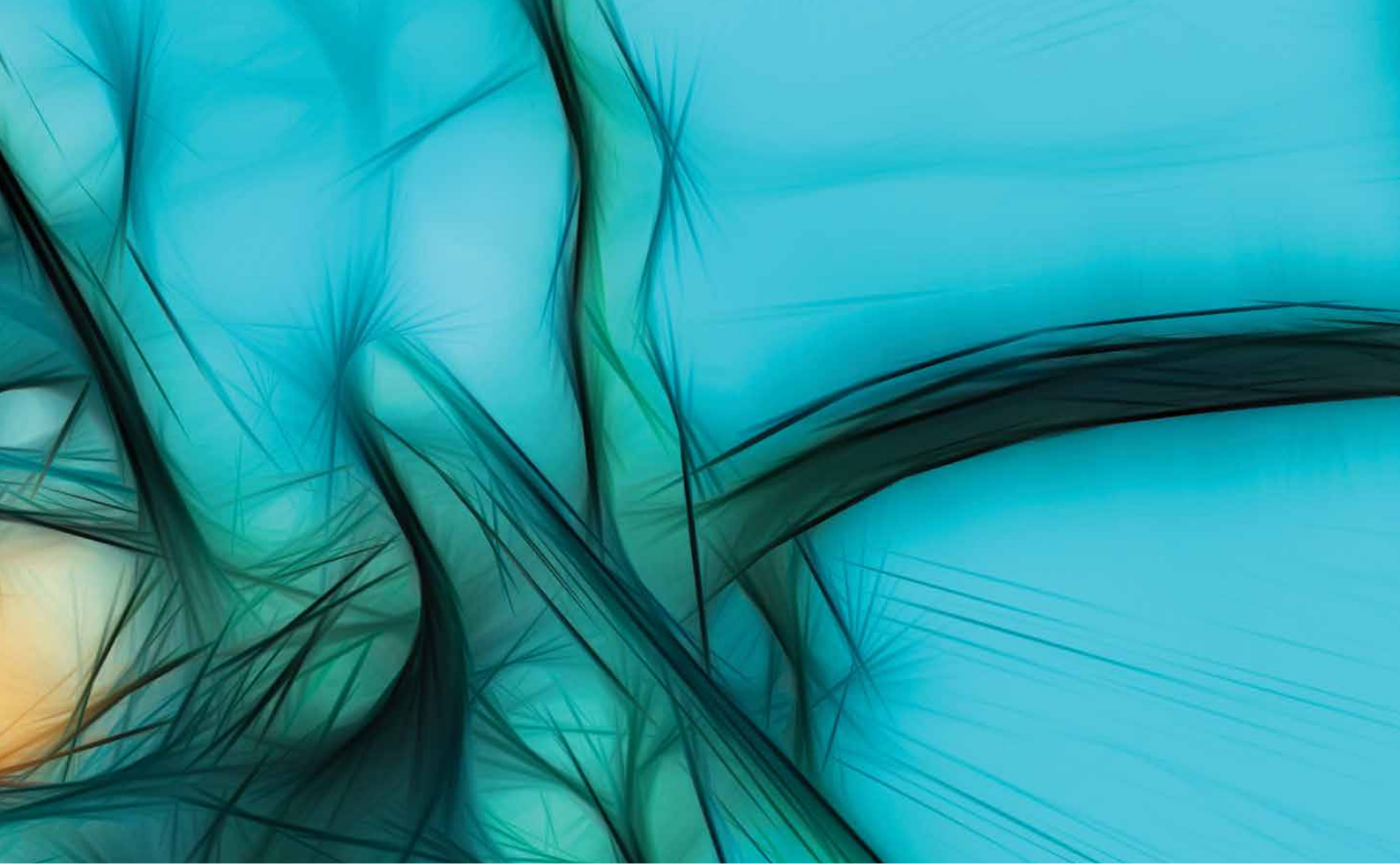
Studies the key genes and molecular pathways that regulate stem cells during normal growth and development. Works to identify how these genes are re-activated in the adult to cause cancer. Focuses on breast cancer, myeloid leukaemia and germ cell cancers.

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
ARC DECRA Fellow
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 on cell signalling and cancer development. Identifies novel pathways that cooperate with the Ras oncogene in cancer.

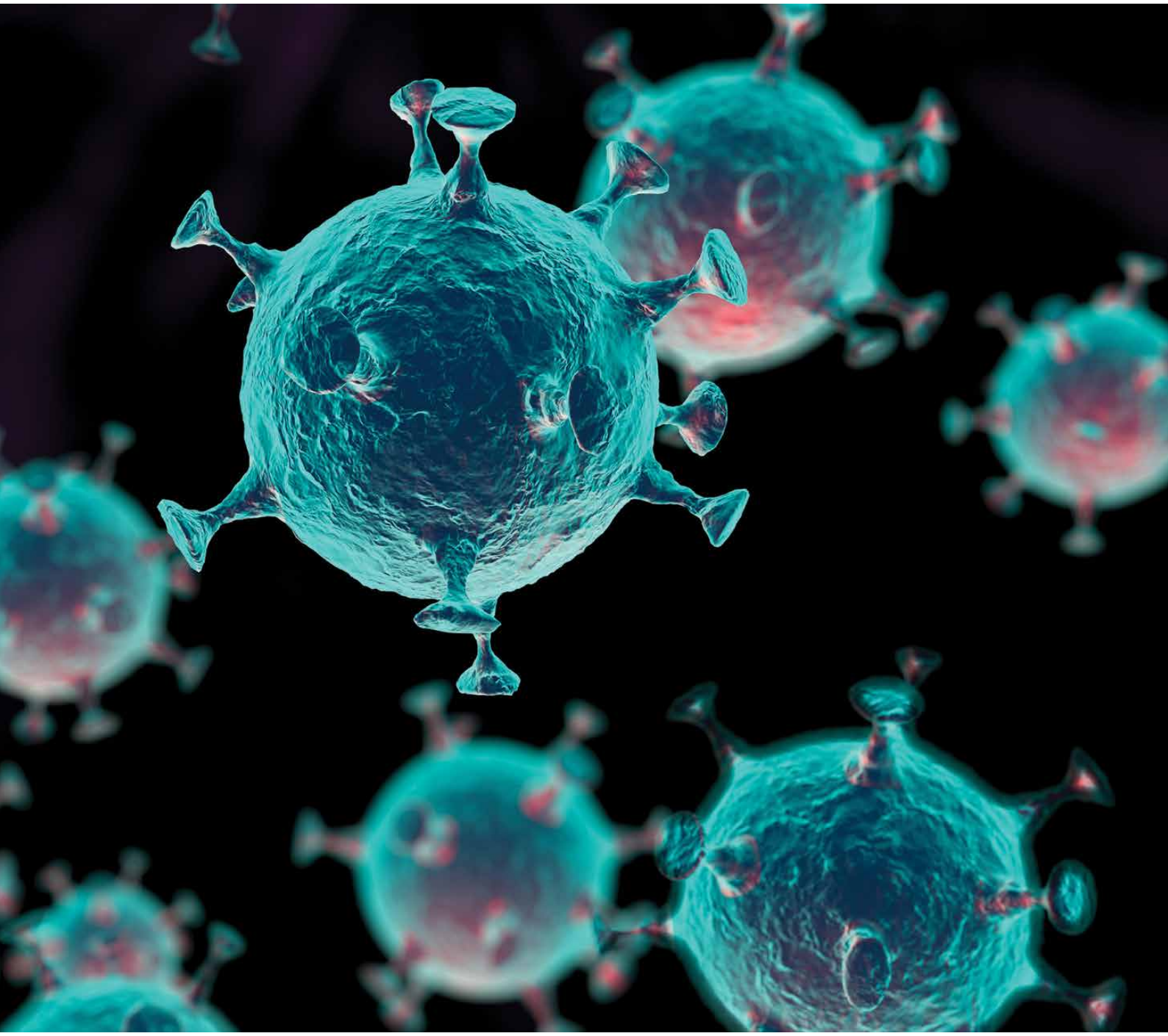
Richard Simpson
Professor
Extracellular vesicles, exosomes and cancer biology

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.

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
ARC Future Fellow
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 protection of humans and crops from pathogens by studying 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 shark antibodies and a library of the human version of these antibodies to identify molecules that will bind to proteins that have been shown to be involved in human diseases including HIV, pulmonary fibrosis and Alzheimer's disease.

Helen Irving
Professor
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 and cell biology and protein chemistry supplemented by bioinformatics and systems approaches.

Ivan Poon
NHMRC Career Development Fellow, Nicholas Hoogenraad Fellow in Molecular Sciences
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 lymphocytes during polymicrobial sepsis leading to lymphopenia, and the death of heart muscle cells leading to cardiomyopathy and heart failure.

Tatiana Soares da Costa
NHMRC Research Fellow
Drug discovery, enzymology, allosteric regulation and bacteriology

Uses a combination of biochemical, biophysical and structural techniques to probe the structure-function relationship of essential bacterial and plant enzyme targets, to provide insight into the design of novel antibiotics and herbicides.

Joseph Tucci
Associate Professor
Bacteriophage as alternatives to antibiotics, pharmacogenomics and pharmacy practice

Studies the use of bacteriophage (viruses that specifically attack bacteria) as an alternative to antibiotics. Examines the personalisation of medicine to fit a patient's genetic profile, and patient management of medication in the treatment of chronic diseases.

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 muscles at both the hip and shoulder 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

Head of Biochemistry and Genetics, Associate Professor

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 protein abundance as a result of exercise, disease and ageing can affect the ability of muscle to produce force and confer strength and stability.

Members

Andrew Hill

Director of LIMS, Professor

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 for reducing obesity.

Jacqueline Orian

Senior Research Fellow

Neurodegenerative diseases

Identifies potential therapeutic targets for Multiple Sclerosis (MS) which are specific to the brain and to the disease, by following changes on the surface of the brain vasculature and surrounding tissue. Uses experimental autoimmune encephalomyelitis to generate proof-of-concept for pathological and molecular mechanisms to evaluate MS drugs.

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

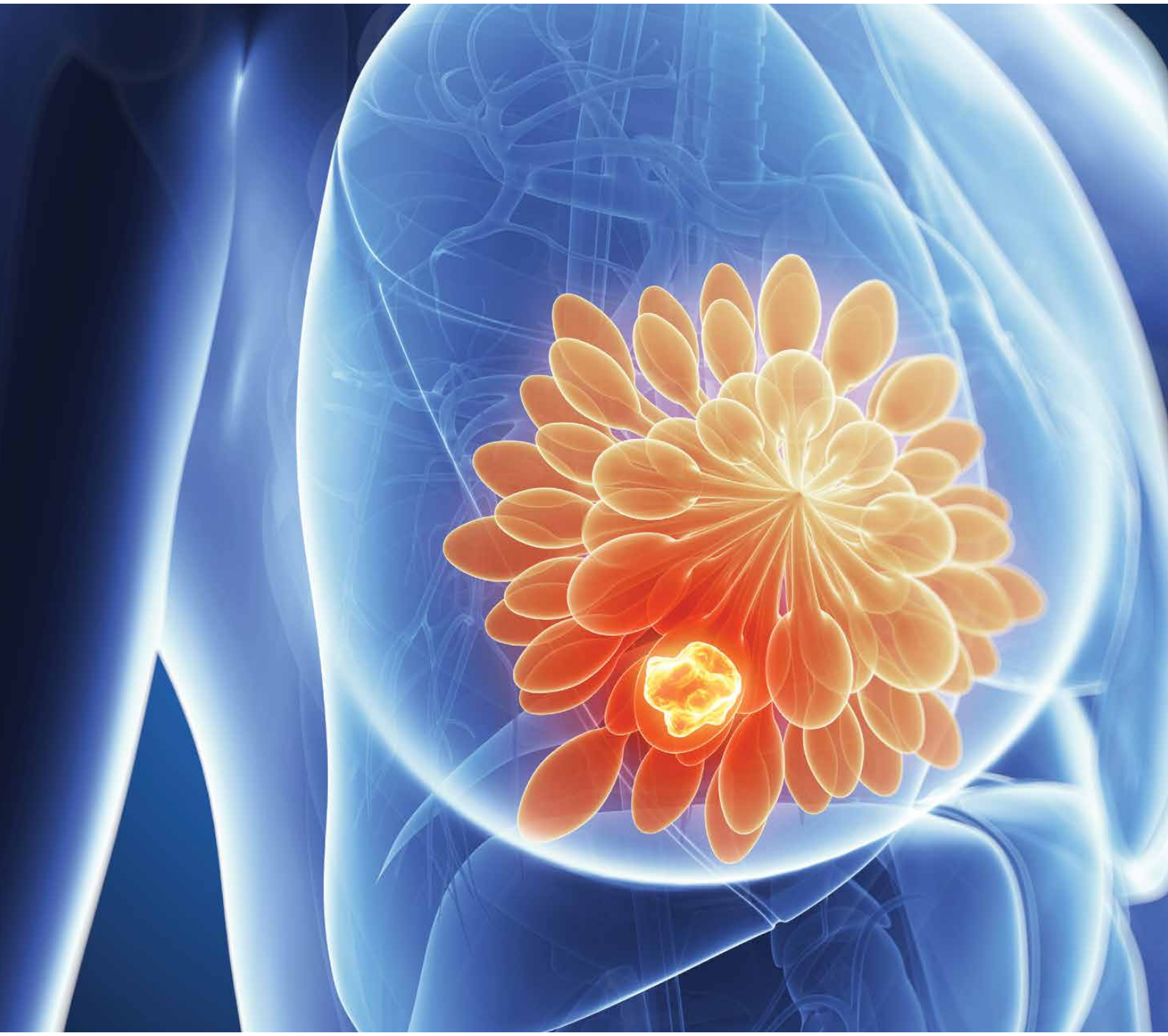
Lecturer

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.

STOPPING
CANCER SPREAD

LIMS DISCOVERY COULD SPARE WOMEN UNNECESSARY TREATMENT.



Approximately 25 per cent of Australian breast cancer patients are diagnosed with 'ductal carcinoma in *situ*' (DCIS). This type of breast cancer starts in the breast duct, where it is surrounded by myoepithelial cells, which act as a barrier.

However, seven per cent of DCIS cancers will break through the myoepithelial cells and spread.

Dr Belinda Parker and Dr Hendrika Duivenvoorden, in collaboration with Professor Sandra O'Toole at the Garvan Institute, have discovered that the composition of myoepithelial cells may be a critical determining factor in breast cancer progression.

Dr Parker's research team have identified a cancer suppressor protein, known as stefin A, that enhances the ability of the myoepithelial cells to act as a barrier, essentially trapping the disease in the breast duct.

"Myoepithelial cells are the barrier that breast cancer cells encounter before they spread through the breast tissue and enter the blood stream," Dr Duivenvoorden said. "When this happens, the risk of a cancer spreading to other parts of the body is increased."

Dr Belinda Parker said results from laboratory tests have been promising. "By modelling early stage breast cancer in the laboratory using tissues donated from patients, we have identified a key function of this protein in blocking the invasive behaviour of cancer cells," Dr Parker said.

She said the discovery could help specialists predict which DCIS patients are likely to develop invasive cancer, allowing them to provide individualised care.

"Without a way to identify those cases that will spread beyond the breast duct, surgery and radiotherapy is currently the predominant treatment option," Dr Parker said. "Women experience fear and uncertainty when they are diagnosed with breast cancer. Being able to determine the likelihood of cancer spread in DCIS will help specialists and patients make more informed decisions about treatment."

Professor O'Toole commented: "Now that we understand more about the biology of DCIS and how it progresses to an invasive cancer, we can work on developing better diagnostic tests and a more personalised approach to treatment."

Published in *The Journal of Pathology*, the research was funded by the National Health and Medical Research Council, Cancer Council Victoria, the National Breast Cancer Foundation and the Sydney Breast Cancer Foundation.

POPULAR WORKOUT BENEFITS AGEING MUSCLES

AN EXERCISE PROGRAM POPULAR AMONG FITNESS FANATICS CAN OPTIMISE AGEING MUSCLES IN SENIORS.

Dr Robyn Murphy is part of a research team that analysed the impact of high intensity training on the muscle health of a group of people aged 68 to 76.

Participants completed a Victoria University-designed program that involved training three times a week for 12 weeks. At each session, they completed four bouts of four-minute high intensity training on an exercise bike, with four minutes of rest in between each bout.

At the end of the 12 weeks, the research team used muscle fibres obtained from biopsied tissue from each participant to investigate their mitochondria – the powerhouse of cells responsible for producing energy. They then compared the results from the older group to those from a group of men and women in their 20s who were involved in a similar study.

"Our study found the mitochondria in the muscles of older people increased at the same rate as reported in young people, by around 40 per cent, after 12 weeks of high intensity training," Dr Murphy said. "Mitochondria become less efficient as people age. By increasing the amount of mitochondria in the cells of our muscles, our bodies are better able to use oxygen and that improves fitness."

"Our study also found that after 12 weeks, two key proteins in the older people were lowered to the same levels as the younger group. These proteins may have increased to keep the mitochondria healthy in the older people. We suspect high intensity training not only increases mitochondria, but also results in healthier mitochondria."

"Our findings prove that older people are able to adapt to high intensity training and achieve comparable health benefits to people who are up to 50 years younger than them."

La Trobe Honorary Visiting Fellow Dr Victoria Wyckelsma and collaborators from Victoria University and Monash University were also involved in the research published in the *Journal of Physiology*.

TURNING PHONES INTO **POCKET-SIZED LABS**

LIMS RESEARCHERS HAVE DISCOVERED A WAY TO TURN A MOBILE PHONE INTO A PORTABLE, POCKET-SIZED LABORATORY THAT COULD BE USED FOR ON-THE-SPOT DISEASE DETECTION.

The breakthrough technology would benefit patients in remote areas and in the developing world and may even lead to patients conducting their own home diagnostic tests in the future.

Lead researcher Dr Conor Hogan said his team had found a way to exploit existing features of mobile phones to make chemical measurements using cheap disposable paper-based test strips.

"With this method there is no need for any other instrumentation whatsoever and the results are obtained directly by the phone using a software app," Dr Hogan said. "This significantly reduces the cost of chemical measurements and could make important diagnostic or environmental testing available to millions more people around the world."

Dr Hogan said his team had used a mobile phone's camera and audio functions to obtain chemical measurements. "We attach wires from the audio jack of a phone to the paper-based test strip, which has a built-in sensor, and then place whatever sample we want to test onto the test strip," Dr Hogan explained.

"We then apply a controlled voltage signal from the phone's audio output to generate light that is detected by the camera on the phone. The sensor uses the electricity to trigger a luminescent chemical reaction – a process known as electrochemiluminescence – and that allows us to detect low concentrations of molecules of interest. Ultimately, this will include disease markers. The technology could eventually be used for early detection of diseases such as sepsis."

In a further extension of mobile phone-based biosensing technology, Dr Hogan has collaborated with La Trobe electronic engineer Darrell Elton to demonstrate that the part of a mobile phone designed to measure sound via a microphone can be used for electrochemical measurements. They have called this method "android voltammetry."

"This is particularly exciting because it opens up the possibility of a wide variety of tests, currently performed in a lab using expensive electrochemical equipment, being done using only a phone and a disposable test strip."

"We can test any liquid using our paper sensors – be it blood, urine or water. We have already used them to detect minute quantities of toxic metals. In the future, this will be a great tool to detect harmful chemicals in drinking water and assess the health of waterways."

The team is now collaborating with other groups at La Trobe and other universities to expand the technology to include more diagnostic tests. They are also working to make the software app more user friendly.

"At the moment measuring molecules, whether for water quality assessment or detecting diseases, is a job done by people in white coats. How great would it be if we could take the testing out of the laboratory and put it into the hands of doctors, nurses, patients or farmers?"


MEDICA

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 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 as PNA-PK, PI3K PDE3 inhibitors for treatment of cancer

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
ARC Future Fellow, Associate Professor

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 structure, bonding and reactivity for a variety of elements.

Yuning Hong
Bruce Stone Fellow in Chemical Biology, 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 self-assembly in lipid membranes, peptide fibrillogenesis and peptide-membrane interactions. Applies these design rules in the development of biomimetic membrane platforms, novel peptide antibiotics and peptide-based metamaterials.

John Moses
Professor

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, School of Molecular Sciences

Modelling molecular interactions

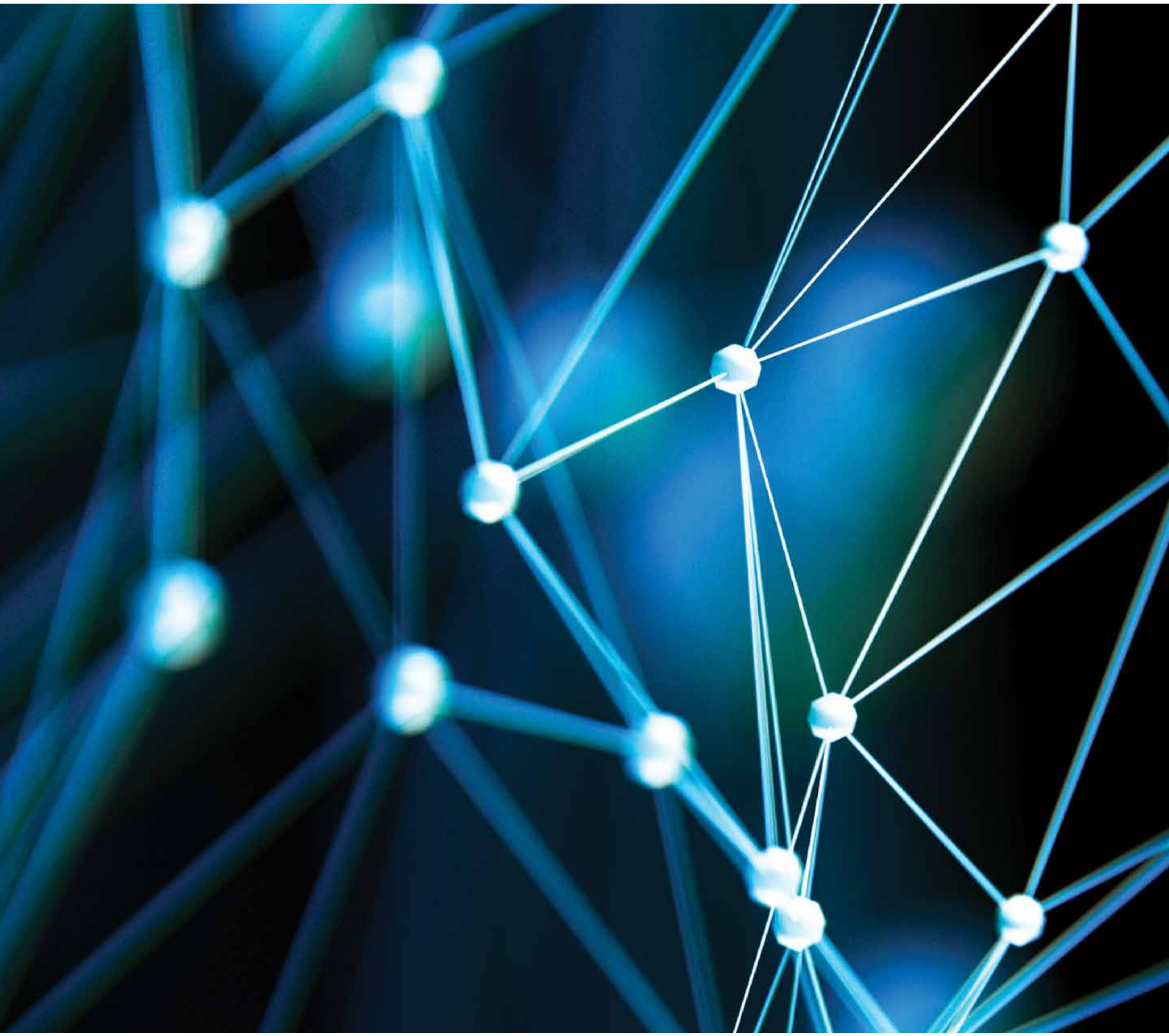
Uses quantum-mechanical methods to understand enzyme mechanism, molecular mechanical methods to explore the dynamics of proteins, and a variety of tools to predict how molecules interact. Uses X-ray crystallography to determine the structures of complexes of proteins, polypeptides and small molecules.

David Wilson
Senior Lecturer

Computational chemistry and quantum chemistry

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

MOLECULAR **IMAGING**



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

Group Leaders

Brian Abbey

ARC Future Fellow, Associate Professor

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

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

Mark Hinds

Associate Professor

Protein structure and interactions

Determines structure and interactions of biomolecules in solution using nuclear magnetic resonance spectroscopy. Investigates structure, function and interactions of viral proteins regulating apoptosis with their host cell targets. Studies biomolecular interactions using biophysical and biochemical techniques.

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

ARC Future Fellow, 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

Senior Lecturer

Metallobiology

Studies the mechanisms by which trace metals are regulated within biological systems. This regulation relies on proteins that fulfill 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.

Group Leader

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

Head of Pharmacy and Applied Science, Associate Professor

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

Head of Chemistry and Physics, Senior Lecturer

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 nanometre 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

ARC Future Fellow, Lecturer

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 2017
AdAlta Ltd	**668,356.71**
Development of human single domain antibodies for use in inflammation and fibrosis (Michael Foley)	615,856.71
Screening of AdAlta's proprietary i-body library on a fibrosis related GPCR target (Christopher Hosking)	52,500.00
Australian Research Council Centre of Excellence	855,000.00
ARC Centre of Excellence in Advanced Molecular Imaging (Administered by Monash University – Brian Abbey)	855,000.00
Australian Research Council	**3,240,025.77**
ARC Training Centre for Portable and Affordable Analytical Technology: Enabling Personal Measurement Through Separation Science (Conor Hogan)	34,000.00
Atomic scale imaging with high coherence electrons and ions (Administered by The University of Melbourne – Keith Nugent)	79,200.00
Cell wall structure and dynamics in emerging fungal pathogens of crops (Administered by the University of Adelaide – Marilyn Anderson)	135,788.50
Complex II proteostasis in mammalian mitochondria (Kaye Truscott and David Dougan)	117,683.21
Control of cell competition by cell shape regulators in tissue development (Helena Richardson)	162,580.16
Crosstalk between breast cancer cells and the microenvironment to promote metastasis (Belinda Parker)	102,155.23
Crosstalk between cell survival and cell death pathways (Erinna Lee)	183,821.90
Determining the mechanism and function of dying cell assembly (Ivan Poon)	134,709.27
Developing next generation click chemistry (John Moses)	119,262.50
Discovering new organic chemistry using an inorganic touch (Jason Dutton)	308,148.72
Electrochemically-sensitized luminescence: a new bio-detection paradigm (Conor Hogan)	161,180.59
Enabling diamond nanoelectronics with transition metal oxide induced surface doping (Dongchen Qi)	251,143.06
Extending X-ray crystallography to allow structure retrieval from highly disordered crystals and nanocrystals (Brian Abbey)	93,012.46
How bacteria fold virulence factors to cause disease (Begoña Heras)	101,085.72
Molecular basis of synergy between proteinase inhibitors and plant and animal defensins against fungal pathogens (Marilyn Anderson)	156,560.70
Molecular reporters for measuring proteostasis capacity in cells (Yuning Hong)	127,999.62
Multi-colour electrogenerated chemiluminescence (Administered by Deakin University – Conor Hogan)	34,045.00
Planetary nitrile chemistry: synchrotron and laboratory spectroscopic investigations (Courtney Ennis)	105,074.30
Structural studies of host-pathogen interactions (Marc Kvansakul)	100,471.95
Surface doping of diamond: A new platform for 2D carbon-based spintronics (Christopher Pakes)	94,566.87
The LINK to regulating lysine levels in wheat (Matthew Perugini)	126,089.16
The molecular mechanisms of dual nucleic acid specificities of SFPQ (Mihwa Lee)	127,139.90
Understanding how protein and RNA cargo are sorted into exosomes (Andrew Hill)	132,128.64
Understanding the role of exosomes in intercellular communication (Suresh Mathivanan)	131,342.87
Unravelling mechanisms of aggregation and biofilm formation critical for bacterial antibiotic resistance (Begoña Heras)	120,835.44
Hexima Ltd	**2,942,828.32**
Antifungal activity implant defensins; discovery of novel insecticidal proteins; interaction between matriptase and proteinase inhibitors (Marilyn Anderson)	2,942,828.32

EXTERNAL **FUNDING**

Project	Total 2017
National Health and Medical Research Council	**2,630,607.54**
Broad spectrum inhibition of an enzyme antibiotic target (Tatiana Soares da Costa)	80,738.42
Cancer cachexia therapeutics (Nick Hoogenraad)	335,471.76
Cellular and molecular characterization of erythroid enucleation (Patrick Humbert)	242,294.39
Characterising the tumour suppressive function of myoepithelial stein A in ductal carcinoma in situ (Belinda Parker)	157,116.06
Deciphering the role of Scribble in development and disease (Patrick Humbert and Marc Kvansakul)	247,606.56
Developing a new treatment method to prevent lymphopenia associated with sepsis (Hamsa Puthalakath)	140,432.65
Disorderly conduct and disturbing the peace: How loss of cell polarity and tissue architecture drives cancer progression (Patrick Humbert)	128,042.19
DsbA inhibitors: From hits to leads (Administered by the University of Queensland – Begoña Heras)	115,000.00
Elucidating the mechanism and function of cell disassembly during apoptosis (Ivan Poon)	107,749.67
Function and molecular mechanism of histidine-rich glycoprotein in necrotic cell and pathogen clearance (Mark Hulett)	176,017.85
Limiting the impact of Influenza (Administered by The University of Melbourne – Weisan Chen)	358,057.80
Mechanism of anoxic iron acquisition in pathogenic bacteria (Administered by the University of Sydney – Megan Maher)	27,967.00
The molecular basis for manganese uptake by pathogenic bacteria (Megan Maher)	213,923.17
Type I interferon regulators as prognostic markers and predictors of therapeutic response in triple negative breast cancer (Belinda Parker)	96,378.00
Complement inhibitors for treatment of chronic inflammatory disease (Robert Pike)	203,812.02
Victorian Cancer Agency	**800,000.00**
Understanding the biological basis of cancer cachexia (Nick Hoogenraad)	720,000.00
Understanding the molecular mechanisms regulating chemotherapeutic drug resistance (Lahiru Gangoda)	80,000.00
Other	**2,751,603.34**
A holistic understanding of cellular trace nutrient homeostasis (Megan Maher)	25,000.00
Australian Synchrotron Secondment (Marc Kvansakul)	25,000.00
A new peptide ligase for protein engineering application (Marilyn Anderson)	50,000.00
Characterisation of pineapple cysteine proteases with therapeutic potential (Lakshmi Wijeyewickrema)	189,979.50
Clive and Vera Ramaciotti Facility for Producing Pharmaceuticals in Plants (Marilyn Anderson)	177,000.00
Connecting ANFF nodes through data (Paul Pigram)	20,000.00
Control of medically important *candidemias* and *candida* based biofilms (Marilyn Anderson)	176,728.00
Data management and resource repository for the exRNA Atlas (Suresh Mathivanan)	99,443.25
Detecting brain specific exosomal miRNA for the diagnosis of Alzheimer's disease (Andrew Hill)	6,057.00
Developing immune markers that predict therapeutic benefit in patients with aggressive types of breast cancer (Belinda Parker)	150,000.00
Development of a liposomal formulation of cefditoren pivoxil (Suzanne Cutts)	1,740.00
Differentiating B-cell depleting strategies during CNS autoimmunity in rodents (Jacqueline Orian)	152,576.84
DNA damage and neurodegeneration in ALS/MND (Administered by Macquarie University – Suzanne Cutts)	93,088.29
Exosomal miRNA profiling in prion disease (Andrew Hill)	51,750.00
Exploring better and safer treatments for osteosarcoma (Christine Hawkins)	191,356.00

Project	Total 2017
F. *graminearum* cell wall (GRDC PhD scholarship for Linda Brain) (Marilyn Anderson)	12,382.00
Far and mid-infrared spectroscopy of astrochemical species and aerosols (Courtney Ennis)	7,500.00
Harnessing the power of exosomes to understand motor neuron disease (Andrew Hill)	99,825.00
i-bodies as biomarkers for Idiopathic Pulmonary Fibrosis (Michael Foley)	75,000.00
Identification of breast cancer subtype-specific tumour antigens with lymph node antibodies using the local immune response (Suresh Mathivanan)	60,000.00
Identification of tumor antigens useful in the detection of ovarian cancer markers within the blood (Suresh Mathivanan)	58,095.00
Investigation of the active components of bromelain (Robert Pike)	35,101.25
Investigation of the structure, composition, coatings and treatments of various glass wool insulation products and associated research and development activities currently manufactured products (Paul Pigram)	110,000.00
Joint La Trobe Australian Synchrotron Fellowship (Brian Abbey)	76,500.00
Keeping the seeds of metastasis grounded: Understanding how stem cell regulator and asymmetric cell division gene GPSM2 controls breast cancer stem cells and metastatic spread (Patrick Humbert)	100,000.00
Longitudinal study of serum exosomal miRNA expression in Alzheimer's disease (Lesley Cheng)	98,408.00
Micrometre scale imaging of residual elastic strain fields in whole components via strain tomography (Brian Abbey)	5,625.00
Personalised medicine for HIV infection in PNG is achievable (Joseph Tucci)	42,500.00
Pharmacogenetic targeting of polarity-impaired Ras-driven breast cancer (Helena Richardson)	104,855.29
Preclinical testing of TLR agonists in triple negative breast cancer models: Critical timing, targets and combination strategies (Belinda Parker)	72,802.95
Regulation of cell polarity and tumourigenesis by Tetraspanin 6 (Helena Richardson)	99,999.98
Research Services for X-ray Vision Australia Pty Ltd (Paul Pigram)	875.00
Research Services for CSL Ltd (Paul Pigram)	3,300.00
Research Services for ExcelPlas Pty Ltd (Paul Pigram)	1,200.00
Research Services for G. James Glass and Aluminium (Paul Pigram)	2,450.00
Research Services for Glassy Act Pty Ltd (Paul Pigram)	9,000.00
Research Services for Pfizer Australia (Paul Pigram)	2,400.00
Research Services for XPS Analysis of Na Compounds – RSA533 (Paul Pigram)	210.00
Research Services for Amcor – RSA528 (Paul Pigram)	7,200.00
Research Services – Robert Bosch Australia - RSA518 (Paul Pigram)	820.00
Structural characterisation of integral membrane metal transporters, metal homeostasis proteins and protein-protein complexes (Megan Maher)	6,000.00
Telomere dysfunction in ALS/MND (Administered by Macquarie University – Suzanne Cutts)	69,834.99
Testing the efficacy and safety of SM-164 for osteosarcoma treatment (Christine Hawkins)	25,000.00
The efficacy and feasibility of a targeted gluteal exercise program to improve hip function and increase activity levels in people with hip osteoarthritis (Rodney Green)	30,000.00
ToF-SIMS Nanocharacterisation Activity Hub – ANFFL EIF Victorian Node Project (Paul Pigram)	125,000.00
Total	**13,888,421.68**

PUBLICATIONS

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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 of our campuses.

The wedge-tailed eagle (*Aquila audax*) is one of the world's largest.

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.

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DC35057 09/18