



VICTORIA PRIZE FOR SCIENCE & INNOVATION

VICTORIA FELLOWSHIPS

—
2020

VICTORIA
State
Government



MESSAGE FROM THE MINISTER

VICTORIA HAS ALWAYS BEEN AUSTRALIA'S HOME OF INNOVATION

Our international reputation in scientific research, engineering, life sciences and medical technologies is a testament to the world-class talent that Victoria's universities and research institutions produce.

Victoria needs more people like you. People that will inquire, test and develop the treatments and technologies of the future, ensuring our state is ready to rise to meet whatever challenges the future may bring.

As 2020 has shown us, Victoria's innovation ecosystem is vital to our collective resilience during a crisis.

It is through the efforts of our world-leading medical researchers, our top-quality clinical trial capabilities, the agility of our advanced manufacturing sector and our enterprising engineers that Victoria has both prevailed and played a leading role in the global fight against coronavirus (COVID-19).

The Victorian Government is proud to have partnered with **veski** since 2013 to deliver the Victoria Prize for Science and Innovation and the Victoria Fellowships, supporting outstanding scientists and their contributions to the global community.

By supporting research and researchers at key stages of the process, we're building a future where our state will be equipped to provide global solutions – from their inception to their commercial reality – growing Victoria's international competitiveness.

Victoria's scientists and researchers have always been the driving force behind innovation in our industries, with a strong culture of collaboration both locally and internationally.

Innovation boosts the global competitiveness of our local companies and attracts the world's leading brands to invest in Victoria, creating more local jobs. This will be key to our economic resilience, as Victoria emerges from coronavirus-related restrictions and starts its journey to recovery.

Through careful support, the innovation ecosystem we nurture will play a critical role in the state's future, paving the way for new opportunities for research organisations and industry, both throughout Australia and across the globe.

Congratulations to this year's Victoria Prize and Fellowship recipients. Thank you for your unwavering dedication to your work and to improving lives around the world.



The Hon. Jaala Pulford MP
Minister for Innovation, Medical
Research and the Digital Economy



VICTORIA PRIZE FOR SCIENCE & INNOVATION

Life Sciences

Professor Kay Crossley

La Trobe University



Professor Kay Crossley has been awarded the Victoria Prize for Science and Innovation in 2020 in the life sciences in recognition of her research focused on young people with early-onset osteoarthritis as well as her success in demonstrating the effectiveness of exercise in managing hip and knee pain.

After getting her start in sports medicine at Olympic Park Sports Medicine Centre, and supporting athletes at the Sydney Olympics in 2000, Professor Crossley continues to deliver world-leading research from the laboratory into clinical practice. Her multidisciplinary research team has delivered a highly technical program of research examining the identification of individuals at risk of developing osteoarthritis through cutting edge imaging and biomechanics analyses, and used these findings to develop innovative, clinically relevant exercise interventions.

Knee, hip pain and osteoarthritis affect one in four people, who also tend to suffer other health conditions, including cardiovascular disease, diabetes and mental health disorders, costing Australia more than \$24 billion annually. Traditionally, patients with these conditions are referred for expensive imaging, injections and orthopaedic surgeries. These interventions are not only costly, but carry inherent risks, and do not address the multitude of associated health conditions.

Professor Crossley oversees a program of knowledge translation and clinical education, training more than 1000 clinicians every year in the delivery of effective exercise programs. Her unique exercise interventions have the potential to save millions of dollars through avoidance of unnecessary, risky and expensive interventions.

As the inaugural Director of the La Trobe Sport and Exercise Medicine Research Centre, Professor Crossley leads, mentors and supports colleagues all over the world to achieve their goals. In particular, she supports women to achieve leadership roles. Over four years, she has led her research centre to produce over 200 research papers and attracts more than \$3 million in grants per year. The centre is now regarded as one of the leading institutions of its kind in the world and attracts exceptional researchers, which in turn draws top quality post-graduate students.

Professor Crossley provided the opening keynote address at the renowned International Congress of Sports Physiotherapy in 2019. She is the editor of the British Journal of Sports Medicine, the highest ranked journal in its field, and has over 280 publications in refereed journals including JAMA and BMJ. She has won numerous national and international awards for her research.

VICTORIA PRIZE FOR SCIENCE & INNOVATION

Physical Sciences

Distinguished Professor Yi-Min (Mike) Xie AM

RMIT University

Professor Yi Min 'Mike' Xie has been awarded the Victoria Prize for Science and Innovation in 2020 in the physical sciences in recognition of his global contributions in developing the Evolutionary Structural Optimisation (ESO) and Bi-directional ESO (BESO) technology, used by thousands of engineers and architects around the world to design novel structures including several landmark buildings.

The original ESO technique, first proposed by Professor Xie and Professor Grant Steven in 1992, was based on the simple concept of gradually removing inefficient material from a structure so that the resulting shape would evolve towards the optimum. A more robust technique known as BESO, developed by Professor Xie's team more recently, allows material to be removed and added simultaneously by redistributing the under-utilised material to the most needed locations.

Among many other applications, ESO/BESO can be used to generate strikingly elegant designs of buildings and bridges and to significantly reduce the weight and the associated energy consumption of motor vehicles and aircraft.

Major international companies, including Arup and Boeing, have collaborated with Professor Xie to design lightweight and high-performance structural components using ESO/BESO. Professor Xie has also extended ESO/BESO to the design of novel cellular materials and composites. By integrating the ESO/BESO technique with the latest technologies in additive manufacturing, Professor Xie's team has designed and fabricated a variety of materials with exceptional or unusual properties. Such materials are of critical importance to the development of impact-resistant body armour for soldiers and advanced biomedical devices for patients.

Collaborating with leading architects in several countries, Professor Xie has focused his current research on further developing the ESO/BESO technique into a powerful digital design platform for the creation of next generation free-form architecture. New buildings and bridges designed using such a digital platform will be structurally efficient, aesthetically pleasing, and conceptually different from existing forms. This will enable architects and engineers to work together towards a high-quality and sustainable built environment of the future.

Professor Xie was appointed a Member of the Order of Australia (AM) in 2019 for his significant service to higher education and civil engineering. He has been recognised by the Australian Research Council with an Australian Laureate Fellowship (2019 – 2024).



VICTORIA FELLOWSHIPS

Life Sciences



Dr Jody Gerdts

Bee Scientifics Pty Ltd

Varroa mites are the largest cause of honey bee colony losses globally impacting both pollination services and honey production. While Australia's apicultural industry remains free of these devastating mites, & considerable resources are dedicated to early detection & eradication, the threat of Varroa becoming established in Australia remains.

Dr Gerdts proposes to commence research studies in the Netherlands at Arista Bee Research Foundation working with BartJan Fernhout, who has been instrumental in the current investigation importing biosecure germplasm into Australia.

Dr Gerdts will also visit world-leading seed company, Bejo Bejo, to explore their interest in importing germplasm from their breeding programs into Australia to increase pollination specific phenotypes essential for successful crop pollination. Pollination specific phenotypes would be of great benefit to the almond industry, with 53 per cent of its production coming from Victoria.



Dr Caitlin Jenvey

La Trobe University

Standard practice is to treat worm infected sheep with drugs, but control is threatened by the evolution of drug-resistant worms. Therefore, easy, affordable, practical, non-chemical control methods need to be developed for use by Australian livestock producers.

Dr Jenvey has developed a novel laboratory-based test to identify worm-resistant sheep. These point-of-care (POC) tests are miniaturised versions of laboratory-based tests. They are stable under a variety of conditions, have a quick turn-around, are user-friendly, can be performed on farm, and are cost-effective.

Dr Jenvey will visit Dr Valentina Busin, and her colleagues, at the University of Glasgow where she will learn how to transfer an existing laboratory-based test into a POC test. This will then be used to develop a multiplex POC test for the detection of worm-resistant sheep on Victorian sheep farms.

VICTORIA FELLOWSHIPS

Life Sciences



Dr Denver Linklater

RMIT University

Through a comprehensive range of in vitro and in vivo tests, Dr Linklater is focused on finding new materials which can be implanted during surgery and reduce the risk of bacterial infection. The aim is to determine the suitability of nanostructured bactericidal materials as implantable biomaterials and produce implantable materials that resist bacterial infection and reduce the risk of post-operative complications, resulting in vastly improved patient recovery rates and quality-of-life.

Dr Linklater will collaborate with Professor Boris Chichkov at Leibniz University as well as the Institute for Advanced Biosciences in France and the Implant Research and Development (NIFE), Germany.

This research aims to decrease the current overuse of antibiotics as well as promote research and development into new products that will prevent, detect and contain antimicrobial resistance, reducing the burden on the Victorian health system.



Dr Jennifer Perret

The University of Melbourne

Chronic obstructive pulmonary disease (COPD) is a non-reversible airway obstruction associated with shortness of breath, disability and premature death. It is the leading cause of preventable hospitalisation in Australia and is commonly diagnosed in older adults, in its advanced stages, when treatments are ineffective.

Using machine learning technology and world-class cohort data, Dr Perret will lead the development of an innovative risk calculator for general practitioners to identify high risk candidates for non-invasive and inexpensive lung function testing to end COPD cases at an early stage.

Dr Perret will gain expertise in the analysis of multi-centre and transnational datasets, prediction modelling and methods to maximise statistical power at ISGlobal in Spain and Imperial College, London. Her work will assist Victorians by detecting COPD earlier, when preventive strategies are of greater benefit.

VICTORIA FELLOWSHIPS

Life Sciences



Mrs Priscilla Prestes

Federation University

High blood pressure is the leading risk factor for heart disease and burden of death in Australia. Circular RNAs are new molecules in the human kidney that may contribute to blood pressure regulation. These non-coding RNAs turn genes on and off by changing how the DNA is read inside cells instead of changing its sequence, known as the epigenome.

Mrs Prestes has identified that dysregulation of circular RNA contributes to blood pressure control and hypertension development that can be targeted for therapy.

Mrs Prestes will use pilot data from a unique tissue biobank resource from the TRANScriptome of renal human Tissue (TRANSLATE) study at the University of Manchester. Once the necessary techniques to efficiently manipulate the circular RNA expression in vitro have been established she will bring this new technique back to Victoria.



Dr Julia Walker

Monash University

Interleukin-6 (IL-6) is a cytokine, a small protein that plays a role in our host immune response towards infection and could play a role in acute COVID-19 cases and influenza. Currently, IL-6 dynamics are not able to be measured outside the body, making their impact and the role they play on our health hard to define.

Dr Walker's research aims to develop a cellular sensor for IL-6 in the body which would track the movement and dynamics of IL-6 in real time, through non-invasive photoacoustic imaging. The information provided by such a sensor would reveal IL-6 activity in the cytokine storm and how this then affects such disease as acute COVID-19, influenzas, cancer and stress.

Following the initial sensor development, the pilot in vitro and in vivo photoacoustic imaging studies will be carried out at Chemical Imaging of Living Systems Institute, Northeastern University with Professor Heather Clark.

VICTORIA FELLOWSHIPS

Physical Sciences



Dr Taimur Ahmed

RMIT University

The human brain comprises billions of neurons interconnected in networks to perform cognitive processes by communicating to each other using a sequence of electrical signals. Any disorder in the signalling sequence leads to the neural disconnection and chaotic response in the form of epilepsy, Alzheimer's, dementia and memory loss.

Development of a new class of artificial neurons, which not only mimic the cognitive processes but also can help to understand neural disorders and their manipulation for targeted diagnoses, is the focus of Dr Ahmed's work. Dr Ahmed will collaborate with the Bioelectronics Group at the Massachusetts Institute of Technology led by Professor Polina Anikeeva.

The project outcomes will help put Victoria's research at the forefront of the rapidly growing international market in medical bionics and machine learning industries in Victoria.



Dr Andreas Boes

RMIT University

Dr Boes believes that photonic chip technology can be used to achieve high precision inertial movement sensors on a single semiconductor chip providing fast and accurate sensing and feedback in real time, weighing only a few grams and powered by a battery fitting in the palm of your hand.

To work on this technology, Dr Boes will visit Professor Christelle Monat and Dr Christian at Grillet Ecole Centrale de Lyon, Professor Gunter Roelkens at Gent University, Dr Jochen Schroeder and Professor Victor Torres Company of Chalmers University, Professor Michal Lipson at Columbia University and Professor John Bowers of the University of California.

Victoria, a state with a solid and agile manufacturing base, will benefit by the development of this technology through the next generation of self-driving cars, drones, robotics, manufacturing machinery, navigation, sensing and surgery equipment.

VICTORIA FELLOWSHIPS

Physical Sciences



Dr Fatemeh Jalali

IBM Research Australia

With the proliferation of IoT devices and sensors on the internet into the billions, the assumption that all computation can simply be pushed into the 'cloud' is not practical.

Dr Jalali is focusing on building a dynamic solution switching between Fog/Edge and cloud for IoT applications to improve performance and better utilise Fog/Edge-Cloud capabilities. A new platform named DEFT (Dynamic Edge-Fabric environment) is being proposed that can learn, using machine learning, where best to execute each task based on real-time system status and task requirements, along with learned behaviour from past performance of the available resources.

Developing efficient learning algorithms, Dr Jalali will work with experts at MIT and IBM-MIT as well as meet with experts in the fields of communications and computer networks. Then Dr Jalali will collaborate with the University of Leeds to study the resilience automated systems.



Dr Conrad Wasko

The University of Melbourne

As increasing rainfall intensifies, so does the risk of flooding in urban areas. Dr Wasko proposes to understand how rainfall patterns are changing on a global scale, quantifying their impact on water availability, and develop methods for adjusting rainfall patterns for flood modelling in infrastructure design.

Dr Wasko will work with Professor Hayley Fowler at Newcastle University (UK) to understand how rainfall patterns, critical to understanding flood and water supply risk, are changing with climate change. He will also collaborate with several of the world's leading experts in the field, including Dr Geert Lenderink from the Royal Netherlands Meteorological Institute.

This research will bring back a world-leading understanding of changes in rainfall patterns and their impact of water supplies to inform recommendations on the impact of climate change on water supplies in Victoria.

VICTORIA FELLOWSHIPS

Physical Sciences



Dr Ali Yavari

Swinburne University

In smart agriculture, drones monitor fertilisation and irrigation in real-time to improve product efficiency. While drones are autonomous, the transmission and processing of the massive amounts of data they collect is limited.

Dr Yavari is aiming to overcome these constraints by designing and developing a platform that can facilitate human-IoT-interaction using augmented and virtual reality. Using 5G, this platform will provide significant improvements for smart manufacturing and smart healthcare.

Dr Yavari will collaborate with Newcastle Urban Observatory and INRIA Paris to develop the first human IoT-interaction platform using virtual and augmented reality over the 5G mobile network. This will create the knowledge base and preliminary development for potential IoT applications to be offered through this platform to industries in Victoria.



Dr Maggie Zhai

RMIT University

Protein and gene-based therapeutics, or vaccines, have the potential to revolutionise current treatments for many complex diseases. However, these fragile molecules are prone to degradation upon entry into biological systems.

Dr Zhai aims to circumvent this by developing a novel drug encapsulating material consisting of lipid nanoparticles with a sponge-like network of swollen water pores.

Visiting the Institute of Food, Nutrition and Health, Switzerland, Lund University and Imperial College London, as well as two world-class synchrotron radiation facilities in Europe, Dr Zhai will identify opportunities to co-design the required materials and characterise their structure.

This work will strengthen Victoria's already highly integrated biomedical research and world-class hubs, increasing knowledge that facilitates cross-disciplinary innovation in the treatment and prevention of complex diseases.



RECIPIENTS OF THE VICTORIA PRIZE FOR SCIENCE & INNOVATION

Year Recipient

2019	Professor Anthony Burkitt Professor Michael Berk
2018	Professor Douglas MacFarlane Professors Andrew Roberts AM & John Seymour AM
2017	Professor Maria Forsyth Professors Jane Visvader & Geoffrey Lindeman
2016	Professor Min Gu Professors Jamie Rossjohn & James McCluskey AO
2015	Professor Calum Drummond AO Professor John Hopper AM
2014	Professor Frank Caruso Professor Ashley Bush
2013	Professor Lloyd Hollenberg Professor Alan Cowman AC
2012	Professor Ana Deletic Professor Terence (Terry) Speed
2011	Professor Andreas Strasser
2010	Associate Professor Voytek Gutowski
2009	Professor Murray Esler AM
2008	Professor Peter Colman AC
2007	Professor Colin Masters AO
2006	Professor David Solomon AM
2005	Professor Eric Reynolds AO
2004	Professor Keith Nugent
2003	Professor David Vaux AO
2002	Professor David Boger
2001	Dr Roger Francey & Dr Paul Steele
2000	Professor Donald Metcalf AC
1999	Professor Graeme Clark AC

Research Area

(Physical) Artificial vision (Life) Mental health
(Physical) Electromaterials (Life) Leukemia research
(Physical) Electromaterials (Life) Breast cancer research
(Physical) Nanophotonics (Life) Infection and immunity
(Physical) Chemistry (Life) Disease prevention
(Physical) Nanomedicines (Life) Translational neuroscience
(Physical) Quantum sensing technology (Life) Malaria research
(Physical) Storm water management (Life) Bioinformatics
Cancer cell research and apoptosis
Manufacturing technology
Cardiovascular neuroscience
A new class of anti-influenza viral drugs
Alzheimer's disease pathways
Polymer chemistry
Remineralisation of dental caries
Quantitative phase imaging
Programmed cell death – Apoptosis
Fluid mechanics
Greenhouse gas monitoring
Haematology
Hearing solutions: Cochlear implants

VICTORIA PRIZE FOR SCIENCE & INNOVATION AND VICTORIA FELLOWSHIPS

Victoria Prize for Science & Innovation

Created in 1998, the annual Victoria Prize for Science & Innovation and Victoria Fellowships program supports and recognises outstanding Victorian scientific research and innovation.

The prestigious \$50,000 Victoria Prize is awarded to outstanding Victorian researchers (in the life sciences and in the physical sciences) whose discovery or innovation, or potential discovery or innovation, has significantly advanced knowledge or has provided commercial or other benefits to the community. The Victoria Prize for Science & Innovation honours the life-long commitment and achievements of the recipients.

Victoria Fellowships

The Victoria Fellowships encourage innovation and the commercial application of research among researchers in the early stages of their careers. Up to 12 researchers are awarded up to \$18,000 each to undertake overseas study missions offering Victoria Fellows the opportunity to broaden their experience, develop international networks and better understand where their activities fit into the local and international scene. A Victoria Fellowship also provides an opportunity to develop commercial ideas.

For further information;

Victoria Prize for Science & Innovation: www.veski.org.au/vicprize

Victoria Fellowships: www.veski.org.au/vicfellow

Australian French Association for Science and Technology (AFAS) Associate Award

Victoria Fellowship applicants planning to study in France are eligible to apply for an AFAS Associate Award. AFAS Associate Awards support study missions to France, in conjunction with the Victoria Fellowship, and aim to facilitate science and technology innovations that are mutually beneficial.

OTHER VICTORIAN FELLOWSHIP AND AWARD PROGRAMS

Premier's Awards for Health and Medical Research

The Premier's Awards for Health and Medical Research recognise the exceptional contributions and capabilities of Victoria's emerging early career researchers in their PhD studies. The Premier's Awards include five category awards: Basic Science Researcher, Clinical Researcher, Aboriginal Researcher undertaking research in any field of health and medical research, Health Services Researcher, Public Health Researcher, with an additional award granted to the Premier's Excellence Award winner.

The award is open to PhD students or recently completed postgraduates, whose research has or is being undertaken in a Victorian research institution, in a field of health and medical research - December 2020 will see the 26th announcement of the award.

<https://www2.health.vic.gov.au/about/clinical-trials-and-research/premiers-award>

veski innovation fellowships

The **veski** innovation fellowships bring Australian expatriates and leading researchers, with outstanding skills in science and innovative technology, typically in the top five percent of their respective fields, to Victoria.

Since 2004, **veski** has awarded 28 fellowships to scientists and researchers working across a range of basic, applied and clinical research fields from modern health issues such as cancer, dengue and obesity to innovative studies into nanotechnology and organic semiconductors.

Applications are sought from globally competitive individuals in the field of biotechnology, biomedical, advanced manufacturing (including food science and bioengineering), digital agriculture, cyber security, environmental and energy technologies, the enabling sciences and technologies, space and transportation.

www.veski.org.au/vif



