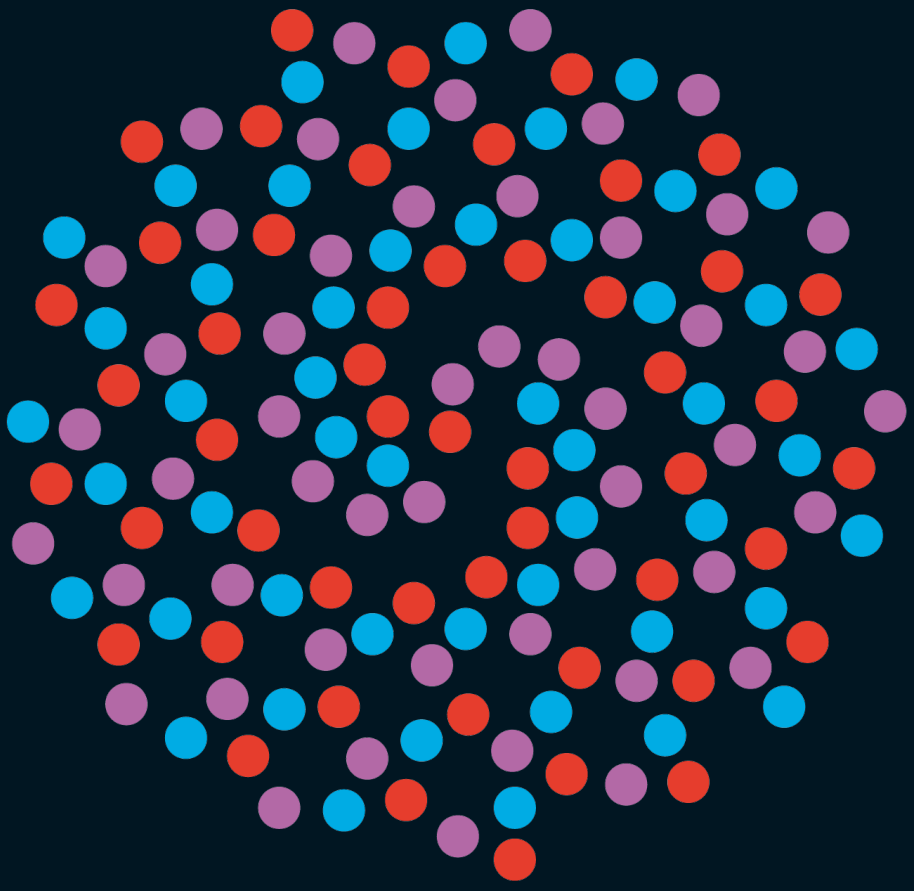


# MAURICE WILKINS CENTRE

New Zealand's Centre of Research Excellence
targeting human disease

# Annual Report 2019

## Maurice Wilkins Centre

The Maurice Wilkins Centre is New Zealand's Centre of Research Excellence targeting major human diseases. It focuses on cancer, diabetes and infectious disease.

New Zealand has an outstanding reputation for biomedical research. The Centre aims to harness this expertise to develop drugs and vaccines, tools for early diagnosis and prevention, and new models of disease. In addition to translational research that directly targets human disease, the Maurice Wilkins Centre encourages innovative fundamental science that has the potential for high impact on human health.

The Maurice Wilkins Centre is a multidisciplinary network that brings together leading biologists, chemists and computer scientists. At the end of 2019 it comprised of 270 investigators throughout the country, over 230 early-career affiliates, and 28 clinical associates, linking researchers and clinicians from six Universities, three Crown Research Institutes, one private research institute and nine district health boards. These investigators represent most of New Zealand's expertise in discovering new drugs, vaccines and diagnostic tools that proceed to clinical trials. The Centre has also partnered with two Māori and two Pacific health organisations to improve the health outcomes of Māori and Pacific peoples.

As the national hub for molecular biodiscovery the Centre provides a point of contact for a broad range of national scientific expertise.  It cultivates collaborations with international researchers and research institutions and also engages with industry and the medical profession. It is committed to building the economy, and building scale in the New Zealand biomedical sector.

For more information, see www.mauricewilkinscentre.org

For more information on New Zealand Centres of Research Excellence, see www.acore.ac.nz

MAURICE WILKINS CENTRE
FOR MOLECULAR BIODISCOVERY

# Director's Report

It's a privilege to be able to reflect on the last year of MWC's research and outreach. As usual these pages hold stories of outstanding achievements from our research teams and the communities that support them.

As we report on page 11, 2019 was one of the years when we brought together our International Science Advisory Board (SAB) to review the MWC's progress and advise on future directions. Years when the SAB is convened are especially exciting because our science is reviewed and critiqued in person by some of the world's most eminent scientists in the fields we work in – quite a challenging experience for scientists at any career stage! This year's SAB was an expanded team, incorporating several new SAB members alongside members who had served on several previous reviews. This meant the SAB incorporated both deep institutional knowledge of our history and "fresh eyes" on our programme.

The comments we report on page 11, are particularly significant because they reflect the SAB's conviction that the MWC continues to evolve and push new scientific boundaries on behalf of New Zealand. The SAB pointed to several programmes that had progressed from being world-class to world-leading – precisely the status that the MWC has always striven towards. The SAB was also impressed at the new confidence shining through in the MWC's international engagement – garnering unprecedented international investment for clinical trials of our new therapies, playing pivotal roles in international consortia fighting infectious disease, and achieving new heights in the level of New Zealand's scientific collaboration with China.

The SAB also had observations of the MWC's culture, and was very pleased to witness a much greater focus on partnership with Māori and Pacific communities. They also remarked on the fact that New Zealand's leading biomedical investigators are now co-operating seamlessly across both disciplinary and institutional boundaries, a phenomenon they believe is still rare internationally.

Of course the SAB also had a number of recommendations for further tweaks to our science and our systems, fulfilling their mandate, but it was very re-assuring to witness their recognition that the MWC continues to push biomedical science in New Zealand into fruitful new territory, serving a pivotal function in the nation's research ecosystem. It was also wonderful to witness all the individual interactions between our investigators and this storied and influential group of international thought leaders. Any nervousness rapidly faded as the SAB's positive feedback radiated through the MWC community, and our investigators left the meeting inspired with a new sense of the significance of their work to the international community as well as our own.

I'd like to add to the SAB's commentary on the continuing evolution of the MWC with some observations of my own. This is my last Director's report on behalf of the MWC – I stood down as

Director at the end of 2019 after 10 years in the role. It's been an honour and a privilege to lead the MWC and I'm genuinely delighted with its achievements. Apart from anything the brilliant colleagues I've come to know, from the 5 founding professors to our latest cohort of post-graduate students, have been a daily inspiration. Excellent research takes excellent people, and it's been wonderful to see the next generations of leaders in biomedicine emerging, mentored by senior colleagues whose achievements they will surely eclipse. The MWC's Early Career Steering Committee has been a particular success as they've taken charge of the MWC's career development agenda.

Connecting all these fine researchers into a highly functional network is one the MWC's greatest achievements, and in the new era where our investigators collaborate seamlessly within NZ and internationally, it's become difficult to remember back to times when many of our top biomedical researchers felt isolated and parochial. The MWC network has also enabled much wider participation in the translation and commercialisation of biomedical research, to the point that some observers describe the MWC as NZ's de facto biotech cluster – the crucible in which the elements of transformative science have so often come together.

I'd therefore like to commend the NZ government for its foresight in funding the Centres of Research Excellence to enable our best scientists to come together in shared endeavours of their choosing. The MWC like other CoREs has stimulated an unprecedented level of co-operation between scientists in different disciplines across the country, so this investment continues to deliver vibrant new science that enriches and strengthens our community, at a level that would not have otherwise been possible.

To close there are two people I need to pay tribute to as I leave the Directorship.

Bill Falconer has served as Chair of the MWC Board since the MWC's inception, and it's been my great pleasure to work with him ever since I was invited to join the MWC. Bill is the living embodiment of good governance, with an unwavering commitment to ensuring the MWC's systems enable it to achieve its mission. The mana that Bill emanates is also a wonder to observe. I will always remember the way he responded to a high-powered review committee's questions on governance with a single sentence that summarised the Board's approach. The esteemed committee members listened, paused – and immediately moved on to the next topic – completely re-assured that the MWC's processes were unimpeachable.

Finally my utmost thanks to Rochelle Ramsay, our Research Operations Manager, who has led the administrative team of the MWC since it was founded. Rochelle is the heart and soul of the MWC, and has built a finely-tuned administrative machine. All the MWC's hundreds of investigators know and trust Rochelle, and she is the "go-to" person for anyone in the country who wants to know how to make national science collaborations work. Rochelle has been a constant pleasure to work with – unflappable under pressure, calmly assertive, strategically agile – and has always carried with her the ethos of hard work, fairness and probity. All of the MWC's works to date bear Rochelle's imprint, and I will always remain grateful to her for making my job as Director such a pleasure.

Prof Rod Dunbar

**MWC Director**

MAURICE WILKINS CENTRE
FOR MOLECULAR BIODISCOVERY

# Mission and Strategic Outcomes

## Mission

The Maurice Wilkins Centre will target major diseases affecting New Zealanders, particularly cancer, diabetes and infectious disease, by delivering world-class research that enables the discovery of new therapies, diagnostics and vaccines.

## Strategic outcomes

MWC will fulfil its mission through the generation and translation of new scientific knowledge, training and outreach initiatives that will achieve:

1. Contributions to improved health and well-being of New Zealanders, and the global population, through clinically relevant world-class research
2. Contributions to the New Zealand economy through discovery of new therapies, diagnostics and vaccines and the development of new technology
3. Contributions to increased innovation across the New Zealand biomedical sector, by fostering inter-disciplinary and inter-institutional collaborations, and engagement with clinical researchers
4. A cohort of young scientists who are trained to contribute to scientific innovation and have skills valued by future employers
5. Enhanced scientific partnerships between New Zealand and other nations that leads to increased opportunities for New Zealand researchers
6. Contributions towards a greater understanding of biomedical science in the New Zealand community.

2019 prestigious award and honours recipients: (left to right, top to bottom) Distinguished Professor Dame Margaret Brimble, Associate Professor Roslyn Kemp, Associate Professor Nuala Helsby, Sesquicentennial Distinguished Professor Greg Cook, Professor Jillian Cornish, Professor Nicola Brasch and Professor Julia Horsfield.

# Highlights

## International and national awards

*In yet another successful year, Maurice Wilkins Centre investigators have been recognised on the national and international stage for their contributions to science.*

The year started with Distinguished Professor Dame Margaret Brimble from the University of Auckland being honoured as a Dame Companion of the New Zealand Order of Merit on New Year's Day, for services to science. Then in August Professor Brimble was inducted into the American Chemical Society MEDI Hall of Fame in 2019[1], alongside world-class drug inventors and Nobel Prize winners. Professor Brimble was the second New Zealander to receive this exclusive accolade, where she was recognised for her work in drug discovery and commercialisation, numerous high-profile awards and significant publication and patent outputs.

Professor Brimble also received several national awards in 2019; the Kiwinet BNZ Supreme Award and Baldwins Researcher Entrepreneur Award, which recognise overall commercialisation excellence and outstanding contributions to business innovation in New Zealand, and the 2019 Zonta New Zealand Women of Achievement Award, which celebrates "women who have empowered women and girls within New Zealand and/or globally".

Associate Professor Roslyn Kemp, from the University of Otago, was re-elected Secretary-General of the International Union of Immunology Societies (IUIS) for a second term, recognising the work she has done since 2016. As part of a five person leadership team, she will liaise between IUIS, the World Health Organisation and the International Science Council[2].

In 2019, University of Auckland Associate Professor Nuala Helsby was made a Fellow of the British Pharmacology Society, acknowledging individuals who make significant contributions in areas of Pharmacology, Clinical Pharmacology and Therapeutics. This fellowship adds to her international profile, including being the Vice Chair for the Drug Metabolism and Drug Transport sub-committee of the International Union of Basic and Clinical Pharmacology and her role as Executive editor for the British Journal of Clinical Pharmacology.

Closer to home, Professor Greg Cook was appointed as one of the inaugural Sesquicentennial Distinguished Chairs at the University of Otago, as part of the 150th year celebrations. The new chairs highlight scholars who are internationally pre-eminent in their fields and have a strong record of leadership and service.

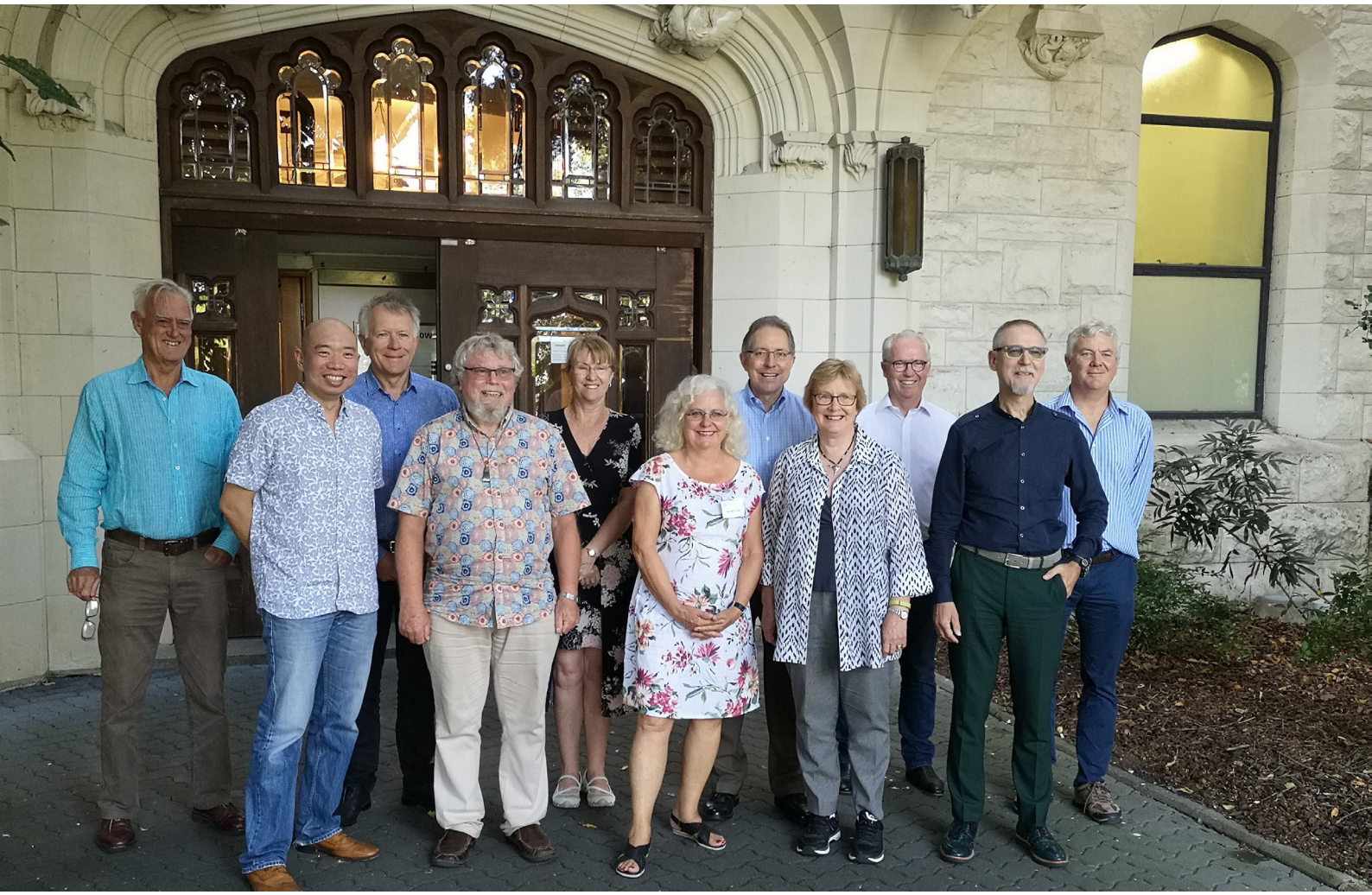
Professors Jillian Cornish and Nicola Dalbeth from the University of Auckland, were both invited to be Royal Society Te Apārangi Fellows, acknowledging their contribution to science in New Zealand. Professor Cornish is recognised as an international leader in bone biology, where her work focuses on understanding the pathways that contribute to normal bone growth. Professor Dalbeth is an expert in gout and applies her clinical background to investigate the functional implications of the condition.

Professor Julia Horsfield from the University of Otago was awarded a prestigious Fulbright Scholar Award, which helps enables scientists to carry out their research at institutions in the US. Julia will use her award to travel to the University of California, Irvine and the University of California, Davis, where she will assess how cell fate decisions are made in a zebrafish model utilising single-cell sequencing.

For more awards and honours received by MWC investigators, see page 91.

1. https://www.acsmedchem.org/?nd=hof

2. https://iuis.org/



The MWC Scientific Advisory Board members (left to right): Professor Peter Andrews, Dr Giles Yeo, Professor David James, Professor Warren Tate (MWC Board representative), Dr Jilly Evans, Dr Jeanette Wood, Dr Christopher Cooper, Professor Suzanne Cory, Dr Warwick Tong, Professor Adrian Harris and Professor Mark Walker.

## Eminent international scientists review MWC research

*The Maurice Wilkins Centre Scientific Advisory Board, comprised of highly respected scientists and science entrepreneurs from around the world, unanimously agreed that the quality of research being undertaken by the centre is outstanding, following a meeting held in Auckland in March 2019.*

The Scientific Advisory Board (SAB) meet biennially to review the progress of major MWC research programmes and advise on future research directions as well as wider MWC strategy. At this meeting the SAB also reviewed ideas for additional new research beyond 2020.

In 2019, we welcomed back the very experienced Professor Peter Andrews (Magic Pudding Inc.) in the role of SAB Chair. Joining him were six of our esteemed advisory board members from past meetings: Dr Christopher Cooper (TB Alliance, USA); Professor Suzanne Cory (The Walter and Eliza Hall Institute, Australia); Dr Jilly Evans (PharmAkea Therapeutics, USA); Professor David James (University of Sydney, Australia); Dr Warwick Tong (Cancer Therapeutics, Australia); and Dr Jeanette Wood (Wood Pharma Consulting Services, Switzerland).

This year, we were also honoured to have three more international experts join our SAB: Professor Adrian Harris (University of Oxford, UK), Professor Mark Walker (The University of Queensland, Australia) and Dr Giles Yeo (University of Cambridge, UK). For more information on the Board, see the MWC website.

Following three days of meetings, reviewing documentation and presentations by MWC investigators, the SAB reported its findings. Their report was very positive in relation to the centre's research performance and value to New Zealand.

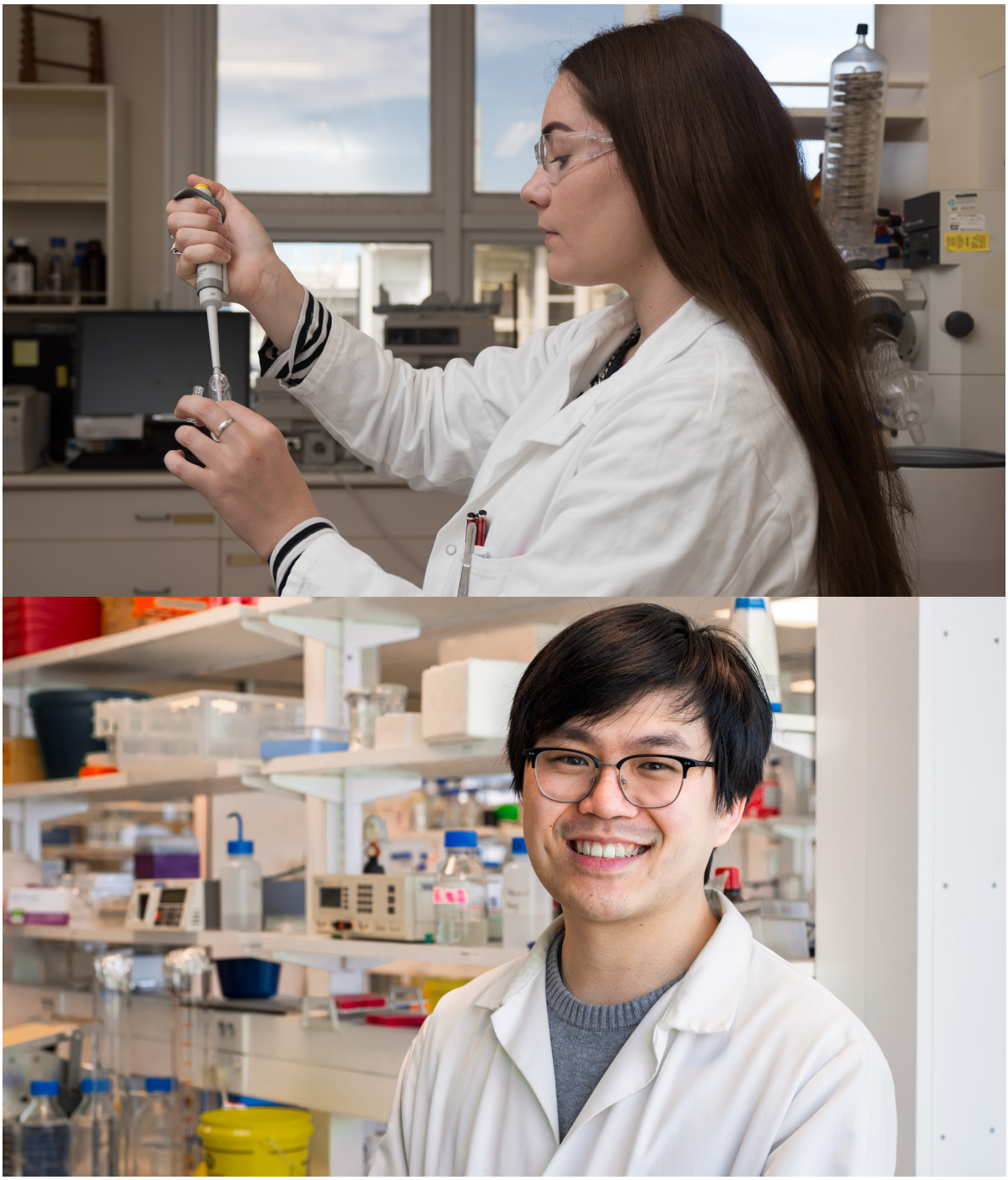
"The MWC has continued its impressive evolution... into a truly national consortium, delivering clear dividends in efficiency and innovation at the national level," the SAB wrote.

The MWC's growing number of clinical partnerships have a strong focus on diseases affecting New Zealanders, the SAB noted. "Outreach into the community at large, and particularly to the Māori and Pacific Island populations, is delivering a greater understanding of the importance of biomedical science to the health and well-being of New Zealanders, and multiple international partnerships are further strengthening the MWC's ability to deliver these outcomes."

The SAB said research programmes underway within the MWC are delivering substantial societal and economic benefits to New Zealand. "At the economic level, noteworthy impact has been achieved through the creation of spinout companies and by licensing IP to pharmaceutical companies... At the societal level, MWC works in a number of areas of market-failure, and has built partnerships nationally and internationally in the infectious disease and metabolic disease areas to ensure that the impact of its work is realised, both in NZ and in international settings."

While in New Zealand, SAB members also took the opportunity to give seminars, meet with research groups, conduct media interviews, and participate in MWC events and workshops.

Overall, the SAB meeting was a highly useful and invaluable exercise for the MWC – the positive feedback and advice on many aspects of the Centre's programmes was much appreciated and has certainly helped the it to refine its future research strategy.



Above: Ms Taylor Cooney, MWC PhD student at the Ferrier Research Institute. *Image courtesy of VUW Image services*
Below: Dr Ben Lu, MWC PhD graduate at the University of Auckland. Image courtesy *Dr Charlotte Johnston*

## MWC continues to lead in NZ cancer vaccine research

*Immune therapy is one of the most exciting and promising areas of cancer research. Around New Zealand, teams of Maurice Wilkins Centre investigators – amongst them postgraduate students – made excellent progress in 2019 in their work to develop novel cancer vaccines.*

The MWC's Immuno-Oncology research flagship programme is focused on the interaction between the immune system and cancer and the development of novel immunotherapies and cancer vaccines. "Cancer vaccines in particular are of huge current interest," says Professor Rod Dunbar, MWC Director based at the University of Auckland. "They can be paired with other immune therapy – especially 'checkpoint blockers' – to increase responses to immune therapy, without lifting toxicity. There's also increasing excitement that personalised vaccines designed for each person's unique tumour might be more successful than 'shared' vaccines that aim for targets that are common to many people's tumours."

The MWC has long invested in developing peptide chemistry technology and the fostering of inter-disciplinary collaboration between chemists and biologists. Two companies – SapVax and Avalia Immunotherapies – have been spun-out by teams of MWC investigators, and New Zealand now has a strong track record in peptide-based vaccine development.

The application of peptide chemistry technology for cancer vaccines involves creating fragments of cancer cell proteins with very high precision, which can then be used in vaccines to stimulate an immune response strong enough to attack and kill cancer T cells. Importantly, our work has also involved talented PhD students who have been able to contribute to this research programme as part of their study.

At the University of Auckland, Dr Benjamin Lu, a MWC student who graduated with a PhD in 2019 while in Professor Dame Margaret Brimble's lab, is focused on synthesising and evaluating novel compounds as potential vaccine adjuvants, immunomodulatory compounds capable of potentiating host antigen-specific immune responses.Benjamin was the lead author on a paper published in 2019 in the Journal of Medicinal Chemistry[1] which reported on the potential use of a novel Toll-like receptor 2 (TLR2) agonist as a cancer vaccine adjuvant. Benjamin and colleagues evaluated the immunostimulatory activity of certain forms of these compounds which they had chemically synthesised.

"Research in to the use of these adjuvants is still on-going, and their application is being expanded into an array of other peptide vaccines," says Benjamin. "It's still conceivable that even stronger and more unique adjuvants may yet be discovered - something we're still looking into."

Ms Taylor Cooney, a MWC PhD student at the Ferrier Research Institute, Victoria University of Wellington, is researching a novel delivery mechanism for cancer vaccines under the supervision of MWC Associate Investigator Professor Gavin Painter. In 2019, Taylor was part of a team that had their work published in the journal Organic and Biomolecular Chemistry[2]. The paper described their finding that a potent NKT cell agonist called galactosylceramide can be administered in a way that is not only effective at stimulating a strong immunotherapeutic response, but devoid of unwanted side effects."I was fascinated by the idea of how the patient's own immune system could be utilised to fight cancerous cells," says Taylor. "Treating cancer is something that has a huge potential impact in people's lives, so being involved in a process that could improve our treatment options is really inspiring."

1. Lu et al (2020). J Med Chem 63: 2282-91
2. Compton et al (2019). Org Biol Chem 17(5): 1225-37

Utilising the expertise and community engagement of researchers and heathcare providers, the WORTH study aims to identify which diabetes drugs are likely to provide patients with the greatest glucose-lowering benefits based on their individual characteristics.

*Image from Karlevana | Dreamstime.com*

# MWC diabetes researchers partner with primary healthcare, communities

*New Zealand primary healthcare and community-led efforts have been instrumental in recruiting patients for a pioneering study that aims to determine if a patient's response to two different type 2 diabetes drugs can be predicted by their personal and genetic characteristics.*

The 'Which One is Right Here' (WORTH) study is an 8-month randomised, open-label, crossover study funded by the Health Research Council and Maurice Wilkins Centre comparing two funded medications – Vildagliptin and Pioglitazone – as add-on therapy for patients whose type 2 diabetes is poorly controlled by their existing standard metformin and/or sulfonylurea regimens.

The study may impact New Zealand diabetes medication prescribing patterns if it can show that certain patient characteristics, genetics, age, body size, and ethnicity, can predict which drugs is most likely to provide an individual with the greatest glucose-lowering benefits. Lead investigator Associate Professor Rinki Murphy, MWC Principal Investigator at the University of Auckland, says a 'precision medicine' approach would have many benefits for more than 200,000 people with type 2 diabetes in New Zealand.

"Knowing who responds best to each type of diabetes drug would help patients to get more effective medication earlier in their treatment, with fewer negative side effects, and improved health outcomes," she says.

Recruitment for the WORTH study began in 2019, targeting enrolment of 300 patients across the upper half of the North Island – in Auckland, Kaitaia, Tairāwhiti and Waikato. "We are particularly interested in whether the response is different among people of Māori and Pacific ancestry," says Rinki. "Our NZ populations are not represented in the international clinical trials evaluating these diabetes medications, and it is possible that due to unique genetics, there may be biological reasons for different metabolism and effectiveness of these drugs."

Strong engagement and support from primary healthcare organisations, nurses, pharmacist prescribers and GPs in these regions resulted in a high level of local community interest and the study's enrolment target being met by February 2020.

Impressive commitment to this cause was shown by the whole team, with particular thanks to Hinemoa McLelland from Ngāti Porou Hauora in Tairāwhiti, Kate Smallman from the Diabetes Foundation Aotearoa in South Auckland, Norma Nehren from Te Hiku Hauora in Kaitaia, Kerry Macskill-Smith from Pinnacle Incorporated, pharmacist prescriber Penny Clark in Hamilton and MWC-funded clinical research fellows Rebecca Brandon, Ryan Yeu and Ry Yves Tweedie-Cullen.

Kate Smallman, Diabetes Nurse Specialist/Prescriber at Diabetes Foundation Aotearoa, led a very successful recruitment drive at an Auckland community centre, recruiting 105 patients.

Kate says recruiting culturally diverse, non-New Zealand European participants for a research study can be difficult for a variety of reasons. "A flexible and 'family style' community approach, paired with strong primary care relationships are vital and may offer a different way of supporting individuals through what can be a challenging and frightening process."

Rinki said they were thrilled with the success of the community approach at all the centres. "We opened for recruitment in February 2019 and when recruitment ended in March 2020 we were above target – 346 participants recruited, of whom 186 [54%] were Māori and Pacific participants, above what we'd hoped. We're really pleased with all the support we've had. The challenges of completing this study during COVID19 times is something we are hopeful we will overcome."


The MWC signed agreements with two Pacific health research centres in 2019; Pacific Health Plus (based in Wellington) and Scientific Research Organisation of Samoa (based in Apia, Samoa).

(Top L-R) Dr Stephen Grice (Pacific Health Plus), Dr Ofa Dewes (MWC), Dr John Fiso (Pacific Health Plus), Prof Peter Shepherd and Prof Emily Parker (MWC).

(Bottom L-R) Dr Ofa Dewes, Prof Peter Shepherd and Prof Rod Dunbar (MWC) with Dr Satu Viali and Dr Seuseu Tauati (SROS).

Images courtesy of Dr Charlotte Johnson and Prof Peter Shepherd

# MWC enters exciting new era of collaboration with Pacific health partners

*The Maurice Wilkins Centre (MWC) signed landmark agreements with two Pacific health research partners in 2019 – the Scientific Research Organisation of Samoa and Pacific Health Plus in New Zealand.*

The MWC has formed collaborations to establish productive research programmes that aim to improve outcomes for Pacific peoples nationally and regionally.

In 2019, two leading Scientific Research Organisation of Samoa (SROS) scientists, Dr Fiame Leo and Mr Viliamu Ah Sam, visited our laboratories in New Zealand over a two-week period as part of a mission to identify potential avenues of biomedical research that could be established back in Samoa.

The visit was a follow-up to an earlier visit by the SROS leadership team. It also followed the signing, in July 2019, of a Memorandum of Cooperation between the SROS and MWC to set up a joint research centre in Apia, Samoa, to house chemistry and cell culture facilities that may be used to identify potential native Samoan biota as sources of valuable bioactive nature products.

MWC Deputy Director Professor Peter Shepherd, who initiated the collaborative relationship between the MWC and the SROS, hosted Fiame and Viliamu while they were in Auckland at the University of Auckland's Faculty of Medicine and Health Sciences.

"The MWC is engaging closely with Māori and Pacific communities in New Zealand, so building research links with Samoa is an important new addition to this strategy," said Peter.

Fiame and Viliamu also visited MWC Associate Investigator Dr Rob Keyzers' lab at Victoria University of Wellington's Centre for Biodiscovery.

"It was great to host Fiame and Viliamu," said Rob. "The visit was very productive in terms of practical discussions around research directions and collaborations for SROS with both MWC and the Centre for Biodiscovery."

The MWC entered into a similarly important collaboration with New Zealand-based Pacific Health Plus a few months earlier, to develop research programmes to investigate health issues of particular relevance to the Pacific community.

An MoC was signed at a special event held in April 2019 by John Fiso (Pacific Health Plus), Professor Peter Shepherd, Dr Ofa Dewes and Professor Emily Parker (for MWC).

The collaboration was welcomed by Mr John Fiso, Chairman of Pacific Health Plus: "No-one can deny that the health outcomes of Pacific people in New Zealand are far worse than any other demographic group... Working with the experts at the Maurice Wilkins Centre is an extraordinary opportunity and provides a pathway to changing this.

"Other than South Auckland, Porirua has the highest concentration of Pacific people in New Zealand and it makes absolute sense that we should partner to improve health outcomes for these communities," Mr Fiso added. "Health and social statistics for Pacific people in New Zealand are totally unacceptable and it is clear that this group of New Zealanders has been overlooked for too long. Better investments and effective partnerships, such as this one, can change this."

Dr Anna Brooks, MWC Senior Research fellow and Director of the Flow Cytometry Shared Resource Laboratory at the School of Biological Sciences (University of Auckland)

*Image courtsesy of Anna Brooks and the University of Auckland Science Faculty*

# MWC technical excellence helps NZ attract new medicines

*A high profile paper has highlighted the growing support the MWC is providing to NZ's burgeoning clinical trials sector.*

The paper, in the world's top liver medicine journal[1], describes the first time patients with chronic hepatitis B virus (HBV) had been treated with the immunotherapy drug anti-PD-1. The study was led by world-renowned Auckland hepatologist Professor Ed Gane, and conducted by Auckland Clinical Studies (ACS) on behalf of the sponsor, Gilead Sciences. While Professor Gane has carried out numerous trials with ACS previously, this paper was the first that included highly sophisticated analysis of patient samples in the laboratory of MWC Director Professor Rod Dunbar.

New Zealand has a fast-growing research sector devoted to early-stage clinical trials, and is increasingly regarded as one of the most attractive countries in the world to trial new drugs. Over a hundred clinical trials were carried out in New Zealand in 2019, and the sector now employs over 700 people, earning at least $150M per annum in export income. However certain clinical trials require very sophisticated analysis of patient samples that is not available through New Zealand's routine clinical laboratories, and this once made the country ineligible for some types of trials.

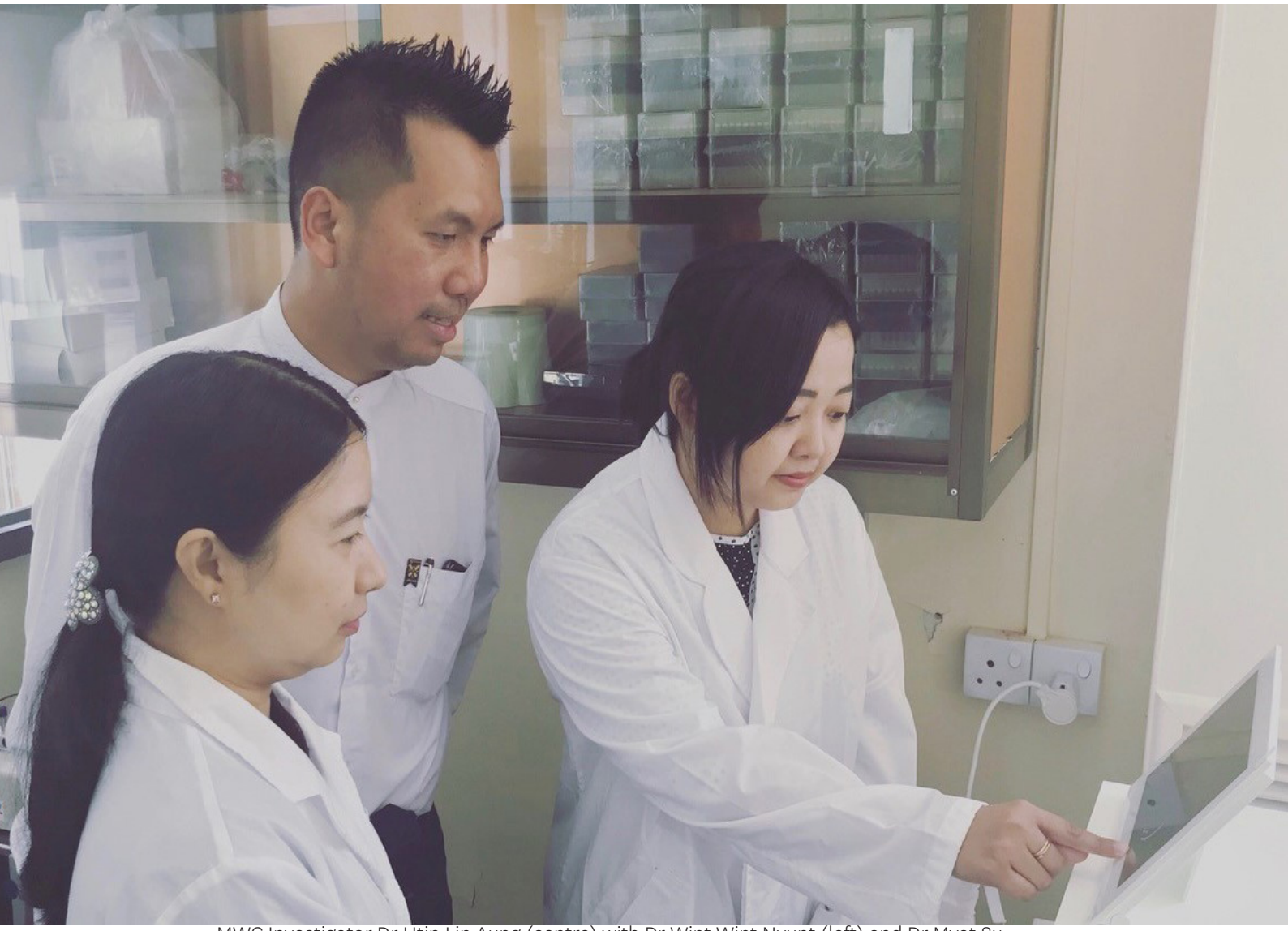
This is where the MWC's development of world-class analytical capability stepped up. In 2012 ACS needed to identify an Auckland-based lab capable of sophisticated blood sample analysis for a clinical trial sponsored by a major international pharmaceutical company. ACS Managing Director Dr Christian Schwabe contacted Rod Dunbar to see whether MWC had the capability needed, and a partnership began that has now helped bring more than a dozen clinical trials to NZ.

Rod says the MWC's long-term investment in building NZ's technical capabilities in analysis of patient samples has brought benefits at many different levels. He pays particular tribute to MWC Senior Research Fellow Dr Anna Brooks who has pioneered new flow cytometry techniques that pharmaceutical companies couldn't access anywhere else in the world.

"Initially being able to provide sophisticated analysis of clinical trial samples helped attract more clinical trials to NZ, benefiting patients and the economy at the same time. But as we've developed our technology, we're been able to offer unique analytical services to international partners, even for clinical trials performed overseas", comments Rod. Many of these studies are also first-in-human studies of new therapies, so they are scientifically exciting as well. In the recent paper with Ed Gane, a patient was cured of Hepatitis B by immunological manipulation typically used in cancer medicine. This work proved that this type of immune therapy could have a role in treating a disease that still afflicts over 100,000 New Zealanders, especially Māori, Pacific and Asian people.

"It's very exciting to help our leading clinicians bring such ground-breaking therapeutic approaches to diseases of importance to New Zealanders," says Rod.

*1. Gane et al (2019). J Hepatol 71(5): 900-07*



MWC Investigator Dr Htin Lin Aung (centre) with Dr Wint Wint Nyunt (left) and Dr Myat Su from the Myanmar National Tuberculosis Reference Laboratory, using their next-generation sequencing machine. Myanmar's National Tuberculosis Laboratory is now one of the few reference laboratories in high-TB burden, low resource countries with this advanced capacity.

*Image courtesy of Dr Htin Lin Aung*

# MWC researchers ramp up international infectious disease work

*The MWC has long recognised the value in investing in research to fight infectious diseases such as tuberculosis (TB), which remains difficult to treat or prevent. MWC teams are contributing to a number of international research collaborations targeting this disease.*

Infectious diseases present a major health threat worldwide and, despite the advantages our geographical remoteness affords, New Zealand is not immune, as demonstrated by the ongoing global coronavirus (COVID-19) pandemic.

TB remains a grave problem for large swathes of the world's population, including New Zealanders and our neighbours in the Pacific Islands, especially as new drug-resistant strains of Mycobacterium tuberculosis - the bacteria that causes TB - emerge and spread. Approximately 80% of all TB cases in New Zealand are from cases born outside the country, according to MWC Associate Investigator Dr Htin Lin Aung, from the University of Otago.

"That is why much of our research and outreach activities are focused on populations abroad – the ultimate aim of these efforts is to mitigate the threat of TB to New Zealand" said Htin.

"Our TB research programme in Myanmar started with a 2014 pilot study supported through the Maurice Wilkins Centre Flexible Research Programme." "It has now become a major TB research site for us."

Their work in the country has continued to progress to ever more advanced levels to the extent that it has also now attracted funding from the World Health Organisation (WHO), the New Zealand Government and New Zealand expatriates living in Myanmar.

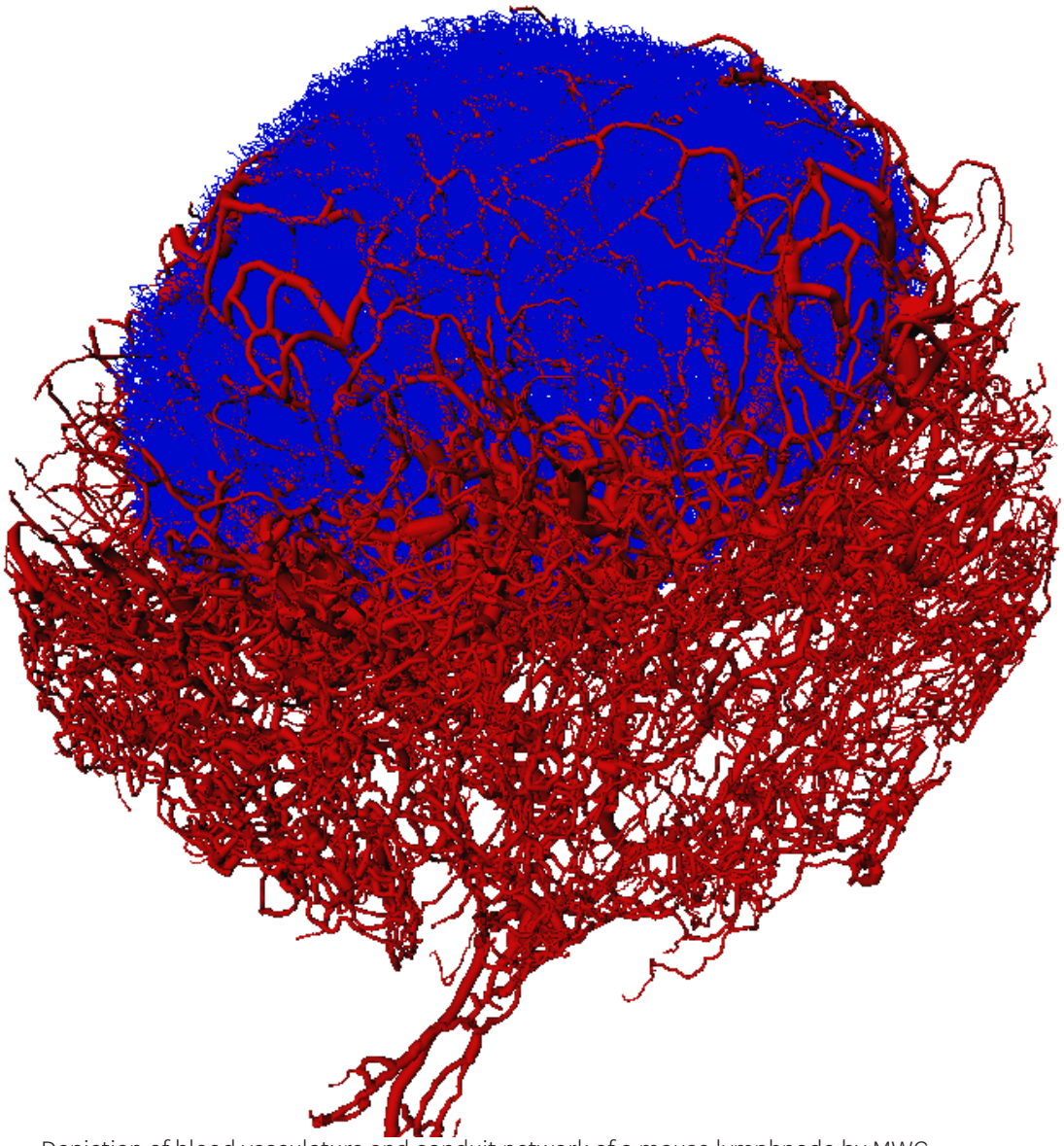
At the end of last year, Htin visited Myanmar to attend a special donation ceremony to unveil state-of-the-art genome sequencing equipment for their project in collaboration with the Myanmar National TB Programme (NTP). This is now one of the few NTPs in high-TB burden, low-resource countries with this advanced capacity.

"This equipment will further support our ongoing collaborative effort to effectively diagnose drug-resistant TB (DR-TB), enable progress in understanding the DR-TB epidemiology and facilitate improved and new DR-TB treatment," said Htin.

The medicinal chemistry expertise within the MWC is internationally recognised with our investigators having significant involvement in international efforts to develop better TB drugs. Investigators at the Auckland Cancer Society Research Centre, led by Professor Bill Denny and Associate Professor Brian Palmer, have continued their ongoing collaboration with the TB Alliance with the development of four new drugs taken to or selected for clinical trials. Professor Dame Margaret Brimble has initiated new work with the TB Alliance that will see the development of an asymmetric synthesis of a new drug targeting the high priority target ATP synthase. This work will reduce the costs of goods of the drug to enable its distribution to poor countries.

In 2019, MWC TB researchers were involved in a number of breakthrough studies on the metabolism and persistence of M. tuberculosis in host tissues. Two of these studies published in Nature Communications provide new and fundamental information on the pathways essential for persistence of Mycobacterium tuberculosis, which will provide the molecular framework for the development of new therapeutics targeting these essential processes[1,2].

1. Bashiri et al (2019) Nat Commun 10(1): 1558
2. Hasenoehrl et al (2019) Nat Commun 10(1): 4215



Depiction of blood vasculature and conduit network of a mouse lymphnode by MWC investigators using a novel 3D imaging system.

*Images courtsey of Dr Inken Kelch*

# New imaging improves our understanding of the immune system

*Maurice Wilkins Centre researchers have used novel imaging technology to reveal the structure and inner workings of entire lymph nodes, core components of the body's immune system.*

MWC-funded research by Dr Inken Kelch and a team of Auckland scientists led by Prof Rod Dunbar, which involved the use of novel 3D imaging system to map out an entire mouse lymph node, has been published in the journal PLOS Biology[1].

Developed by collaborators at the Auckland Bioengineering Institute (ABI), Dr Gregory Sands and Associate Prof Ian LeGrice, this New Zealand technology features a customised confocal microscope capable of producing very high resolution images of large areas of tissue.

"The problem with conventional imaging methods is that the higher the resolution you seek, the smaller the area that you can cover. There's usually a trade-off between size and resolution," explained Dr Kelch.

"Our collaborators built a system where you can achieve high resolution imaging but you can also cover a large area. This was ideal for what we wanted – to look at lymph nodes, which are small organs with a very intricate, complicated architecture."

Illustrated in their paper, the powerful 3D images that Dr Kelch and her co-authors including Prof Anthony Phillips (University of Auckland ) were able to take using the new system provide a detailed 'big picture' of a lymph node dissected from a mouse. They reveal how various regions of the lymph node are supplied by a fine tubing system called 'conduits', including their close relationship with blood vessels and their anatomy in regions where immune responses are kick-started.

The architecture of the lymph node supports crucial interactions between immune cells, said Dr Kelch. "We often talk about lymph nodes as being the headquarters of the immune system where immune responses are formed and different immune cells can come together and talk to each other. It is now becoming clear that the structural framework of the lymph node is needed to support and shape these interactions."

To get the most of their unique images, Dr Gib Bogle developed software to turn the conduit network into a computer reconstruction, enabling an extensive range of measurements and in particular modelling of the conduit anatomy's roles in lymph node function.

"We're particularly interested in the homing zone for T cells," added Dr Kelch. "T cells are important for immune responses to infections and cancer, they are the acting agents – the 'police force' – that can seek and destroy a tumour." Interestingly, T cells are highly motile and constantly scan lymph nodes for alarm signals. We are now able to simulate their migration in a realistic context using our conduit map'.

"A large amount of research is being carried out into the role of T cells and how we might be able to manipulate them in a way that is advantageous for patients with cancer in particular. However, the normal biology and function of lymph nodes and the immune system as a whole is yet to be fully understood. This is why our work is important – it will provide researchers with a better insight into how lymph nodes are organised to support immune function and gives us a new comprehensive map to aid modelling of the immune system.

1. *Kelch et al (2019). PLoS Biol 17(12):e3000486*


2019 MWC Category 4 recipients. (Clockwise from top left) Alana Whitcombe at the Telethon Kids Institute, Elyse Williams (second from left) with scientists from the University of Groningen, and Dr Matthew McNeil at Cold Spring Harbour (bottom left)

# Young MWC scientists gain valuable specialist research training

*Over 2019, a record number of emerging researchers took up the opportunity to access valuable specialist research training and facilities, supported by the Maurice Wilkins Centre's Flexible Research Programme.*

The Centre provides early and mid-career researchers with a means to travel for short-term placements in research laboratories to gain experience in new techniques, access highly specialised facilities that are not available at their local institutions and to attend specialist training courses here in New Zealand or abroad.

As well as being of great value to the participants for their own research and personal development, they are able to amplify that value by sharing what they learn with others in the MWC network on their return. Keeping up to date with developments in state-of-the-art equipment and techniques being used around the world is also important for maintaining the Centre's world-class research programme.

In 2019, we had more Category 4 funded researchers than ever before – 15 in total.

Ms Elyse Williams, a PhD student in the School of Chemical Sciences at the University of Auckland, spent five months in a lab at the University of Groningen in the Netherlands. During her visit, Elyse gained experience in photocatalysis and enzymatic catalysis, two emerging techinques for peptide/protein modification that are important in her PhD research.

"Bringing these new methodologies to New Zealand and the MWC will really give us an edge and hopefully we can produce more therapeutically relevant peptides," said Elyse. "I was given the opportunity to present my research at the MWC Symposium in December 2019, where I shared my experience. I have also been able to apply my new skills in peptide/protein modification to my own PhD project."

Dr Matthew McNeil, a Research Fellow at the Department of Microbiology at the University of Otago, took the opportunity to attend a high-throughput biology workshop at the Cold Spring Harbor Laboratory in New York, USA. Taught in collaboration with the Canadian Bioinformatic Workshops, this seven-day course was very comprehensive and covered a range of key bioinformatics concepts and tools required to analyse DNA- and RNA-sequencing experiments.

PhD student Ms Alana Whitcombe from the University of Auckland's Department of Molecular Medicine and Pathology, received funding to visit the Telethon Kids Institute at the Perth Children's Hospital in Australia.

"While there, I learned valuable technical skills and expertise relevant to my research," said Alana. "In particular, the use of multiplex bead-based immunoassays in Group A Strep seroepidemiology studies."

"You get a little bit consumed with your own project. So it was great to see a different lab and workspace, and the kind of research others are working on."

The new perspectives Alana brought back were put into practice during the height of New Zealand's COVID-19 response in March/April 2020, for developing COVID serology antibody assays in MWC Principal Investigator Dr Nikki Moreland's lab at the University of Auckland.

The MWC started this contestable programme in 2011 and since that time has supported 56 training opportunities for early and mid-career reseachers. For full details and reports for all our 2019 Category 4 fund recipients, please refer to page 56.

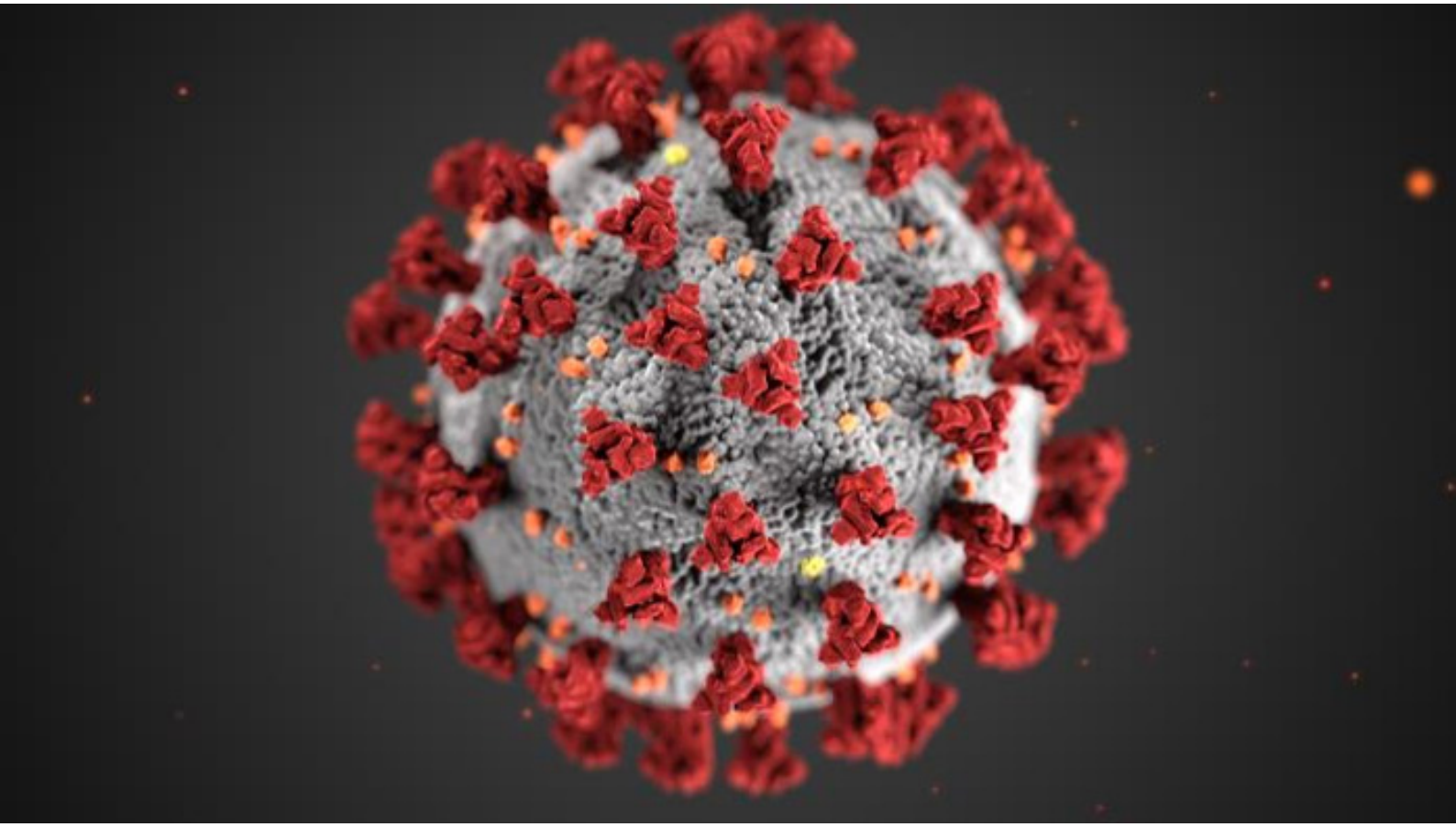


Illustration of SARs-CoV-2 (COVID19)

*Image credit Alissa Eckert, MSMI; Dan Higgins, MAMS*

# Nationwide research flagship takes fight to global viral threats

*A growing network of Maurice Wilkins Centre investigators around New Zealand are collaborating on research to tackle important viral infectious diseases.*

The MWC Virology Flagship research group has grown from strength to strength in recent years and is now a truly national network that has demonstrated agility in pivoting towards new threats.

The Flagship was developed following a national workshop of virology researchers hosted by the MWC in 2016 that identified areas of synergy and complementary world-class research expertise across New Zealand in multiple disciplines – biology, chemistry, structure-based design, manufacture and translation – that could be combined to target viruses. The group secured funding from the MWC Flagship Research Programme in 2018 to support research on direct acting antiviral design, vaccine design, and diagnostics. This has allowed the group to build on existing research programmes by leveraging national and international collaborations that span the antiviral development sphere. Current projects feature several types of viruses - influenza, norovirus, arbovirus and hepatitis B. Within the influenza theme, they are applying structure based methods to identify new antiviral drugs that can block viral replication. They are also utilising novel technologies to design broader, more effective anti-influenza vaccines.

The Flagship is working to develop new antiviral treatments for arboviruses, such as the dengue virus and norovirus, a bug that causes diarrhoea and vomiting, both of which are prevalent in the Asia Pacific region. It also aims to develop an effective antiviral agent for hepatitis B and a vaccine effective in cases of chronic active hepatitis.MWC Virology Flagship leader Professor Kurt Krause, University of Otago, says that the MWC's support for building cross-institutional/multidisciplinary teams has been instrumental in its success in becoming strong and agile across a wide array of core areas- virology, cell culture, medicinal chemistry, structural biology and biochemistry.

The value of having an existing network of experts has been shown recently in response to the COVID-19 pandemic. "Within the cross-collaboration, the teams in place are ready to address their own milestones, but also prepared to tackle emerging viral threats as needed," said Kurt. "Since COVID-19, we have been able to pivot to diagnose, isolate, and grow SARS-CoV-2, test agents against this novel virus and even start working on a COVID-19 vaccine at Otago. Having the Flagship in place greatly accelerated our ability to work together during this crisis."

The Flagship is well placed to contribute to the development of new antiviral drugs with top medicinal chemists on board from the University of Auckland and the Ferrier Institute at Victoria University of Wellington, which can then be tested at the University of Otago. One of the current potential antiviral drugs that is being studied for use against COVID-19 is galidesivir, which was designed and first synthesised by Professor Peter Tyler at the Ferrier Institute.

In 2019 the group received a MBIE Endeavour Fund grant towards the 'New Frontiers in Antiviral Development project' that aims to develop new classes of antiviral drugs. "There are a lot of viruses out there for which there's no treatment," said project leader Professor Vernon Ward, MWC Associate Investigator from the University of Otago. "On top of that, just like you talk about antimicrobial resistance from bacteria, we get antiviral resistance from viruses. So you generally need combination therapy or a range of antiviral options."

The collaborations fostered within the MWC Virology Flagship network will be vital for future success in the development of new antiviral drugs, vaccines and diagnostics.

MAURICE WILKINS CENTRE
FOR MOLECULAR BIODISCOVERY



# Outreach

## International engagement

The Maurice Wilkins Centre (MWC) is actively building international links for New Zealand biomedical science. As a national Centre of Research Excellence it is in a unique position to represent New Zealand on the global stage, providing a crucial connection between local and international researchers. In addition to investigators' links with scientists, laboratories and companies overseas (see pages 83 and 88), the Centre is building strategic relationships with institutions and government agencies at city, provincial and national level, in particular in the Asia-Pacific region.

### 2019 MWC-GIBH Joint Symposium

Maurice Wilkins Centre researchers gathered with a visiting delegation of scientists from the Guangzhou Institutes of Biomedicine and Health (GIBH), Chinese Academy of Sciences, for a joint symposium in Auckland on the 4th December.

The long-standing relationship between the MWC and GIBH has seen many visits and exchanges over the past several years, the establishment of a joint centre, joint projects, intellectual property and joint symposia. This was the second joint research symposium between the two institutions with the first being held in Guangzhou in November 2018.

The symposium featured research presentations of current work from GIBH's nine Principal Investigators led by Director General Prof Xinwen Chen, and 12 investigators from MWC including Professors Rod Dunbar, Peter Shepherd, Dame Margaret Brimble, Greg Cook, and Gavin Painter, Associate Professors Alan Davidson, Roslyn Kemp, Goetz Laible, Kerry Loomes, and Bjorn Oback, and Drs Anna Brooks and Robert Weinkove.

As part of the visit to New Zealand, two members of the GIBH delegation, Professors Liangxue Lai and Donghai Wu, also visited AgResearch in Hamilton where they had further meetings with Associate Professors Laible and Oback discussed potential scientific collaboration in the generation of disease models with complementary skills from each institution.

Other members of the delegation visited Wellington and attended the MWC's annual research symposium held at the Victoria University of Wellington on the 6th December. They also visited the Malaghan Institute of Medical Research to learn more about the successful CAR-T immunotherapy clinical trial, a collaboration between GIBH Principal Investigator Professor Peng Li and MWC investigators Professor Ian Hermans and Dr Robert Weinkove from the Malaghan Institute. This collaboration was initiated through the MWC-GIBH relationship.

*GIBH Deputy Director Professor Guangjin Pan with MWC Director Professor Rod Dunbar*

## Engagement with China

The MWC continued its programme of engagement with China in 2019,building on relationships initiated over 2012 to 2018:

- March: New Party Secretary of Guangzhou Institutes of Biomedicine and Health (GIBH), Chinese Academy of Sciences, Professor Ziyuan Duan and Principal Investigators, Professors Donghai Wu and Yong Xu visited MWC and met with MWC Director Professor Rod Dunbar. Discussion covered the construction progress of the Guangdong Provincial Laboratory in GIBH, possibilities of setting up a joint PhD programme, as well as plans for the MWC-GIBH annual joint symposium in late 2019.
- March: MWC Deputy Director Professor Peter Shepherd and Principal Investigator Professor Debbie Hay travelled to Shanghai to attend the 2019 Queenstown Molecular Biology (QMB) Meetings on the 21st -22nd March as invited speakers. This conference is the spring version of QMB New Zealand and has brought thousands of attendees from more than 30 countries and regions together every year for the past 7 years, since it was launched as part of the Sino-New Zealand collaboration in science and technology in 2013.
- March: On the 27th, a senior medical delegation of 18 people from China's leading hospitals visited MWC with the purpose of learning about the operations and research expertise of the Centre, particularly in the cancer field. The visit was hosted by Professor Rod Dunbar at the Faculty of Medical and Health Sciences (FMHS) of University of Auckland (UoA). The meeting included presentations to the delegation by Professor Dunbar, Associate Professor Jeff Smaill, Professor Bill Denny, Dr Ben Lawrence, and Dr Sanjeev Deva. The visit ended with a brief tour to the Auckland Cancer Society Research Centre (ACSRC) led by Professor Denny.

- April: MWC Principal Investigator Professor Greg Cook was invited to Guangzhou Jinan University (JNU), one of the prestigious “211” or “double first class” universities in China, by Professor Ke Ding, Dean of Pharmacy. Prof Cook was invited to deliver a 2-hour presentation to a wide audience from the school under the special theme of “Frontiers of Drug Discovery and Technologies” as part of a lecture series on “Frontiers of Pharmaceutical Sciences”. The lecture introduced topics on tackling drug-resistant tuberculosis and using green antimicrobials for agritech applications.
- May: MWC hosted an official visit of six top-level leaders from JNU on the 13th May at the University of Auckland. The delegation was led by President Professor Xianzhong Song and included the Dean’s of Pharmacy and Science and Technology, and three other senior research leaders. MWC leading investigators, including Professor Rod Dunbar, Professor Peter Shepherd, Professor Garth Cooper, and Associate Professors Adam Patterson and Jeff Smaill attended the meeting and welcomed the delegation.
- This visit was based on the long-standing relationship between MWC and the previously mentioned Professor Ke Ding, and the successful establishment of the International Joint Laboratory for Traditional Chinese Medicine Modernization and Innovative Drug Design between UoA and JNU. MWC is a key international partner of this joint laboratory, and MWC Principal Investigators, Professor Rod Dunbar and Professors Garth Cooper and Greg Cook are serving on its Academic Advisory Board.During the visit, President Song expressed JNU’s wish to continue and expand the current collaboration.
- The JNU delegation also travelled to Dunedin on the 14th May, to visit MWC investigators at the University of Otago. A MoU was signed between the two universities based on Professors Cook and Ding’s joint research on Tuberculosis.
- May: Guangzhou City Party Secretary Shuofu Zhang, accompanied by a delegation from the Guangzhou Municipal Science and Technology Bureau and Guangzhou Foreign Affairs Office, visited the MWC on the 20th. Professor Rod Dunbar and Mr Peter Lai hosted the visit, with discussion focussed on MWC’s strong collaborations and achievements with scientific colleagues in Guangzhou.
- May: On the 22nd, Professor Liangxue Lai from GIBH, who is one of China’s leading experts in gene editing large animals, visited MWC and gave a seminar to MWC investigators in related fields, including Professors Rod Dunbar and Russell Snell and the members of their research groups. Associate Professor Goetz Laible from AgResearch also travelled from Hamilton to meet with Profesor Lai. Discussions after the seminar explored new opportunities for collaboration.
- August: A delegation from Guangdong Pharmaceutical University (GDPU), one of the three Pharmaceutical Universities in China, visited MWC on the 12th August to explore opportunities for collaboration. It was led by six leaders including Party Secretary Professor Sheng Liu, Director of Science and technology office Professor Quan Yang, Dean of Pharmacy Professor Xiangjiu He, and Dean of Life Science Professor Rongxin Zhang. Professor Peter Shepherd, MWC Principal Investigator Professor Bill Denny, and Associate Dean of FMHS Professor Andrew Shelling took the lead in hosting the meeting and discussion attended by MWC investigators Associate Professors Alan Davidson, Rinki Murphy and Jeff Smaill, and Dr Jack Flanagan.
- October: A joint research grant application between MWC and GIBH was officially announced as being successful. This application is between MWC Associate Investigator Associate Professor Kerry Loomes and GIBH Principal Investigator Professor Donghai Wu, based on their joint project “Targeting CGRP Receptor: Studying its Mechanism of Action in Browning of White Adipocytes and Developing New Weight Loss Strategies and Therapeutics”. This 3-year special fund (2020-2022) is provided by the Guangdong Provincial Science and Technology Department for international cooperation projects between China and key overseas countries including New Zealand.

## European Commission meeting

On the 30th of July, the MWC hosted Mr Jean-Eric Paquet, the Director-General for Research and Innovation, European Commission (EC), to discuss how the MWC could be involved in fostering European Union (EU) -New Zealand cooperation in the research and innovation sector. Mr Paquet was accompanied by Mr Peter Saktor (Head of Trade and Economic Section, EU and EC), Ms Carmela Cutugno (Policy Officer for the Delegation of the EU to New Zealand) and Mr Peter Bartlett (Counsellor for Science and Innovation, NZ Mission to the EU). They were met by MWC Director Professor Rod Dunbar along with MWC investigators Professor Bill Denny, and Associate Professors Shaun Lott, Adam Patterson and Jeff Smaill, who together presented an introduction to Centre and an overview of projects underway with EU partners.  A number of areas of common interest were identified for potential future cooperation.

## Industry engagement

Maurice Wilkins Centre investigators support innovation in the biotechnology and drug development sector by providing companies with the expertise and facilities that their research and development programmes require. MWC investigators also provide consultancy to industry as described on page 88.

In 2019, MWC investigators provided expertise and/or facilities to:

- **Allergan Pharmaceuticals**

Allergan, headquartered in Ireland, is a global pharmaceutical company with a focus on developing new medicines in critical therapeutic areas. Associate Investigator Associate Professor Kerry Loomes from the University of Auckland is working with Allergan to develop new therapeutic strategies to combat metabolic disease.

- **Auckland Clinical Studies Ltd.**

This company provides Phase I and II clinical research to local and international pharmaceutical and biotechnology companies. In 2019 Maurice Wilkins Centre investigators Professor Rod Dunbar, Dr Anna Brooks and Dr Vaughan Feisst continued to work with Auckland Clinical Studies, providing analytical services such as immune monitoring to support ongoing clinical trials sponsored by a major pharmaceutical company.

- **Avalia Immunotherapies Ltd.**

Avalia Immunotherapies is developing immunotherapies that support the treatment of cancers and other diseases. Investigators Professor Gavin Painter from the Ferrier Research Institute and Professor Ian Hermans from the Malaghan Institute of Medical Research have patented a new immunotherapy technology and are working with Avalia Immunotherapies to further advance the technology and progress it to clinical trials.

- **Comvita**

Comvita New Zealand is an international natural health products company with offices across Asia, the USA and the UK. Comvita are working with investigators Professor Dame Margaret Brimble and Associate Professor Kerry Loomes to identify the active components and biomarkers present in Manuka honey components and biomarkers present in Manuka honey.

- **Connovation Ltd.**

This company is based in Auckland and undertakes research, development and manufacture of invasive animal pest control technologies. The company aims to develop smarter pest control products which are humane, cost effective and more specifically targeted to pest species. Maurice Wilkins Centre investigator Professor Dame Margaret Brimble is working with the company on developing new molecules as humane rodenticides to replace the widely used but controversial pesticide 1080.

- **Living Cell Technologies Ltd.**

Living Cell Technologies (LCT) is biotechnology company, historically-focussed on cell therapy for diabetes. Numerous MWC investigators are sought by LCT for their expertise and to carry out contract research, including Professor Debbie Hay (Auckland), Professor Dame Margaret Brimble and Associate Professors Alexander Tups (Otago) and Kerry Loomes (Auckland).

- **Rain Therapeutics**

Rain Therapeutics is a company based out of the United States which aims to develop targeted

cancer therapies. It has secured funding for Phase II clinical trials of the hypoxia-activated pro-drug, Tarloxotinib, which was invented by Associate Professors Adam Patterson and Jeff Smaill. These MWC Investigators continue to provide expertise and consult with Rain Therapeutics regarding this research. In 2019, Associate Professors Patterson and Smaill also served as members of the companies Scientific Advisory Board.

- **SapVax LLC.**

Sapvax LLC was founded in 2016 and is developing a pipeline of products for the treatment of different cancers, with an initial focus on tumours expressing NY-ESO-1. Professors Dame Margaret Brimble and Rod Dunbar are the academic founders of this company, which is headquartered in the USA, and in 2019 they continued to consult and carry out contract research for the company.

- **Upside Biotechnologies**

Upside Biotechnologies, founded by a group including MWC Principal Investigator Rod Dunbar, grew human skin in the laboratory to replace skin lost in severe burns. The work was a spin off a project by Professor Dunbar and MWC Investigator Dr Vaughan Feisst. After operating for over 3 years, Upside Biotechnologies closed at the end of 2019.

In addition to these examples above, Maurice Wilkins Centre investigators have established a variety of other relationships with companies and non-profit organisations that drive the translation of their research and expertise into new approaches to fight human disease.

## Science education

Supporting high-quality science education in New Zealand schools not only encourages the next generation of scientists but also helps others to understand and value science.

Since 2012 the Centre has supported a very popular programme of free teacher professional development days, running 43 workshops at 21 different venues from Kaitaia to Invercargill. No workshops were held in 2019 however the Centre looks forward to resuming these popular workshops in 2020.

In 2019 the Maurice Wilkins Centre supported the following science education initiatives;

- **'Sugar in Schools' study**

  The MWC 'Sugar in Schools' study was launched in July 2017, with the aim to investigate the variation in fructose absorption in a healthy population. This study, led by Professor Peter Shepherd was coordinated by high school biology teacher Ms Crystal Gerring, who took over in 2019 from Ms Helen Webber. In 2019, Ms Gerring ran the study in 13 schools around New Zealand with participation of over 780 students.

  External grants funded further testing in additional schools, conducted by Mr Conor Watene-O'Sullivan, Mr Corbin Whanga and Ms Jess Jones of the Moko Foundation, and Dr Ofa Dewes from the University of Auckland. The Moko Foundation group conducted the study with over 350 additional students across several schools in 2019, including Maori immersion schools.

  Overall, the study has now involved over 2700 students across the country since its inception and has been well received by the participating schools. There is a long waiting list of schools wanting to participate in the study for the first time, as well as schools that have previously participated and want to run the study again with new students or conduct follow-up measurements.

- **Maurice Wilkins Centre biology teacher development scholarships**

  In 2019 the MWC provided sponsorship for scholarships for high-school biology teachers to attend the Queenstown Research Week in early September. The scholarships give New Zealand teachers the opportunity to attend an international conference on contemporary biological research and to network with colleagues and practising biologists from around the world. Recipients of the awards in 2019 were; Deborah Taylor from Havelock North High School, Ilze Jacobs from Otahuhu College and Penelope McComb from Te Kura.


*Maurice Wilkins Centre biology teacher development scholarships receipients (l-r): Penelope McComb, Deborah Taylor and Ilze Jacobs.*

## Public engagement

The Maurice Wilkins Centre actively engages with the public by sharing news of its research successes and by providing commentary on topical scientific issues. MWC investigators communicate with New Zealanders through the news media, public lectures and presentations, and through school visits.

In 2019, MWC investigators were involved in public events and national and regional media coverage on a variety of scientific topics. Examples of public engagement activities include:

- **Tātai Oranga: Joining forces to tackle metabolic conditions**

The third annual Tātai Oranga meeting, organised in partnership with Ngāti Porou Hauora, was held at Korou Kore Marae in Ahipara on the 9th and 10th of March.

The meeting kaupapa was to bring together scientists, researchers and clinicians from New Zealand and overseas to meet with communities to discuss and develop strategies for how to use cutting edge medical and genetic research to improve health outcomes for Māori and Pacific peoples.

The 2019 hui featured presentations by leading scientists and clinicians in the field of metabolic disease, including international speakers Dr Giles Yeo (Cambridge University) and Dr Keolu Fox (University of California, San Diego), as well as talks from numerous MWC investigators and students.

The event also provided the opportunity for attendees to visit the Waharoa ki te Toi Research Centre at Kaitaia Hospital, a Centre established in partnership between The Moko Foundation and the Maurice Wilkins Centre.

This meeting was a great success with over 70 attendees from a range of organisations including representatives of the Korou Kore Marae and Ngāti Porou Hauora, universities, research institutions, public health and community groups.

- **'Hitting the sweet spot': June 2019 NZ Listener article**

A feature article 'Hitting the sweet spot' appeared in the print version of the NZ Listener, on 29 June 2019, and was subsequently published online in two parts entitled 'Busting the fat myths: How new research will revolutionise Māori and Pacific health' and 'The students learning how diet choices affect their microbiome', on 4 July 2019. The articles covered our genetics in diabetes research programme, investigating the extent to which certain individuals and populations, in particular Māori and Pacific people, may be at greater risk of developing metabolic disorders than others.

The article also provided an insight to the 'Sugar in school' programme- an ongoing collaborative study between the MWC and the Moko Foundation which aims to understand how children in New Zealand vary in their ability take up fructose.

- **Utilising genetic profiles for tailored disease treatment**

Professor Peter Shepherd was interviewed in April 2019 on Dateline Pacific (RNZ), to discuss the research conducted by Maurice Wilkins Centre scientists which aims to utilise our understanding of how specific genetic variants can contribute to disease formation, to tailor an individual's disease treatment based of their genetic profile. This work, which is being done in conjunction with Pacific Health Plus, has significant focus on Maori and Pacific people due to their health disparities for diseases like diabetes.

- **Māori and Pacific specific gene variant linked with increased height**

A New Zealand Herald article was published in September 2019 that focused on a recent publication by several MWC principal and associate investigators which found a common variant found in Māori and Pacific people in the CREBRF gene was linked with increased height. The piece featured interviews from MWC Principal Investigators Associate Professor Rinki Murphy (University of Auckland) and Professor Tony Merriman (University of Otago), along with Ngati Porou Hauora's deputy chair, Huti Puketapu-Watson.

- **Other engagement through the media and events**

Many MWC investigators engaged with the public through the media and some examples of this include;

New Zealand Doctor published a media release in April 2019 on the joint project between the Maurice Wilkins Centre and Pacific Health Plus (located in Porirua), which will focus on the health disparities in Pacific people predisposing them to heart disease, diabetes and obesity.

Dr Robert Weinkove, MWC Associate Investigator and Clinical Director of the Malaghan Institute, gave a TEDx talk in June 2019 titled "CAR-T Cell Therapy: Reprogramming the immune system to treat cancer" in Tauranga, outlining the development and function of cancer immunotherapies.

Professor Peter Shepherd was interviewed on the AM Show in October 2019 to discuss inequities in bariatric surgery access for Pacific people. The interview focused on the benefits of bariatric surgery for weight loss, and the access issues faced by Pacific people leading to high dropout rates in comparison to other groups. The interview highlights the barriers faced by Pacific people within the hospital system. The interview was also published online on the 31st of October.

Professors Bill Denny and Greg Cook, from the University of Auckland and the University of Otago, respectively, were interviewed for a press release featured on SCOOP discussing their contributions to an innovative new drug candidate for treating tuberculosis.

MWC investigators are often invited to give talks or run workshops with secondary school students, allowing students to become engaged with the scientific work currently underway in New Zealand. In 2019, Dame Professor Margaret Brimble gave the talks "Life as a Medicinal Chemist' and 'Women in Medicinal Chemistry' at Epsom Girls Grammar and Baradene College ,respectively.  Dr Bridget Stocker, from Victoria University of Wellington, gave a presentation to students and teachers visiting the University. In addition, several University of Auckland MWC investigators were involved with the 2019 Rotary National Science and Technology Forum, including Professor Poul Nielsen, Associate Professor Jane Allison and Dr Vinod Suresh.

# Supporting the New Zealand science community

## Research symposium and workshops

- **Maurice Wilkins Centre Research Symposium**

The 2019 MWC Research Symposium was held on the 6th of December at Victoria University of Wellington. The Symposium commenced with presentations from the leaders of the three research themes, overviewing progress of key MWC projects to date. This was followed by sessions profiling a cross section of investigators, who were invited to discuss their research in the context of the present and future directions of MWC research.

The day ended with a strategy forum for senior MWC investigators, where the focus was on the CoRE rebid.

The symposium was popular with over 150 registered attendees, including guests from the Ministry of Business, Innovation and Employment and from the Guangzhou Insttitute of Biomedical Sciences.

The previous day, the MWC early career steering group organised an extremely successful Future Science Day symposium. This event featured talks from early career investigators who received MWC funding, and offered the first 'Dragons Den' funding round. For futher details see page 55.

- **Telling your Research Story: Writing for Publications, Grants and Press**

The MWC Early Career Steering Group developed and hosted two comprehensive workshops in 2019 designed to help MWC investigators enhance their writing and storytelling skills, which are key to a successful academic career.

The workshops, held in Dunedin on the 12th August and in Auckland on the 14th August, featured talks by local researchers experienced in writing and reviewing publications, grants and media stories. They also included an overview of publication strategies for early career researchers and presentations from local research advisors on how to make the most of grant applications.

Each workshop also featured a special guest with a lecture from award-winning author and filmmaker Professor Lloyd Davis on 'Creative scientific writing' (in Dunedin) and an interactive session facilitated by awarded author Professor Helen Sword on "Stylish academic writing" (in Auckland).

The feedback from participants at both workshops was very positive. Many reported that they came away with a variety of helpful strategies on how to structure a paper and communicate their research more effectively.

- **MWC Commercialisation workshop**

The MWC hosted a full-day workshop at Victoria University of Wellington on the 22nd February with the aim of introducing early career researchers to science commercialisation pathways in biotechnology. The workshop programme was developed by Ms Marina Rajic, a member of the MWC Early Career Steering Group, Prof Rod Dunbar, MWC Director, and Ms Evelyn Body from Auckland UniServices.

The workshop featured talks and panel discussions with experts in IP and commercialisation from several institutions, including a number of MWC investigators who have founded biotechnology companies. Over the day speakers outlined the process from discovery to market, covering issues such as how to protect intellectual property, where to find early stage 'seed' support, and the different pathways to market, including the basics of how to start up new companies and fund their growth.

The workshop was attended by 50 investigators, who also worked in groups during the afternoon to come up with their own commercialisation plans which they then presented to the workshop. Feedback from attendees was positive, with support for running similar workshops in the future.

- **MWC Technology Workshop**

The centre aims to hold workshops which are designed to inform investigators about the technologies and facilities that are available across New Zealand, the most recent applications of the technology and give investigators information on how they could use the technology in their own research space.

- CRISPR workshop – 2nd September in Queenstown

The MWC Early Researcher Steering Group hosted a workshop during Queenstown Research Week on CRISPR Cas 9 technology. The workshop covered the basics of the technology as well as advanced applications and new Cas-based technologies. Holding this workshop at Queenstown Research Week made good use of having many MWC investigators and experienced speakers in the same location at one time and enabled committee members to connect with other early career researchers in the field.

## The Maurice Wilkins Centre NZIC Prize for Excellence in Chemical Science

The New Zealand Institute of Chemistry awarded the 2019 Maurice Wilkins Centre Prize for Excellence in Chemical Science to Professor Justin Hodgkiss from Victoria University of Wellington.

Justin is a Professor of Chemistry at Victoria University of Wellington, and Co-Director of the MacDiarmid Institute CoRE. His research group's area of interest is developing advanced materials for next-generation biosensors and solar cells, including understanding photo-physical processing using optical spectroscopy and bio-template assembly of organic semi-conductors.

## Conferences, meetings and organisations

Scientific conferences, meetings and networks are important fora to share knowledge and form

collaborative relationships. In addition to the Symposia and workshops that the Centre and its investigators convene, the Maurice Wilkins Centre supports national and international scientific meetings held in New Zealand and sponsors speaking slots at international conferences that help to raise the profile of New Zealand science.

In 2019 the Maurice Wilkins Centre provided support for:

- **Queenstown Research Week**

  This is the largest annual science event in New Zealand. In 2019 this event was held in September and generally attracts over 1500 registrations for the twelve individual scientific meetings held over the course of the week. These included the Queenstown Molecular Biology Meeting and satellite meetings focussed on cancer, drug discovery, stem cells and regenerative medicine, heart disease, genomics, diabetes, cell communications and plant biology.

  The MWC is a premier academic sponsor for this event that provides an important opportunity for Centre investigators to meet and hear about some of the latest national and international research. This year the MWC provided sponsorship for two new events held at QRW; Te Whanaketanga Pūtaiao Maori, a one-day workshop highlighting the increasing presence of Māori in contemporary scientific research and the National Biomedical Research Infrastructure Summit, where researchers across the country discussed the difficulties in getting access to cutting edge equipment to allow them to stay globally competitive.

  The Centre also provides sponsorship for New Zealand secondary school teachers to attend the Queenstown Molecular Biology meeting (See page 35)

- **Australasian Virology Society Conference**

  The Australasian Virology Society held its 10th biennial meeting (AVS10) in Queenstown from the 2nd- 5th of December. The meeting was attended by leading

  researchers from around the world and showcased basic translational and clinical virology. This meeting provides researchers with an opportunity to discuss a range of issues related to viral disease, including new disease threats and ways to control them. The MWC provided sponsorship for a student award at this conference.

- **Asian Conference on Transcription**

  The 16th Asian Conference on Transcription was held in Dunedin from 1st-4th December, and was convened by MWC investigators Professor Julia Horsfield and Dr Justin O'Sullivan. More than 100 delegates attended the conference, which included sessions on genetic and epigenetic mechanisms of gene transcription in prokaryotes and eukaryotes, chromatin structure, cancer biology, antimicrobial resistance, developmental biology, and genomics. The MWC provided sponsorship towards student prizes at this conference.

- **NZ Society for Oncology Conference 2019**

  The New Zealand Society for Oncology Conference 2019 was held in conjunction with the NZNO Cancer Nurses College and Cancer Trials New Zealand in Wellington on the 25th and 26th of October. The conference featured the best of fundamental and clinical cancer research presented by leading national and international speakers. The MWC provided sponsorship for student prizes.

# Service

Maurice Wilkins Centre investigators support both the national and international science communities through service in leadership roles and on many advisory boards and panels.

**National roles**

In 2019, Maurice Wilkins Centre investigators served in advisory and governance roles in many New Zealand organisations including;

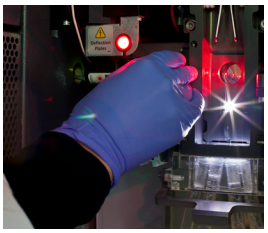
- Auckland Medical Research Foundation
- Auckland Regional Tissue Bank
- Australasian Proteomics Society
- Australasian Society for Biophysics
- Australia and New Zealand Bone and Mineral Society
- Australia and New Zealand Society for Immunology
- Cancer Society of New Zealand
- Cancer Research Trust
- Canterbury Society Tissue Bank
- Diabetes Auckland
- Freemason Roskill Trust
- Health Research Council of New Zealand
- Kea World Class NZ Awards Selection Panel
- Leukaemia & Blood Cancer New Zealand
- L'Oreal-UNESCO Women in Science Fellowships in Australia and New Zealand
- Melenoma Network of New Zealand (MelNet)
- Ministry of Business, Innovation and Employment
- Ministry of Health
- Ministry of Primary Industries
- Neurological Foundation of New Zealand
- New Zealand eScience Infrastructure
- New Zealand Institute of Chemistry
- New Zealand Microbiological Society
- New Zealand Microbiology Network
- New Zealand Organisation for Rare Diseases
- New Zealand Society for Oncology
- New Zealand Society for the Study of Diabetes
- New Zealand Society of Endocrinology

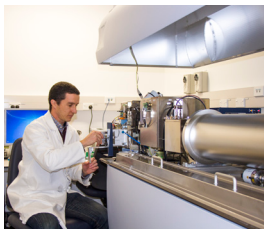
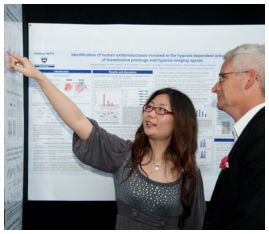
- Physiological Society of New Zealand
- Queenstown Molecular Biology Society (Queenstown Research Week)
- Royal Society of New Zealand
- Synthetic Biology Australasia
- Te Manawa Museum of Art, Science and History
- Tertiary Education Committee
- The Australasian Society of Clinical and Experimental Pharmacologists and Toxicologists
- The Physiological Society of New Zealand

## International roles

In 2019, members of the Maurice Wilkins Centre served in more than 160 advisory, editorial and governance roles in international organisations based in the United States of America, Australia, the United Kingdom, Belgium, Canada, France, Germany, Japan, Singapore and Switzerland.

MAURICE WILKINS CENTRE
FOR MOLECULAR BIODISCOVERY



# Organisational development

## Flagship research programme

The MWC Flagship programme enables MWC investigators to bring together nationally-integrated collaborative teams to accelerate multi-disciplinary research with potential for clinical impact.

In 2019, the Centre supported six ongoing Flagship research programmes;

- Addressing antimicrobial resistance
- Group A streptococcus
- Immuno-oncology
- Using genetic risk for metabolic disease to understand disease mechanisms and guide treatment
- Antivirals, vaccines and molecular tools for viral pathogens
- Therapeutics for metabolic disease

The MWC provides support for Flagship teams to meet regularly, with 11 Flagship meetings held in 2019. These meetings often include all research staff and students working on the particular Flagship programme which provides emerging researchers with opportunities to gain wider knowledge of their research area.

## Flexible research programme

One of the Maurice Wilkins Centre's main objectives is to encourage collaborations between investigators from different scientific disciplines, achieved through the contestable Flexible Research Programme.

Two rounds of this programme were held in 2019; in April and September. Three categories of support were open for applications from MWC investigators in 2019; new initiatives involving postgraduate students, access to specialised facilities and equipment and access to specialised international facilities and training (see page 56 for details).

A process to review applications under $10,000 in value on a continuous basis was continued in 2019. This has proven to be an effective way of enabling MWC investigators to take advantage of new opportunities more quickly with 23 applications being awarded support through this process in 2019.

### Inter-disciplinary PhD training

The Maurice Wilkins Centre fosters new interdisciplinary collaborative research involving Centre investigators by supporting fully funded PhD student projects that will also promote progress in scientific areas of importance to the MWC.

A total of 24 PhD students have been awarded scholarships through this training programme

since 2015 with 17 students continuing study in 2019. Two of these students completed their PhD study by the end of 2019, with a further 4 students submitting their PhD thesis by the end of 2019.

The two students who completed their PhD study in 2019 were:

- **Dr Sean Bisset** (Massey University). *Understanding the mechanism of action of the glycosylated bacteriocin glycocin F* (Supervisor: Associate Professor Gillian Norris)
- **Dr Benjamin Lu** (University of Auckland): S*ynthesis and Biological Evaluation of Novel TLR2 Agonist-Conjugated Antigenic Peptides for use in Cancer Therapeutics* (supervisor: Professor Dame Margaret Brimble)

### New initiatives involving post-graduate students

The Maurice Wilkins Centre supports new collaborative research involving MWC investigators by providing working expenses for new interdisciplinary postgraduate student projects that also promote progress in scientific areas of importance to the MWC.

Twelve projects awarded funding in previous years were ongoing in 2019 and 22 new projects were awarded working expenses in 2019 (**project leader, host institution and student names are in bold**):

- Development of new synthetic biological tools for cloning and expression of antibiotic biosynthetic gene clusters from microbial genomes; **Jeremy Owen,** Peter Fineran, **Peng Hou**, **Victoria University of Wellington.**
- Long non-coding RNAs as new drivers of metastasis in colorectal cancer; **Sarah Diermeier**, Rachel Purcell, Sebastian Schmeier. Mike Eccles, **Kathleen Lucere, University of Otago.**
- Investigating a novel mechanism of gatekeeper inhibition in protein kinases; **Christopher Squire**, Jeff Smaill, Adam Paterson, **Andra Popa, University of Auckland**.
- Investigating RNase HI as a target for novel anti-bacterial co-therapy; **Shaun Lott**, Stephanie Dawes, Greg Cook, Abeer-Al-Zubaidi, **Evie Mansfield, University of Auckland**.
- Understanding the role of TAp63 and the IL-6 -174 G/C (rs1800795) promoter variant in metabolism; **Troy Merry,** Nicholas Fleming, Peter Shepherd, **Lauren Watson, University of Auckland.**
- The use of WGS to describe the molecular epidemiology of TB in NZ; **Greg Cook,** Vic Arcus, Cris Print, Sally Roberts, Htin Aung, **Veronica Playle, University of Otago.**
- Regulatory T cell populations in colorectal cancer – mechanisms of anti-tumour effects; **Roslyn Kemp,** John McCall, Mik Black, Sam Norton, Hamish Angus, Luis Munoz-Erazo, Kirsten Ward-Hartstronge, **Jessica Harte, University of Otago**.
- Fine tuning of gene expression using genome editing to improve the cancer-targeting function of primary human immune cells; **Hilary Sheppard**, Rod Dunbar, Sarah Meidinger, **Chloe Potts, University of Auckland.**
- Adapting DNA-based inhibitors to cellular studies; **Vyacheslav Filichev**, Elena Harjes, **Harikrishnan Mohana Kurup, Massey University.**
- Genetic characterisation of drug resistant *M. tuberculosis* to guide the therapeutic exploitation of collateral susceptibilities; **Matthew McNeil**, Htin Aung, Greg Cook. Philip Hill, James Ussher, Sally Roberts, **Natalie Waller, University of Otago.**
- Cardiomyocyte fructose metabolism in diabetes; **Kim Mellor**, Troy Merry, Tony Hickey, **Marco Annandale, University of Auckland.**

- Identifying candidate genes of antimicrobial tolerance in *Enterococcus faecalis*; **Greg Cook**, Jack Flanagan, Rachel Darnell, **Francesca Todd-Rose, University of Otago**.
- Characterising a new mechanism for blocking PI3K; **Jack Flanagan**, Michelle Wilson, Peter Shepherd, Gordon Rewcastle, **Hannah Zhu, University of Auckland**.
- The effect of effector Treg tumour infiltrate on clinical outcome in colorectal cancer; **Roslyn Kemp**, John McCall, Mik Black, Jessica Harte, Sam Norton, Luis Munoz-Erazo, **Janet Rhodes, University of Otago.**
- Exploring the Genomic and Transcriptomic Landscape of the *Mycobacterium tuberculosis* Southern Cross Strain Prevalent in Pacific Communities; **Htin Lin Aung**, Greg Cook, Vic Arcus, Sally Roberts, Veronica Playle, **Jordan Taylor, University of Otago**.
- Effects of a malic enzyme 2 small molecule inhibitor on melanoma; **Kerry Loomes**, Jeff Smail, Peter Shepherd, Tony Hickey, **Cody Mullins, University of Auckland**.
- Kinase inhibition activity of new marine-derived nucleoside isosteres; **Rob Keyzers**, Joanne Harvey, **Joe Bracegirdle, Victoria University of Wellington**.
- Second-generation Hypoxia-activated TDB pro-drugs; **Bridget Stocker**, Bill Wilson, Mattie Timmer, **Ayesha Khan, Victoria University of Wellington**.
- Visualising membrane interference: investigating the mechanism of cytotoxic peptide AN-58; **Margaret Brimble**, Paul Young, Iman Kavianinia, Louise Stubbing, **Johanes Kasim, University of Auckland.**

### Access to specialised facilities and equipment

The Centre provides support for investigators to access specialised facilities and equipment across New Zealand. The scheme is intended to cover the costs of user charges attracted by these facilities or equipment, as well as travel and accommodation necessary to enable MWC investigators to work in facilities away from their host institution.

As part of the development of this scheme, a register of New Zealand facilities and equipment was set up within the members section of the MWC website. Over 95 facilities and items of equipment were registered in 2019. It is intended that MWC investigators use this register as a resource to identify and compare facilities and equipment across New Zealand that they can use for their research.

Twenty five projects awarded funding in previous years were ongoing in 2019 and 24 new applications to this scheme were approved in 2019 (**project leader, host institution and student names are in bold**):

- Whole genome CRISPR/Cas9 screens to identify genes that modulate tolerance to tumour microenvironment stress; T**et-Woo Lee**, Stephen Jamieson, Dean Singleton, Bill Wilson, Cris Print, Stefan Bohlander, **Hanting Yong, University of Auckland**.
- Identification of global targets, molecular pathways and networks in cancers that are regulated by the Δ133p53 isoform family; **Marina Kazantseva**, Antony Braithwaite, Sunali Mehta, **University of Otago**.
- Do Māori and Pacific Specific INSL5 and RXFP4 gene variants modulate blood pressure by regulating renin levels?; **Peter Shepherd**, Vicky Cameron, Rinki Murphy, Kate Lee, Troy Merry, **Hannah Burden, Shalinda Fernando, University of Auckland.**
- Establishing a clinical sample storage system to diabetes flagship; **Troy Merry**, Peter Shepherd, Rinki Murphy, Tony Merriman, **Hannah Burden, University of Auckland.**

- Determining the prevalence of fecal carriage of carbapenemase producing Enterobacteriaceae in healthy persons in selected townships of Yangon region, Myanmar; **James Ussher, Aye Mi San, University of Otago**.
- Does WNT signalling cooperate with cohesin mutation to drive transcription dysregulation in myeloid leukaemia?; **Jisha Antony**, Silke Neumann, Julia Horsfield, **University of Otago.**
- Single-cell gene expression analysis of iPSC-derived beta-like cells to study the underlying mechanisms behind insulin secretion; **Peter Shepherd, Alan Davidson**, Kate Lee, **Jake Oh, University of Auckland**.
- Targeting cysteine biosynthesis in gonorrhoea for new antimicrobial inhibitors; **Joanna Hicks**, Wanting Jiao, Vic Arcus, **Keely Oldham, University of Waikato.**
- Synthesis of a new antibiotic family, the Cadasides and analogues; **Greg Cook**, Paul Harris, Margaret Brimble, **Nadia Kovalenko, University of Auckland.**
- Developing and testing efficacy of modified forms of the MOTS-c peptide to promote metabolic health; **Troy Merry**, Paul Harris, Tony Hickey, Margaret Brimble, **Alex Chan, University of Auckland.**
- CRISPR-Cas9 screens to identify new approaches for treating IDH1 mutant glioma; **Dean Singleton,** Tet-woo Lee, Stephen Jamieson, Bill Wilson, **University of Auckland**.
- RXFP4 variant mouse model: a tool for studying hypertension and metabolic consequence of T6N in Maori and Pacific people; **Kate Lee,** Peter Shepherd, **Shalinda Fernando, University of Auckland.**
- Using LC-MS to understand the impacts of Māori and Pacific genetic variant SLC22A3 T44M on substrate transport in both in vivo and in vitro models; **Peter Shepherd, Claire Wang, University of Auckland.**
- A zebrafish model for DDX11-driven familial haematopoietic malignancy; J**ulia Horsfield, University of Otago.**
- Regulation of gene expression in head and neck cancer under chronic tumour microenvironment stress; **Tet-woo Lee**, Stephen Jamieson, Dean Singleton, **Hanting Yong, University of Auckland.**
- Following the Hyperuricaemic Trail: why the elevated serum urate levels in Pacific peoples?; **Lisa Matisoo-Smith**, Tony Merriman, **University of Otago.**
- The CLR receptor: A new genetic determinant of hypertension in NZ; **Alan Davidson**, Debbie Hay, Tony Merriman, Prasanna Kallingappa, **University of Auckland.**
- Molecular epidemiology of antibiotic resistance of critical pathogens according to the World Health Organization (WHO) priority list, in Samoans in New Zealand and in Samoa; **Philip Hill,** James Ussher, **Lupe Isaia, University of Otago.**
- Pharmacokinetic Characterisation of Perforin Inhibitor Pro-Drugs; **Julie Spicer**, Stephen Jamieson, Jagdish Jaiswal, **University of Auckland**.
- Investigation and Validation of differential DNA methylation associated with type-two diabetes in an NZ Polynesian cohort: confirmation of a sexdifference; **Donia Macartney-Coxson,** Tony Merriman, Mik Black, **University of Otago**.
- Establishing a flow cytometry panel for mouse and human neutrophil populations; **Troy**

**Merry,** Anna Brooks, Rinki Murphy, **University of Auckland**.

- Delivery of amoxycillin into epithelial cells to fight intracellular Group A Streptococcus; **Thomas Proft**, Margaret Brimble, Alan Cameron, David Rennison, Paul Harris, Catherine Tsai, **University of Auckland.**
- Biochemical kinase screening of hypoxia-activated prodrugs and their effectors; **Jeff Smaill, University of Auckland.**
- The Jejunal Microbiome in Type-two Diabetes; **Donia Macartney-Coxson**, Xochitl Morgan, Jeremy Krebs, **Institute of Environmental Science and Research.**

### Support for publication in high quality journals

MWC aims to enable publication in high quality journals by supporting the preparation of new data requested by reviewers or editors, as well as other costs associated with publications. In 2019 support for provided for publication of 'A revised biosynthetic pathway for the cofactor F420 in prokaryotes' in Nature Communications (Bashiri, G., Antoney, J., Jirgis, E.N.M. et al. A revised biosynthetic pathway for the cofactor F420 in prokaryotes. Nat Commun 10, 1558 (2019). https://doi.org/10.1038/s41467-019-09534-x)

# New investigators

## Associate and affiliate investigators

During 2019, 64 new associate investigators were invited to join the Centre, bringing the total number of associate investigators to 249 at the end of the year. The larger than usual number of appointments and promotions was due to a review of the MWC investigator cohort and a number of new investigators joining the Centre in association with the CoRE rebid. In line with the MWC strategy of supporting future leaders, 34 of these new associate investigators were previously MWC affiliate investigators and on review in 2019 had developed their careers to the stage that they were approved for promotion to associate investigators. In addition, 55 postdoctoral and postgraduate students were appointed as affiliate investigators in 2019, with the total cohort numbering over 240.

### New associate investigators appointed in 2019:

- Professor Greg Anderson, Department of Anatomy, University of Otago
- Dr Amir Ashoorzadeh, Auckland Cancer Society Research Centre, University of Auckland
- Dr Jonathan Astin, Department of Molecular Medicine and Pathology, University of Auckland
- Dr Htin Aung, Department of Microbiology and Immunology, University of Otago
- Professor Nicola Brasch, Department of Chemistry, Auckland University of Technology
- Dr Anna Brooks, School of Biological Sciences, University of Auckland
- Dr Rosemary Brown, Department of Anatomy, University of Otago
- Dr Davide Comoletti, School of Biological Sciences, Victoria University of Wellington
- Dr Lisa Connor, School of Biological Sciences, Victoria University of Wellington
- Dr Stephanie Dawes, School of Biological Sciences, University of Auckland
- Dr Ofa Dewes, Molecular Medicine and Pathology, University of Auckland
- Dr Catherine Drummond, Department of Pathology, University of Otago
- Dr Vaughan Feisst, School of Biological Sciences, University of Auckland
- Dr Vyacheslav Filichev, Institute of Fundamental Sciences, Massey University
- Dr Nicholas Fleming, Department of Pathology, University of Otago
- Dr Kiel Hards, Department of Microbiology and Immunology, University of Otago
- Dr Lawrence Harris, Ferrier Research Institute, Victoria University of Wellington
- Dr Joanna Hicks, Faculty of Science and Engineering, University of Waikato
- Dr Samantha Holdsworth, Department of Anatomy and Medical Imaging, University of Auckland
- Dr Teresa Holm, Department of Molecular Medicine and Pathology, University of Auckland
- Dr Sue Huang, Institute of Environmental Science and Research
- Dr Matloob Husain, Department of Microbiology and Immunology, University of Otago
- Dr Karl Iremonger, Department of Physiology, University of Otago
- Associate Professor Keith Ireton, Department of Microbiology and Immunology, University of Otago
- Dr Chris Jackson, Department of Medicine, University of Otago

- Dr Simon Jackson, Department of Microbiology and Immunology, University of Otago
- Dr Wanting Jiao, Ferrier Research Institute, Victoria University of Wellington
- Associate Professor Peter Jones, Department of Physiology, University of Otago
- Associate Professor Rajesh Katare, Department of Physiology, University of Otago
- Associate Professor Bronwyn Kivell, School of Biological Sciences, Victoria University of Wellington
- Dr Sharon Ladyman, Department of Anatomy, University of Otago
- Dr Regis Lamberts, Department of Physiology, University of Otago
- Dr Ries Langley, Department of Molecular Medicine and Pathology, University of Auckland
- Dr Annette Lasham, Department of Molecular Medicine and Pathology, University of Auckland
- Dr Megan Leask, Department of Biochemistry, University of Otago
- Dr Kate Lee, Department of Molecular Medicine and Pathology, University of Auckland
- Dr Euphemia Leung, School of Medical Sciences, University of Auckland
- Dr Ivanhoe Leung, School of Chemical Sciences, University of Auckland
- Associate Professor Dong-Xu Liu, School of Science, Auckland University of Technology
- Dr Jacelyn Loh, Department of Molecular Medicine and Pathology, University of Auckland
- Associate Professor Jun Lu, Faculty of Health and Environmental Sciences, Auckland University of Technology
- Professor Lisa Matisoo-Smith, Department of Anatomy, University of Otago
- Dr Brya Matthews, Department of Molecular Medicine and Pathology, University of Auckland
- Dr Matthew McNeil, Department of Microbiology and Immunology, University of Otago
- Dr Sunali Mehta, Department of Pathology, University of Otago
- Dr Jennifer Miles-Chan, School of Biological Sciences, University of Auckland
- Dr Andrew Muscroft-Taylor, Callaghan Innovation
- Dr Yoshio Nakatani, Department of Biochemistry, University of Otago
- Dr Anna Pilbrow, Christchurch Heart Institute, University of Otago
- Dr Rachel Purcell, Department of Surgery, University of Otago, Christchurch
- Dr Shakila Rizwan, School of Pharmacy, University of Otago
- Dr Euan Rodger, Department of Pathology, University of Otago
- Associate Professor Bruce Russell, Department of Microbiology and Immunology, University of Otago
- Associate Professor Daryl Schwenke, Department of Physiology, University of Otago
- Dr Dianne Sika-Paotonu, Department of Pathology and Molecular Medicine, University of Otago, Wellington
- Dr Dean Singleton, Molecular Medicine and Pathology, University of Auckland
- Dr Tania Slatter, Department of Pathology, University of Otago
- Dr Jonathan Sperry, School of Chemical Sciences, University of Auckland

- Dr Hamish Sutherland, Auckland Cancer Society Research Centre, University of Auckland
- Dr Andrea Vernall, School of Pharmacy, University of Otago
- Dr Logan Walker, Department of Pathology, University of Otago, Christchurch
- Associate Professor Clare Wall, Department of Nutrition, University of Auckland
- Dr Wenhua Wei, Department of Women's and Children's Health, University of Otago
- Dr Lyn Wise, Department of Microbiology and Immunology, University of Otago

### Clinical associates

The MWC investigator cohort includes practising clinicians with clinical challenges and ideas being actively promulgated through the MWC's research programmes. The Clinical Advisory Board, made up of ten of NZ's leading clinician-scientists, also provides clinically-focused review of our research programmes and enables new collaborations between MWC and other clinicians within their clinical networks.

In October 2019, the MWC provided support for Principal Investigator Associate Professor Rinki Murphy to facilitate a combined meeting of diabetes, cardiology and renal specialists along with Pharmac representation to discuss metabolic medication in New Zealand. The successful meeting was also an opportunity to establish further clinical links between these specialties and the MWC, and will be used as a model for similar meetings in future years.

In 2018, the MWC launched a new 'Clinical Associate' membership category as part of a commitment to expand its clinical networks to include a wider group of practising clinicians who wish to be involved with the MWC. 15 new clinical associates were appointed in 2019:

- Dr Janek de Zoysa, Waitemata District Health Board
- Dr Michelle Locke, Counties Manukau District Health Board
- Associate Professor Mark Thomas, Auckland District Health Board
- Dr Will Dransfield, Auckland District Board
- Dr Ryan Yeu, Waitemata District Health Board
- Dr Rebecca Brandon, Pihanga Health Turangi
- Dr Sanjeev Deva, Auckland District Health Board
- Dr Ashok Raj, Counties Manukau District Health Board
- Dr Edmond Ang, Auckland District Health Board
- Dr Angela Mweempwa, Auckland District Health Board
- Dr Ryan Paul, Waikato District Health Board
- Dr Glenn Doherty, Tongan Health Society Inc
- Dr Kerry Macaskill-Smith, Pinnacle Ventures
- Dr Rebekah Doran, Pinnacle Ventures
- Dr Carl Eagleton, Auckland District Health Board

# Human capability development

The multidisciplinary and collaborative nature of the Maurice Wilkins Centre research programme provides an excellent training environment for the young scientists and students who are our future science leaders.

## Support for postgraduate students

The MWC supports a large cohort of postgraduate students within its associated research groups by providing funds for stipends, working expenses and travel, as well as opportunities to access specialised research facilities and equipment. Over 2019, the MWC provided direct full or partial financial support for 71 postgraduate students at the University of Otago, University of Canterbury, Victoria University of Wellington, Massey University, University of Waikato and the University of Auckland. 15 postgraduate students who received MWC support prior to or during 2019 completed their degrees in 2019.

## Support for emerging scientists

The success of the core MWC research programmes is dependent on the skills and expertise of a large cohort of research and post-doctoral fellows, many of whom are in the early to mid-stage of their careers.

In 2019 the MWC provided full or partial salary support for 40 research and post-doctoral fellows (16.2 FTE) at the University of Otago, the University of Canterbury, the Malaghan Institute of Medical Research, the University of Waikato and the University of Auckland.

The MWC also provided partial support for 31 research technicians and assistants (9.2 FTE) to carry out specific roles in the core MWC research programme over 2019.

Many of the members of this cohort have been involved in Flagship research communities and this has given them the opportunity to widen their networks and develop their careers. The MWC has provided fora for emerging scientists to present their work in such as Flagship meetings and the Early Career Researchers Symposium.

Emerging scientists are also encouraged to apply to the MWC for funding through the flexible research programme to access specialised facilities, equipment and training both in New Zealand and internationally (see pages 47 and 55). This programme is a good way for emerging scientists for start learning how to write research grants. Applicants are given feedback on unsuccessful applications which allows them to work on revising these and re-submitting to future rounds.

## Early Career Steering Group

The Early Career Steering Group's mission is support and facilitate the ongoing career development of early-career researchers within the MWC, including through the development of workshops and  events. In 2019, the MWC Early Career Steering Committee convened several aimed to upskill early career researchers on skills and techniques relevant to their work.

In February, the Early Career Group organised a commercialisation workshop aimed to introduce Early Career investigators to science commercialisation pathways in biotechnology.  In August, the committee convened two writing workshops held in both Dunedin and Auckland, and in September held a technical workshop on CRISPR Cas 9 in conjunction with Queenstown Research Week (see page 41 for more details).

The committee also planned the annual Future Science Day in December (see below) and continued to publish newsletters throughout the year, keeping MWC members informed of news and events within the early career researcher space.

In May 2019, the committee launched a pilot mentoring programme within the MWC consisting of nine mentor and mentee pairings. The committee plan to use feedback and insight from the pilot group to design and implement a larger mentoring programme across the wider MWC network in 2020. A unique aspect of the programme is that it involves researchers at various levels in their career participating as both mentors and mentees, from different institutions and locations around New Zealand.

Members of the Early Career Committee in 2019 were: Dr Kate Lee (Chair, University of Auckland), Dr Rebekah Bower (University of Auckland), Dr Simon Jackson (University of Otago), Dr Iman Kavianinia (University of Auckland), Ms Marina Rajic (Massey University), Dr Euan Rodger (University of Otago), Dr Catherine Tsai (University of Auckland) and Dr Effie Fan (Victoria University of Wellington).

## Maurice Wilkins Centre Future Science Day

The Maurice Wilkins Centre Future Science Day was held on the 5th of December in Wellington, and was organised by the MWC Early Career Steering Committee. The programme featured presentations from recipients of MWC funding, a session dedicated to answering burning questions from early career researchers and a session on Mentoring led by Professor Katherine Sutherland from the Centre For Academic Development at Victoria University of Wellington.

MWC early career researchers are encouraged to submit abstracts in the lead up to the meeting and from these the committee selected nine researchers to each present a short research talk during the day. These presentations reflected a wide range of topics from each of the MWC research themes and were of a very high standard that shows the talent of many of our early career researchers. The day concluded with a poster session featuring some great posters presented by early career researchers which sparked plenty of lively discussion among attendees during the course of the evening.

Travel prizes are offered for the best poster presentations and research talks and in 2019 the committee introduced two People's choice awards where attendees voted for their favourite research talk and poster presentation. Prize winners in 2019 were:

**Research talks:** 1st – Abigail Bland (University of Otago), 2nd – Cintya Del Rio Hernandez (Victoria University of Wellington) , 3rd – Joe Bracegirdle (Victoria University of Wellington), People's Choice – Abigail Bland

**Research posters:** 1st – Rosannah Cameron (Victoria University of Wellington), 2nd – Liam Harold (University of Otago), People's Choice – Rakesh Banerjee (University of Otago)

This year the committee also introduced a new **'Dragons Den'** competition to the Future Science Day with early career researchers encouraged to pitch an idea for a collaborative research project and face questions from the committee and selected senior MWC investigators. The winning team, led by Dr Waruni Dissanayake from the University of Auckland, were awarded $10,000 funding to initiate their project ''A sweet as use for candy floss' – a novel method of growing beta-cell monolayers' in 2020.

## Technical training opportunities

In order to maintain a world class research programme it is important that Maurice Wilkins Centre investigators and students keep up to date with international developments in their fields.

The MWC provides support for early career investigators to access specialised international facilities and training, and share what they learn with their New Zealand colleagues. This contestable programme supports investigators' travel to national and international workshops and laboratories to learn new technical skills. A criterion for a successful application is that the investigator must present a plan for how they will disseminate their new knowledge and skills to other members of the New Zealand science community on their return.

During 2019, 15 investigators travelled under this scheme:

**Dr Sarah Meidinger** (University of Auckland) visited Associate Professor Tudor Fulga's lab at The MRC Weatherall Institute of Molecular Medicine at the University of Oxford (United Kingdom). The aim of this trip was to learn the innovative CRISPR/Cas9 genome editing detection system, established by the Fulga lab, for 'translationally scar-less' detection and isolation of engineered live cells. Sarah was taught the skills to alter and design the different components of this experimental platform, to apply in primary human cells as part of her research in New Zealand. Application of the Fulga group methods for non-invasive live cell detection of genome editing events has the potential to fast track Sarah's research by drastically reducing the time frame and simplifying the enrichment of edited live cells, which is crucial for clinical translation. The visit provided her with the opportunity to experience the fast pace, high-level research environment of a world-class research institute , and strengthened the collaboration with Tudor Fulga and the University of Oxford.

**Dr Matthew McNeil** attended a High-throughput Biology workshop held at the Cold Spring Harbor Laboratory in New York, taught in collaboration with the Canadian Bioinformatic Workshops. The workshop was a comprehensive seven-day course that covered key bioinformatics concepts and tools required to analyze DNA- and RNA-sequencing experiments. This included evaluating sequence read quality, mapping reads to a reference genome, and analyzing sequence reads for variation and expression levels. The course also covered integrating results from high throughput experiments through pathway and network analysis.

**Ms Elyse Williams** spent 5 months at the University of Groningen in the Netherlands, to learn and gain experience in photocatalysis and enzymatic catalysis. Both of these fields are emerging as new methods for peptide/protein modification, and are relevant to Elyse's PhD research. Photocatalysis uses light to initiate chemical reactions, and is a mild and selective way to modify compounds. During her visit, Elyse learnt how to set up successful photocatalysis reactions and used this method to install an aldehyde upon a peptide/protein, which can then act as a 'handle' for further modification via hydrazone linkage, achieved using enzymes. Following this, Elyse learnt how to express and purify an enzyme known as LmrR, a catalyst for the formation of hydrazone linkages which can be utilised for many downstream modifications. Elyse thoroughly enjoyed her experience and is looking forward to sharing her new skills and experiences with her colleagues and other MWC investigators.

**Dr Yoshio Nakatani** visited the lab of electrochemistry expert Professor Lars Jeuken at the University of Leeds in the UK in early 2019. Professor Jeuken has established a novel bioelectrochemical assay platform that performs both characterization of the respiratory membrane proteins from pathogenic microorganisms and assessment of compounds targeting them in the membrane environment. Work that Dr Nakatani carried out in Leeds has now been published in the highly influential Journal of the American Chemical Society (IF14.695) https://pubs.acs.org/doi/10.1021/jacs.9b10254. Professor Jeuken visited Dunedin in mid- 2019 and helped Dr Nakatani establish an identical tool available at the University of Otago. This new research device will accelerate our MWC research where we aim to identify new compounds that target bacterial respiratory components. The relationship with the University of Leeds continues

to grow in 2020 with a subsequent offer to share knowledge of the latest single-particle cryo-electron microscopy technologies with New Zealand researchers.

**Dr Catherine Tsai** attended a three-day advanced PATRIC (Pathosystems Resource Integration Center) workshop, held at the Argonne National Laboratory in Chicago. PATRIC is a comprehensive bacterial bioinformatics resource with a focus on human pathogenic species and allows researchers to create a workplace and virtually integrate their private data with the public genomic data available for bacteria or archaea. As Catherine is aspiring to expand her knowledge and technique repertoire to include genomics and bioinformatics, she found this workshop particularly useful as it provided an efficient learning environment to quickly acquire the know-how of the tools on PATRIC. This workshop also provided an interactive session for researchers to share, discuss and draft research ideas using PATRIC, along with face-to-face consultation with the PATRIC team, an opportunity that could not have been accessed in New Zealand.

**Dr Rachel North** (University of Canterbury) visited the Institute for Stem Cell Science and Regenerative Medicine (InStem) in Bangalore, India. Here, she gained access to a state-of-the-art Titan Krios fully automated single-particle Cryo-electron microscope (Cryo-EM), an instrument equipped for rapid, stable, and high-resolution data collection and not currently available in New Zealand. Rachel also visited the laboratory of Professor S Ramaswamy and Dr Vinothkumar Kutti Ragunath (faculty leader of The National Electron Cryo-Microscopy Facility at InStem) where she was able to gain hands-on experience in single-particle cryo-electron microscopy (cryo-EM).This trip was very valuable for Rachel as she was able to gain practical skills in sample preparation, grid freezing, data collection, and data processing from experts in the field of cryo-EM. Further, it provided Rachel the opportunity to to collect and process some very exciting preliminary data. The knowledge, skills, and connections gained have strengthened an international collaboration between New Zealand and India that will be of benefit to the wider Maurice Wilkins Centre research community.

**Dr Nikki Moreland** and PhD student **Alana Whitcombe** visited Dr Lea-Anne Kirkham's laboratory in the Telethon Kids Institute in Perth, Australia. The main purpose of the visit was to learn technical skills and expertise in the development of multiplex bead-based immunoassays, and the application of these in sero-epidemiology studies for Group A Streptococcus (GAS) vaccine development. While a 3-plex assay for GAS has been developed in Auckland, expansion of the assay to include more GAS antigens (up to 10) is planned, and the capability to use the assay in large clinical cohorts is needed. This requires a step-change in technical skills and scale, and the Kirkham lab have extensive expertise in optimising robust, reproducible and stable assays for other bacterial pathogens, which they use to analyse large patient cohorts. During their visit Nikki and Alana gained first-hand laboratory experience with expanded multiplex technology, aided by PhD student Sonia McAlister. By spending time with Dr Kirkham and her team they also gained insight into protocols for multiplex assay optimisation and application in vaccine clinical trials. The skills gained from this visit are critical in setting up a robust and cutting-edge multiplex immunoassay in Auckland. The trip also helped to foster future collaborations with this group and enabled engagement with clinicians working on GAS disease in Western Australia.

**Mr Yann Hermant** is working on the chemical synthesis and derivatisation of lipidated antimicrobial peptides as a part of his PhD in the Brimble Lab group (University of Auckland). Yann was supported by the MWC to spend time in the laboratory of Dr Jeremy Owen at Victoria University of Wellington, where he worked on the production of different acylase enzymes to be used in the modification of selected natural antimicrobial lipopeptides. This gave Yann the opportunity to be trained in molecular biology techniques to complement his organic chemistry skills, and allowed him to further his research goals. While optimisation of the reaction could not be concluded, the project is still ongoing through continuous collaboration between the Owen and Brimble groups.

The MWC also supported a number of Early Career Researchers and PhD students to attend technical workshops being held in New Zealand in 2019. Postdoctoral fellow **Dr Thu Ho** and PhD students **Michael Currie** and **Chris Horne** attended the 24th International Analytical Ultracentrifugation (AUC) Workshop, hosted by the University of Canterbury. The workshop covered a wide range of expertise levels in AUC, from background knowledge for beginners to in-depth data processing for challenging systems. The group agreed the experience not only strengthens their knowledge of the technique, but also opens up more experimental options for future work.

**Dr Rachel North, Dr Adele Woolley** (University of Otago) and **Mr Gerd Mittelstadt** (Victoria University of Wellington) attended the Single-particle cryo-electron microscopy and tomography workshop and mini symposium held at the University of Otago. The workshop covered most aspects of the single particle cryo-EM workflow from ideal data collection to raw model to map fitting, and emphasis was put on particle alignment, averaging, and 2D classification. These crucial and computationally expensive steps were trained on a variety of available software including EMAN 2.2 and the SPHIRE suite. The streamlined workflows were tested on model data sets allowing attendees to experience most of the software features first hand. Gerd was given the opportunity to present his work on the structural characterisation of ATP-phosphoribosyltransferase during one of the 6-minute flash talk sessions of the symposium and during the concluding Poster session, where he won one of the four poster prizes. He says this was an ideal opportunity to fill a “knowledge gap” and is confident that the skills learned during this workshop make a great addition to his team at the Victoria University of Wellington and the wider New Zealand structural biology community.

**Dr Qian (Claire) Wang**, from the University of Auckland, also received funding to attend a CRISPR Hub Workshop that was hosted by the University of Otago, on 29th November 2019. The workshop provided a systematic and comprehensive introduction to the development and mechanism of different subtypes of CRISPR techniques and involved a number CRISPR experts who shared methods that attendees could apply to their own research. During this workshop, Claire learnt about the benefits and limitations of individual delivery and validation methods of CRISPR editing in different research systems (including cell lines and animal models) which will help to advance the precision and assurance of CRISPR editing in her own projects. In addition, this workshop also provided her with opportunity to talk to other researchers and experts in this field, expanding her network for sharing knowledge.

# International visits

The Maurice Wilkins Centre runs an international engagement programme to build partnerships with priority international institutions that benefit the Centre's investigator network. In 2019 this involved MWC investigators travelling to China and hosting visiting delegations in New Zealand. The Centre also hosts visits from international and national scientists and officials.

## International Scientists

The Maurice Wilkins Centre hosts visits from international scientists so that they can share their knowledge and research experiences with the New Zealand research community and establish research links.

Maurice Wilkins Centre investigators hosted the following visitors to the centre in 2019:

- Prof Xinwen Chen, Guangzhou Institutes of Biomedicine and Health, China
- Dr Christopher Cooper, TB Alliance, New York, USA
- Prof Adrian Harris, University of Oxford, UK
- Prof Liangxue Lai, Guangzhou Institutes of Biomedicine and Health, China
- Prof Peng Li, Guangzhou Institutes of Biomedicine and Health, China
- Prof Yinxiong Li, Guangzhou Institutes of Biomedicine and Health, China
- Prof Rosalind John, Cardiff University, UK
- Prof Guangjin Pan, Guangzhou Institutes of Biomedicine and Health, China
- Assoc Prof David Sleat, Rutgers University, New Jersey, USA
- Prof Mark Walker, Australian Infectious Disease Research Centre, Australia
- Dr Jeanette Wood, Wood Pharma Consulting Services, Switzerland?
- Prof Donghai Wu, Guangzhou Institutes of Biomedicine and Health, China
- Prof Yong Xu, Guangzhou Institutes of Biomedicine and Health, China
- Prof Robert Young, Simon Fraser University, Canada
- Prof Tianyu Zhang, Guangzhou Institutes of Biomedicine and Health, China
- Prof Hui Zheng, Guangzhou Institutes of Biomedicine and Health, China

## International and national officials and delegations

In 2019, Maurice Wilkins Centre investigators hosted or participated in visits by the following officials and delegations:

***Guangzhou Institutes of Biomedicine and Health Delegation, March 2019***

Prof Ziyuan Duan, Party Secretary

Prof Donghai Wu, Principal Investigator

Prof Yong Xu, Principal Investigator

***Senior Medical Delegation, March 2019***

Prof Lijun Zhang, Chief Physician, First Affiliated Hospital, China Medical University

Prof Qingyuan Zhang, Deputy Director, Third Affiliated Hospital, Harbin Medical University

Prof Xiangshi Lu, Chief Physician, Third Affiliated Hospital, Harbin Medical University

Prof Yang Zhang, Chief Physician, Liaocheng People's Hospital

Dr Dongmei Ji, Assoc Chief Physician, Shanghai Cancer Center, Fudan University

Assoc Prof Yan Ma, Huashan Hospital, Fudan University

Prof Weizhen Shou, Chief Physician, Longhua Hospital, Shanghai University of Traditional Chinese Medicine

Assoc Prof Sili Wang, Chief Physician, First Affiliated Hospital, Xiamen University

Mr Runqi Chen, Assoc Chief Physician, Shanxi Cancer Hospital

Assoc Prof Xiaojiang Tang, Assoc Chief Physician, First Affiliated Hospital, Xi'an Jiaotong University

Mr Xiangmin Jin, Assoc Chief Physician, General Hospital, Ningxia Medical University

Prof Bin Li, Chief Physician, Cancer Hospital, Chinese Academy of Medical Sciences

Ms Kaiping Ou, Assoc Chief Physician, Sanhuan Cancer Hospital

Dr Jida Chen, Assoc Chief Physician, Sir Run Run Shaw Hospital, Zhejiang University

Assoc Prof Kai Luo, Chief Physician, Jiangsu Province People's Hospital

Mr Wei Cheng, Chief Physician, Jiangsu Cancer Hospital

Dr Zhiqin Dai, Chief Physician, Jiangsu Cancer Hospital

Mr Shaoqing Chen, Assoc Chief Physician, First Affiliated Hospital, Nanchang University

***Jinan University Delegation, May 2019***

Prof Xianzhong Song, President

Prof Ruoqian Pu, Director, Office of International Exchange and Cooperation

Prof Ke Ding, Dean, School of Pharmacy

Prof Zhenqiang Chen, Dean, School of Science and Technology

Prof Shuaizhang Feng, Dean, Institute of Economic and Social Research

Prof Boguang Wang, Deputy Dean, Institute of Environmental and Climate Research

***Guangzhou Institutes of Biomedicine and Health Delegation, May 2019***

Prof Ziyuan Duan, Party Secretary

Prof Liangxue Lai, Assistant Director & Principal Investigator

Dr Ting Li, Deputy Director, Research and Education Department

***Guangzhou Municipal Government Delegation, May 2019***

Mr Shuofu Zhang, Party Secretary, CPC Guangzhou Committee

Mr Baochun Liu, Director General, Guangzhou Foreign Affairs Office

Mr Chenhui Liu, Director General, Guangzhou Municipal Commerce Bureau

Mr Hongwu Gong, Deputy Director General, Guangzhou Science and Technology Bureau

Mr Tian Miao, Deputy Section Chief, General Office of CPC Guangzhou Committee

Ms Mi Zhang, Guangzhou Foreign Affairs Office

Mr Ping Lin, Deputy Inspector, Guangzhou Education Bureau

Ms Jie Chen, Director, Guangzhou Foreign Affairs Office

Mr Xiangjian Zeng, Consultant, Guangzhou Foreign Affairs Office

Mr Qien Huang, International Coordinator, Guangzhou Foreign Affairs Office

***Guangzhou Pharmaceutical Holdings Ltd Delegation, May 2019***

Mr Chuyuan Li, Chairman

Mr Shuxin Chen, Assistant Director, General Office

Mr Xinyang Chen, Director, R&D Administration Department

Mr Shaoquan Weng, General Manager, Guangzhou Wanglaoji Great Health Industry Ltd

Mr Bohao Ruan, Sales Executive, Guangzhou Wanglaoji Great Health Industry Ltd

***European Union and Commission Delegation, July 2019***

Mr Jean-Eric Paquet, Director General, Research & Innovation, European Commission

Mr Peter Saktor, Head, Trade and Economic Section, European Union to New Zealand

Ms Carmela Cutugno, Policy Officer, European Commission

***Guangdong Pharmaceutical University Delegation, August 2019***

Prof Sheng Liu, Party Secretary

Dr Yahui He, Director, International Exchange and Cooperation Office

Prof Quan Yang, Director, Science and Technology Office

Prof Xiangjiu He, Dean, School of Pharmacy

Prof Rongxin Zhang, Dean, School of Life Science and Biopharmaceutics

Assoc Prof Yutao Lan, Deputy Dean, School of Nursing

# External funding

Many of the projects within the Maurice Wilkins Centre research programme are supported by co-funding from other sources. The Centre also targets a proportion of its research budget to initiate and develop new projects to the point where they will become successful in securing competitive funding.

## New Zealand public good funding

In 2019, Maurice Wilkins Centre investigators were awarded new grants worth more than $36 million from New Zealand funding sources (other than the TEC) for research projects to be carried out over the next one to five years, including over $10 million from the Health Research Council of New Zealand, $9.8 million from the Marsden Funds and $14 million from the Ministry of Business, Innovation and Employment Endeavour Fund.

## New Zealand commercial funding

In 2019, Maurice Wilkins Centre investigators secured new funding of over $6 million from New Zealand companies to support research.

## International funding

In 2019, Maurice Wilkins Centre investigators secured new funding of $1.4 million from international sources to support research.

# Governance and management

## Maurice Wilkins Centre Board

In 2019, the MWC Board Members were; Mr Bill Falconer (Chair), Professor Conan Fee (University of Canterbury), Professor John Hosking (University of Auckland), Professor Jim Metson (University of Auckland), Ms Maxine Simmons (Biocatalyst Ltd), Professor Warren Tate (University of Otago), and Professor Dave Harper (Victoria University of Wellington).

Professor Mike Wilson's term with the Board ended in early 2019 after joining the Board in 2015 as the representative of Victoria University of Wellington. The MWC gratefully acknowledges Professor Wilson's contribution to the Board and the Centre over this time.

The MWC Board met three times in 2019; April, August and November. At the April meeting the Board reviewed the report and recommendations from the MWC Scientific Advisory Board meeting held in early 2019.

The Board ran a process to select a new Director for the Centre, to succeed Professor Rod Dunbar from 2020 onwards as well as reviewing and advising on strategy for the process to bid for a re-newed CoRE contract from 2021 onwards.

They also approved funding recommendations from the 2019 MWC Project Review Committees in for allocation of resources to new research projects and monitored progress of the MWC research programme through the year for compliance with the funding mandate and budget.

## Management Committee

The Maurice Wilkins Centre Management Committee consists of the following principal investigators; Professors Rod Dunbar (Director and Chair), Peter Shepherd (Deputy Director), Margaret Brimble, Bill Denny and Associate Professor Rinki Murphy (University of Auckland), Professors Antony Braithwaite, Greg Cook and Dave Grattan (University of Otago), Professor Emily Parker (Victoria University of Wellington) and Professor Ian Hermans (Malaghan Institute of Medical Research).

The Management Committee controls the operation of the Centre, under the guidance of the MWC Board and the Scientific and Clinical Advisory Boards. The Committee met nine times during 2019. Initial focus was on planning the meeting of the international Scientific Advisory Board in March and then reviewing the recommendations of the report when this was received. The committee also spent time reviewing research progress against the 2018-2020 MWC plan as well as developing the Centre's future research strategy. The committee continued to manage the MWC research, training and outreach programmes including the allocation of resources through the Flexible Research Programme.

## Non-management Principal Investigators

This role includes leading specific areas of the research programme and other initiatives of strategic importance as required. In 2019 all of this group were active in leading aspects of the MWC research programme, particularly the Flagship research programmes. This group were also involved in developing future research strategy for the Centre alongside the Management Principal Investigators.

Ten Non-management Principal Investigators continued in this position in 2019:

Professor Vic Arcus (University of Waikato), Professor Gary Evans (Victoria University of Wellington), Professors Mike Eccles, Kurt Krause and Tony Merriman (University of Otago), Professors Cris Print and Professor Debbie Hay, Associate Professors Shaun Lott and Adam and

Dr Nikki Moreland (University of Auckland).

## Investigator Strategy Forum

This forum, convened by the MWC Director, is a representative body for all MWC principal and associate investigators and meets twice a year with one forum involving all principal investigators (management, non-management and emeritus) and a second forum which all principal and associate investigators are invited to attend.

The first forum, attended by principal and associate investigators who were involved in leading flagship projects, was held in Auckland on the 8th of August. Discussions at this forum were focused on developing future research plans for the MWC across the three main theme areas.

The second forum, attended by principal and associate investigators, was held in Wellington on the 7th of December. The purpose of this forum was to update investigators on the MWC CoRE rebid proposal.

## Scientific Advisory Board and Clinical Advisory Board

The members of the Scientific Advisory Board (SAB) for 2015 to 2019 were; Professor Peter Andrews (Australia), Dr Christopher Cooper (USA), Professor Suzanne Cory (Australia), Dr Jilly Evans (USA), Professor David James (Australia), Dr Warwick Tong (Australia) and Dr Jeanette Wood (Switzerland).

In 2019, Dr Giles Yeo (University of Cambridge), Professor Mark Walker (Australian Infectious Disease Research Centre) and Professor Adrian Harris (University of Oxford) joined as members of the SAB.

A lively meeting of the SAB was held on the 6th, 7th and 8th of March during which they reviewed both the current MWC research programme and plans for the future of the Centre.

Feedback from the SAB was positive: 'it is the unanimous view of the SAB that the quality of the research undertaken by the MWC is outstanding' and 'Overall, these and other research programs aross the Centre are delivering substantial societal and economic benefits to New Zealand.' The SAB also identified areas where further improvements could be made and provided advice on future strategy in these areas.

The Clinical Advisory Board did not formally meet in 2019 however several members of the Board were involved in developing the Centre's future research strategy over the past year.

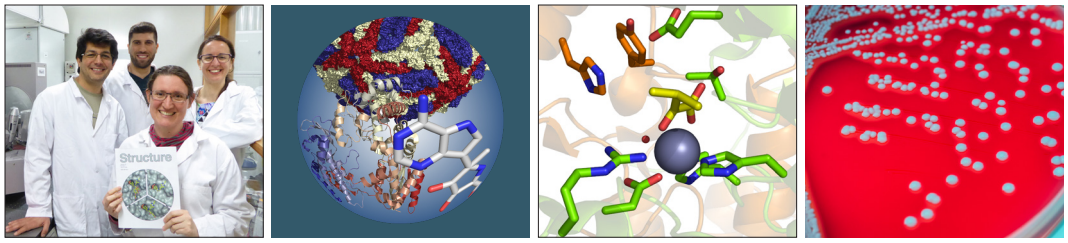
## Project Review Committee

The Project Review Committee convened twice, in April and September 2019, to review applications submitted in 2019 for inclusion in the Flexible Research Programme and make recommendations to the Management Committee and MWC Board on which applications to approve.

In April, the Project Review Committee consisted of 7 principal and 4 associate investigators from the University of Otago, Victoria University of Wellington, Malaghan Institute of Medical Research and the University of Auckland. They reviewed applications for Categories 2 and 3 of the Flexible Research Programme.

In September, the Project Review Committee consisted of 4 principal and 11 associate investigators from the University of Otago, University of Canterbury, Institute of Environmental Science and Research, Massey University, Victoria University of Wellington and the University of Auckland. The committee reviewed applications for Categories 2 and 3 of the Flexible Research Programme.

MAURICE WILKINS CENTRE
FOR MOLECULAR BIODISCOVERY




# Research Outputs

## Publications

In 2019, research outputs from Maurice Wilkins Centre investigators included more than 940 peer-reviewed scientific papers published in international journals, and numerous patents granted, published or filed. Maurice Wilkins Centre contributed support to the following 118 scientific papers and reviews and 20 patents granted, published or filed.

### Papers and Reviews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# Patents

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3. Patterson, A. V., Smaill, J.B., Hermans, I.F., Fu, Z. Combination of a kinase inhibitor and an immunotherapeutic agent, compositions and methods comprising the same. *International Patent Application PCT/IB2019/001146*. 2019

4. Abbattista, M.R., Brimble, M.A., Harris, P.W.R., Patterson, A.V., Smaill, J.B., Stubbing, L.A. Peptide compounds, conjugates thereof, and uses thereof. *International Patent Application PCT/IB2019/059597*. 2019

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# Presentations

The significance of the research being done by Maurice Wilkins Centre investigators and their teams is demonstrated by more than 250 invitations to give international and national presentations in 2019. The presentations included invited lectures at conferences and seminars at academic institutions in Australia, Austria, Belgium, Canada, China, Croatia, the Czech Republic, France, Germany, Greece, India, Indonesia, Israel, Japan, Malaysia, the Netherlands, Norway, Poland, Russia, Singapore, Spain, Switzerland, Thailand, the United Kingdom and the United States of America, as shown in the diagram below.

## Presentation highlights

- Distinguished Professor Dame Margaret Brimble gave multiple plenary presentations during 2019, including at the 5th Annual Peptides and Proteins Symposium, Singapore; at the 13th Australian Peptide Conference, Port Douglas, Australia; European Federation of Medicinal Chemistry International Symposium on Advances in Synthetic and Medicinal Chemistry (EFMC-ASMC19), Athens, Greece; American Chemical Society Fall Meeting MedChem Toolbox Session Privileged and Under-privileged Functional Groups in Drug Design and the ACS MEDICHEM Hall of Fame Ceremony, San Diego, USA; 20th Tetrahedron Symposium, Bangkok, Thailand; 44th Lorne Conference on Protein Structure and Function, Lorne, Australia; 9th International Conference on Advanced Materials and Nanotechnology, Wellington, NZ and the NZIC Conference, Christchurch, NZ.

- As part of the George and Christine Sosnovsky Award in Cancer Therapy, Distinguished Professor Dame Margaret Brimble also presented two lectures 'Peptide-Based Therapeutics: Paving the Way from the Lab to the Clinic - The Resurgence of Covalent Drugs' and 'Nature's Medicine Chest: Opportunities for Synthesis and Drug Discovery' at the University of Wisconsin, Milwaukee, USA
- Professor Debbie Hay gave the plenary presentation 'New treatments for diabetes and obesity to offset the impact of the increasingly toxic environment' at the International Symposium of Research Frontiers of Transboundary Pollution, Kanazawa, Japan.
- Professor Hay was also invited to give the plenary presentations 'Understanding CGRP Receptors In Migraine and Beyond' at the Shanghai Drug Discovery conference, Shanghai, China and at the Gordon Conference: Molecular Pharmacology, Ventura, California, USA in 2019. At the International Headache Congress, Presidential Symposium, held in Ireland, United Kingdom, Professor Hay gave the plenary presentation 'New insights into CGRP and related receptors'. She also presented the plenary 'Profiling Class B GPCR Function From Cells To Tissues' at The PerkinElmer Symposia - On Cell Biology, Immunology, Cancer and Drug Discovery, held in Sydney and Melbourne, Australia.
- Professor Dave Grattan presented the keynote presentation at the British Society for Neuroendocrinology Early Career Day in Glasgow, United Kingdom, entitled 'Beyond Lactation: What does prolactin do in the maternal brain?'. He also gave the invited presentations 'Interactions between prolactin and oxytocin in the maternal adaptation to pregnancy' at the World Congress on Neurohypophyseal Hormones, held in Ein Gedi, Israel and 'Prolactin in pregnancy, and how it affects maternal metabolism and behaviour' at the Annual Meeting of the Endocrine Society (Endo2019), in New Orleans, USA.
- Professor Emily Parker gave the keynote presentation 'Inhibition of Biosynthetic Enzymes for Essential Amino Acids' at the Tuberculosis Drug Discovery and Development Gordon Research Conference in Barcelona, Spain. She also gave invited presentations including 'Reconstructing pathways for indole diterpene production' at the Synthetic Biology Australasia conference in Brisbane, Australia.
- Professor Antony Braithwaite presented the keynote 'Are D133p53 isoforms regulators of immune cell function' at the International p53/p63/p73 isoform Workshop held in Dubrovnik, Croatia. He also gave a number of invited presentations, including 'Modulation of Antigen Presenting Cell function by Delta 133 isoforms' at the 8th International Mutant p53 Workshop in Lyon, France 'YB-1: Master regulator of cytokinesis' at the Cold Shock Protein Symposium held in Magdeburg, Germany and 'Role of p53 in inflammation and defense' at the EMBO Workshop - Impact of bacterial infections on human cancer, Berlin, Germany.
- Professor Greg Cook was Discussion Leader for Emerging Advances in Bioenergetics at the Bioenergetics Gordon Conference on Integration of Structure, Mechanism and Theory of Bioenergy Conversion in Health and Disease held in Andover, New Hampshire, USA.
- Professor Ian Hermans gave the plenary presentation 'Can the helper function of NKT cells be exploited in vaccine design?' at the EMBO Workshop – CD1/MR1: Beyond MHC-restricted Lymphocytes, held at the University of Oxford, United Kingdom. Professor Hermans also gave the plenary presentation 'Designing vaccines for cancer therapy' at the Accurity GP conference in Wellington, NZ.
- Professor Rod Dunbar presented the plenary 'Novel strategies in the era of immunotherapy' at the New Zealand Society for Oncology Conference, held in Wellington, NZ.

- Professor Cris Print gave the opening keynote presentation “Cancer Bioinformatics: How hard can it be?’ at the Victorian Cancer Bioinformatics Symposium, held in Melbourne, Australia.  Professor Print was also invited to give a number of plenary presentations, including ‘PROSPER - Profiling of Oncology Patients as part of Clinical care and Research’ at the Cancer Trials NZ Annual Scientific Meeting in Wellington, NZ.
- Associate Professor Kerry Loomes gave the keynote presentation ‘Creating an integrated Bioscience Ecosystem’ at the Jinan International Conference of Tech Transfer in Jinan, Shandong, China.
- Associate Professor Jeff Smaill was a keynote speaker at the Mini-Symposium of Innovative Drug Research Frontier Theory at Jinan University in Guangzhou, China, giving the presentation ‘Design and synthesis of NMQ prodrugs: A platform technology’.

# Collaborations

The Maurice Wilkins Centre contributes to and benefits from an extensive network of national and international collaborations that have been built up by our investigators over a number of years. The research funded through the Centre has strengthened many of these existing links and helped to establish new collaborations.

The international and national reach of these collaborations is shown in the diagram below.

## New academic collaborations

- Arizona State University (USA)
- Ben Gurion University of the Negev (Israel)
- Danish Headache Centre (Denmark)
- Flinders University (Australia)
- Fudan University (China)
- Georgia State University (USA)
- Guy's Hospital (UK)
- Hackensack Meridian Health Centre for Discovery and Innovation (USA)
- Imperial College London (UK)
- Instituto de Biología y Medicina Experimental (Argentina)
- Jagiellonian University (Poland)
- Keio University (Japan)
- Kent State University (USA)
- Medical University of Innsbruck (Austria)
- Michigan State University (USA)
- Montreal University (Canada)
- National Cheng Kung University (Taiwan)
- National University of Malaysia
- (Universiti Kebangsaan Malaysia) (Malaysia)
- New York University (USA)

- Novosibirsk State University (Russia)
- QIMR Berghofer Medical Research Institute (Australia)
- Queen's University (Canada)
- Rockefeller University (USA)
- Shenzhen University (China)
- Shiv Nadar University (India)
- Sun Yat-sen University (China)
- Temple University (USA)
- Tokyo Institute of Technology (Japan)
- University of Antwerp (Belgium)
- University of Cologne (Germany)
- University of Connecticut (USA)
- University of East Anglia (UK)
- University of Edinburgh (UK)
- University of Guam (Guam)
- University of Hamburg (Germany)
- University of Iowa (USA)
- University of Lethbridge (Canada)
- University of Lyon (France)
- University of Malaya (Malaysia)
- University of Maryland (USA)
- University of Miami (USA)
- University of Münster (Germany)
- University of Papau New Guinea (Papau New Guinea)
- VIB-KU Leuven Center for Brain & Disease Research (Belgium)
- Western University (Canada)
- Xinjiang University (China)

## Continuing academic collaborations

**Asia Pacific**

- Australian Institute of Marine Science (Australia)
- Australian National University (Australia)
- Children's Medical Research Institute (Australia)
- Edith Cowan University (Australia)
- Garvan Institute (Australia)
- Griffith University (Australia)
- Latrobe University (Australia)
- Menzies Institute for Health Research (Australia)
- Monash University (Australia)
- Murdoch Children's Research Institute (Australia)
- Peter MacCallum Cancer Centre (Australia)
- Telethon Kids Institute (Australia)
- The Peter Doherty Institute for Infection and Immunity (Australia)
- University of Adelaide (Australia)
- University of Melbourne (Australia)
- University of New South Wales (Australia)
- University of Newcastle (Australia)
- University of New South Wales (Australia)
- University of Newcastle (Australia)
- University of Queensland (Australia)
- University of Sydney (Australia)
- University of Technology Sydney (Australia)
- University of Wollongong (Australia)
- Walter and Eliza Hall Institute (Australia)
- Fujian University of Traditional Chinese Medicine (China)
- Guangzhou Institute of Biomedicine and Health (China)
- JINAN University (China)
- National Center for Protein Sciences (China)
- Peking University (China)
- Qingdao University (China)

- Shanghai Jiao Tong University (China)
- Zhejiang University (China)
- University of Hong Kong (Hong Kong)
- Indian Institute of Science (India)
- Indian Statistical Institute (India)
- Pondicherry University (India)
- Universitas Gadjah Mada (Indonesia)
- Universitas Padjadjaran (Indonesia)
- Hokkaido University Hospital (Japan)
- Kyushu University (Japan)
- Nagasaki University (Japan)
- National Defence Medical College (Japan)
- Okinawa Institute for Science and Technology (Japan)
- RIKEN institute (Japan)
- Seoul National University (Korea)
- University of Medicine 1 (Myanmar)
- University of Sarghoda (Pakistan)
- Samoa Cancer Society (Samoa)
- A*Star (Singapore)
- National University of Singapore (Singapore)

## UK and Europe

- Medical University of Vienna (Austria)
- University of Vienna (Austria)
- Université Libre de Bruxelles (Belgium)
- University of Namur (Belgium)
- Czech Academy of Sciences (Czech Republic)
- University of Eastern Finland (Finland)
- Paris VI (France)
- Université de Picardie Jules Verne (France)
- University of Strasbourg (France)
- Braunschweig University of Technology (Germany)
- Charite University (Germany)
- Free University of Berlin (Germany)
- Hamburg University of Applied Sciences (Germany)
- Jacobs University (Germany)
- Johannes Gutenberg University (Germany)
- Leibniz University Hannover (Germany)
- Max Planck Institute for Infection Biology (Germany)
- Max Planck Institute for Molecular Genetics (Germany)
- RWTH Aachen University (Germany)
- Technical University of Dortmund (Germany)
- University of Freiburg (Germany)
- University of Hannover (Germany)
- Vilnuis University (Lithuania)
- University of Leiden (Netherlands)
- University of Maastricht (Netherlands)
- University of Oslo (Norway)
- University of Dundee (Scotland)
- Karolinska Institute (Sweden)
- Research Institutes of Sweden (Sweden)
- Uppsala University (Sweden)
- École polytechnique fédérale de Lausanne (EPFL) (Switzerland)
- ETH Zurich (Switzerland)
- Paul Scherrer Institut (Switzerland)
- Swiss Federal Institute of Technology (Switzerland)
- Aston University (UK)
- Defence Science and Technology Laboratory (UK)
- Essex University (UK)
- Keele University (UK)
- Queen Mary University of London (UK)

- University of Bath (UK)
- University of Bristol (UK)
- University of Cambridge (UK)
- University of Exeter (UK)
- University of Huddersfield (UK)
- University of Leeds (UK)
- University of London (UK)
- University of Liverpool (UK)
- University of Manchester (UK)
- University of Nottingham (UK)
- University of Oxford (UK)
- University of Reading (UK)
- University of Southampton (UK)
- University of Warwick (UK)

## North America

- British Columbia Cancer Agency (Canada)
- McGill University (Canada)
- Montreal Neurological Institute and Hospital (Canada)
- University Laval (Canada)
- University of British Columbia (Canada)
- University of Ottawa (Canada)
- Albert Einstein College of Medicine (USA)
- Arkansas State University (USA)
- Binghamton University (USA)
- Brown University (USA)
- Cedars-Sinai Hospital (USA)
- Cleveland Clinic (USA)
- Colorado State University (USA)
- Connecticut College (USA)
- Cornell University (USA)
- Emory University (USA)
- Fralin Life Science Institute, Virginia Tech (USA)
- Georgia Institute of Technology (USA)
- Global Alliance for TB Drug Development (USA)
- Harvard University (USA)
- Icahn School of Medicine at Mount Sinai (USA)
- Indiana University School of Medicine (USA)
- Johns Hopkins University (USA)
- La Jolla Institute for Allergy and Immunology (USA)
- MD Anderson Cancer Center, University of Texas (USA)
- National Institutes of Health (USA)
- Penn State University (USA)
- Phoenix Children's Hospital (USA)
- Rutgers University (USA)
- Sanford Burnham Medical Discovery Institute (USA)
- Stanford University (USA)
- Stony Brook University (USA)
- Texas A&M University (USA)
- University of Alabama (USA)
- University of California (USA)
- University of Chicago (USA)
- University of Colorado (USA)
- University of Georgia (USA)
- University of Illinois at Chicago (USA)
- University of Michigan (USA)
- University of Minnesota (USA)
- University of Missouri (USA)
- University of North Carolina (USA)
- University of Oklahoma (USA)
- University of Pennsylvania (USA)
- University of Pittsburgh (USA)
- University of Southern California (USA)
- University of Tennessee (USA)
- University of Texas South Western (USA)
- University of Texas Southwestern Medical Center (USA)
- University of Utah (USA)
- University of Washington (USA)

- Vanderbilt University (USA)
- Wake Forest University (USA)
- Winona State University (USA)

### South America

- Federal University of Minas Gergais (Brazil)
- Federal University of Sao Paulo (Brazil)

### Africa

- Rhodes University (South Africa)
- University of KwaZulu-Natal (South Africa)

# Uptake of Maurice Wilkins Centre research and expertise

The primary focus of the Maurice Wilkins Centre is on finding new ways to effectively target human disease. The Centre drives the translation of its research and expertise from the laboratory through a variety of partnerships with commercial and non-profit organisations, in New Zealand and overseas.

The creation of spin-out companies is an important pathway for the development of the Centre's research, and this often brings in international partners and funds. Maurice Wilkins Centre investigators maintain close links with such companies and further work is regularly contracted back to their research groups.

The Maurice Wilkins Centre also partners with established companies, and the knowledge and expertise developed by its investigators in scientific fields vital to the biotechnology and pharmaceutical sectors are highly sought after. Examples of contract research and the provision of facilities to industry are outlined on page 33 of this report. The Centre's investigators also act as consultants for a number of national and international companies.

In 2019 the expertise of Maurice Wilkins Centre investigators was sought by:

- Abbott Diagnostics
- Aeroqual Ltd
- AgGenetics (US)
- AntibioTx (DK)
- Antido Therapeutics (US)
- Arrowhead Pharmaceuticals (US)
- Auckland Clinical Studies Ltd
- Avalia Immunotherapies Ltd
- Bayer Animal Health NZ
- Beca Ltd
- Biotelliga Ltd
- Caldera
- Cancer Research (UK)
- Canterbury Scientific Ltd
- Comvita Ltd
- Connovation Ltd
- Convert Pharmaceuticals (BE)
- Dairy Goat Cooperative Ltd
- Deosan NZ
- Enztec Ltd
- Fisher and Paykel Healthcare Ltd
- Gilead Sciences Ltd (US)

- GlycoSyn Ltd
- Hikurangi Bioactives Ltd
- Intarcia Therapeutics, Inc
- Izon Ltd
- JunoFem
- Kea Therapeutics Ltd
- Kezar Life Sciences Inc
- Landcare Research NZ Ltd
- Living Cell Technologies Inc
- Mote Research Ltd
- Metavention (US)
- Merck & Co Inc (US)
- MitoQ Ltd
- Mote Ltd
- Nacuity Pharmaceuticals Inc (US)
- New Zealand Pharmaceuticals Ltd
- NZeno Ltd
- Ossis Ltd
- Quality Scientific Solutions LLC
- Rain Therapeutics Inc (US)
- Roche Diagnostics
- SapVax LLC (US)
- Sphingotec GmBH Ltd (Germany)
- Synthase Biotech Ltd
- Upside Biotechnologies
- Upstream Medical Technologies Ltd
- VIR Biotechnology Inc (US)
- Wellington Zhaotai Therapies Ltd
- Zespri International Ltd

The establishment of partnerships with international non-profit organisations is another way in which the Maurice Wilkins Centre achieves uptake of its research and expertise. For example, Maurice Wilkins Centre investigators are involved with international organisations such as the Global Alliance for TB Drug Development.

# Awards and honours

MWC investigators, affiliates and students were acknowledged with a number of international and national honours in 2019 (for more detailed information on a selection of these awards, see the highlights story on page 9):

- **American Chemical Society MEDI Hall of Fame and further honours**

In yet another successful year, Professor Margaret Brimble from the University of Auckland was inducted into American Chemical Society MEDI Hall of Fame, and received the Kiwinet BNZ Supreme award, Kiwinet Baldwins Researcher Entrepreneur award and the Znonta New Zealand Women of Acheivement award.

- **Secretary General for the International Union of Immunology Societies**

Associate Professor Roslyn Kemp, from the University of Otago, was elected Secretary General for the International Union of Immunology Societies.

- **British Pharmacological Society Fellowship**

University of Auckland Associate Professor Nuala Helsby was made a fellow of the British Pharmacology Society.

- **Sesquicentennial Distinguished Chair (Poutoko Taiea)**

MWC Management Investigator and Flagship leader Professor Greg Cook, was made a University of Otago Sesquicentennial Distinguished Chair. This position recognises the university's internationally acclaimed Professors, who are also regarded for their teaching excellence and community outreach.

- **Royal Society Te Apārangi Fellowship**

MWC Investigators Professor Jillian Cornish and Professor Nicola Dalbeth from the University of Auckland, were both invited to be Royal Society Te Apārangi fellows in 2019.

- **Fullbright New Zealand Scholar Awards**

In 2019, MWC Associate Investigator Professor Julia Horsfield from the University of Otago was awarded a Fulbright Scholar Award to help fund research in the United States.

- **Sir Charles Hercus Fellowships**

These prestigious fellowships from the Health Research Council provide four years of full support for outstanding emerging researchers who are committed to a career in health research in New Zealand. In late 2019, four MWC investigators were awarded these fellowships; Dr Nicholas Fleming (University of Otago) to study 'Rational extension of immunotherapy in colorectal cancer', Dr Natasha Grimsey (University of Auckland) ' Novel strategies to harness therapeutic potential of CB2 in the immune system', Dr Muhammed Hanif (University of Auckland) 'Tickling cancer cells to provoke an antitumour immune response' and Dr Rachel Purcell (University of Otago) will study 'Molecular mechanisms and the gut microbiome in colorectal cancer'. They will all start their fellowships in 2020.

Two MWC investigators who were awarded their fellowships in 2018 started in 2019; Dr

Rosemary Brown (University of Otago) to study the 'The neurobiology of maternal care; understanding the critical role of prolactin' and Dr Khoon Lim (University of Otago) is working on '3D bioassembly of functional bone grafts – a Lego approach'.

- **Heart Foundation Senior Research Fellowship**

Dr Jacelyn Loh, University of Auckland, was awarded one of two Heart Foundation Senior Research Fellowships in 2019, which will support her work for up to 3 years.

- **Rutherford Foundation postdoctoral fellowship**

Dr Emma Davison, an MWC Affiliate Investigator from the University of Auckland, was awarded the prestigious Rutherford Foundation postdoctoral fellowship in 2019. Her research is aimed at building automated flow chemistry synthesiser, to be used to produce novel, personalised cancer vaccines.

- **Keliher Charitable Trust Emerging Researcher Start-up Award**

MWC Early Career Committee member and Affiliate investigator Dr Catherine Tsai (University of Auckland) received the 2019 Kelier Charitable Trust Emerging Researcher Award. This award provided her with funding to allow her to continue her work desigining and modifying vaccines for Group A Streptococcus.

- **Early Career Researcher Award (Australian and New Zealand Obesity Society)**

Ms Naomi Davies, who in 2019 was completing her PhD at the University of Auckland, received the Early Career Research Award at the Australian and New Zealand Obesity Society meeting in mid-October. Ms Davies was a MWC PhD scholarship recipient, whose work focused on changes in gut hormones and microbiomes in patients undergoing weight loss surgeries.

# Summary

| Broad category | Detailed Category | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|
| FTEs by Category | Principal investigators | 1.70 | 1.72 | 1.75 | 1.72 | 1.90 |
| | Associate investigators | 2.09 | 2.50 | 2.38 | 1.49 | 8.22 |
| | Postdoctoral fellows | 7.29 | 13.98 | 14.80 | 8.89 | 7.80 |
| | Research technicians | 0.57 | 0.63 | 5.28 | 4.80 | 9.34 |
| | Administrative/support | 2.81 | 3.27 | 3.66 | 2.86 | 2.65 |
| | Research students | 14.58 | 18.44 | 22.92 | 17.91 | 9.41 |
| | Total | 29.04 | 40.54 | 50.79 | 37.67 | 39.32 |
| Headcounts by category | Principal investigators | 19 | 20 | 20 | 24 | 24 |
| | Associate investigators | 145 | 155 | 164 | 184 | 243 |
| | Postdoctoral fellows | 20 | 24 | 43 | 39 | 33 |
| | Research technicians | 2 | 4 | 15 | 28 | 41 |
| | Administrative/support | 7 | 5 | 8 | 7 | 6 |
| | Research students | 23 | 69 | 77 | 75 | 69 |
| | Total | 216 | 277 | 327 | 357 | 416 |
| Peer reviewed research outputs by type | Journal articles | 84 | 93 | 95 | 92 | 113 |
| | Book chapters | 1 | 1 | 2 | 1 | 4 |
| | Conference Proceedings | 9 | - | - | - | - |
| | Total | 94 | 94 | 97 | 93 | 117 |
| Value of external research contracts awarded by source (000) | Vote Science and Innovation contestable funds | 2,831 | 2,351 | 2,659 | 4,680 | 4,330 |
| | Domestic- other non-Govt | 373 | 432 | 673 | 586 | 406 |
| | Overseas | 2,068 | 1,153 | 222 | 599 | 244 |
| | Other | 118 | 154 | 167 | 830 | 1,494 |
| | Total | 5,390 | 4,090 | 3,721 | 6,695 | 6,474 |
| Commercial activities | Patent applications | 4 | 10 | 16 | 9 | 17 |
| | Patents granted | 5 | 0 | 1 | 2 | 2 |
| Students studying at CORE by level | Doctoral degree | 21 | 58 | 66 | 70 | 62 |
| | Other | 2 | 11 | 11 | 5 | 7 |
| | Total | 23 | 69 | 77 | 75 | 69 |
| Number of students completing qualification by level | Doctoral degree | - | 5 | 10 | 14 | 11 |
| | Other | 1 | 7 | 7 | 3 | 3 |
| | Total | 1 | 12 | 17 | 17 | 14 |
| Immediate post-study graduate destinations | Employed in NZ | 1 | 4 | 7 | 12 | 6 |
| | Employed overseas | - | 5 | 5 | 3 | 5 |
| | Further study in NZ | - | - | 2 | 2 | 1 |
| | Other | - | - | 1 | 0 | 1 |
| | Unknown | - | 3 | 2 | 0 | 1 |
| | Total | 1 | 12 | 17 | 17 | 14 |

*In addition to the directly funded FTE in the above table in 2019, Principal investigators contributed to an additional 1.75 FTE in time only and 0.2 FTE was co-funded; Associate investigators contributed an additional 2.53 FTE in time only and 2.60 FTE was co-funded; Postdoctoral fellows, Research technicians and Administrative/Support staff had an additional 7.74 FTE, 7.46 FTE and 2.08 FTE cofunded respectively.

**Research students had an additional 53.09 EFT co-funded from other sources.

# Summary Financial Statement 2019

## Funding summary for the year ended 31 December 2019

**Actuals**

| $0 | |
|---|---|
| **Funding received** | |
| Tertiary Education Commision grant | 7,082 |
| **Total funding received** | **7,082** |
| Salaries and salary related costs | 3,144 |
| Overheads | 3,326 |
| Project costs | 1,812 |
| Travel | 413 |
| Postgraduate students | 393 |
| **Total expenditure** | **9,026** |
| **Net surplus/(Deficit)** | -1,944 |

This report covers the period from 1 January 2019 - 31 December 2019 and details funding received and fund distributed to collaborative partners of the CoRE.

All amounts shown are exclusive of Goods and Service tax (GST)

In 2018 the CoRE carried forward a net surplus of 1,570. This surplus has been added to the 2019 income to fund the CoRE's research programme in 2019. The CoRE therefore has a net deficit of -895 that will be carried forward into 2020 to fund future expenditure of the CoRE.

# Directory

## Governing Board

Mr Bill Falconer (Chair)
Prof Conan Fee
Prof John Hosking
Prof Jim Metson
Ms Maxine Simmons
Prof Warren Tate
Prof Dave Harper

## Scientific Advisory Board

Prof Peter Andrews (Chair)
Dr Chris Cooper
Prof Suzanne Cory
Dr Jilly Evans
Prof David James
Dr Warwick Tong
Dr Jeanette Wood

## Principal investigators (management)

| | | |
|---|---|---|
| Prof Rod Dunbar (Director) | School of Biological Sciences | University of Auckland |
| Prof Peter Shepherd (Deputy Director) | Department of Molecular Medicine and Pathology | University of Auckland |
| Prof Antony Braithwaite | Department of Pathology | University of Otago |
| Prof Margaret Brimble | School of Chemical Sciences | University of Auckland |
| Prof Greg Cook | Microbiology and Immunology | University of Otago |
| Prof Bill Denny | Auckland Cancer Society Research Centre | University of Auckland |
| Prof Dave Grattan | Department of Anatomy | University of Otago |
| Prof Ian Hermans | Malaghan Institute of Medical Research | |
| Assoc Prof Rinki Murphy | Department of Medicine | University of Auckland |
| Prof Emily Parker | Department of Chemistry | University of Canterbury |

## Principal investigators (non-management)

| | | |
|---|---|---|
| Prof Vic Arcus | Department of Biological Sciences | Waikato University |
| Prof Michael Eccles | Department of Pathology | University of Otago |
| Prof Gary Evans | Ferrier Institute | Victoria University |
| Prof Debbie Hay | School of Biological Sciences | University of Auckland |
| Prof Kurt Krause | Department of Biochemistry | University of Otago |
| Assoc Prof Shaun Lott | School Of Biological Science | University of Auckland |
| Assoc Prof Adam Patterson | Auckland Cancer Society Research Centre | University of Auckland |
| Prof Cris Print | Department of Molecular Medicine and Pathology | University of Auckland |
| Prof Tony Merriman | Department of Biochemistry | University of Otago |
| Dr Nikki Moreland | Department of Molecular Medicine and Pathology | University of Auckland |

## Principal investigators (emeritus)

| Name | Department | Home Institution |
|---|---|---|
| Prof Ted Baker | School of Biological Sciencecs | University of Auckland |
| Prof Garth Cooper | School of Biological Sciencecs | University of Auckland |
| Prof Peter Hunter | Auckland Bioengineering Institute | University of Auckland |
| Prof John Fraser | Faculty of Medical and Health Sciences | University of Auckland |

## Associate investigators

| Name | Department | Home Institution |
|---|---|---|
| Assoc Prof David Ackerley | School of Biological Sciences | Victoria University of Wellington |
| Assoc Prof Jane Allison | School of Biological Sciences | University of Auckland |
| Dr Timothy Allison | School of Physical and Chemical Sciences | University of Canterbury |
| Assoc Prof Iain Anderson | Auckland Bioengineering Institute | University of Auckland |
| Assoc Prof Bob Anderson | Auckland Cancer Society Research Centre | University of Auckland |
| Prof Greg Anderson | Department of Anatomy | University of Otago |
| Dr Catherine Angel | School of Biological Sciences | University of Auckland |
| Dr Amir Ashoorzadeh | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Johnathan Astin | Department of Molecular Medicine and Pathology | University of Auckland |
| Prof Paul Atkinson | School of Biological Sciences | Victoria University of Wellington |
| Dr Htin Lin Aung | Department of Microbiology and Immunology | University of Auckland |
| Prof Bruce Baguley | Auckland Cancer Society Research Centre | University of Auckland |
| Prof Michael Baker | Department of Public Health | University of Otago, Wellington |
| Assoc Prof Adam Bartlett | Department of Surgery | University of Auckland |
| Dr Ghader Bashiri | School of Biological Sciences | University of Auckland |
| Prof Chris Battershill | Faculty of Science and Engineering | University of Waikato |
| Prof Mike Berridge | Malaghan Institute of Medical Research | |
| Assoc Prof Mik Black | Department of Biochemistry | University of Otago |
| Dr Cherie Blenkiron | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Gib Bogle | Auckland Bioengineering Institute | University of Auckland |
| Prof Stefan Bohlander | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Michael Booth | Waitemata Specialist Centre | Waitemata District Health Board |
| Dr Mihnea Bostina | Department of Microbiology and Immunology | University of Otago |

| | | |
|---|---|---|
| Prof Nicola Brasch | Department of Chemistry | Auckland University of Technology |
| Dr Anna Brooks | School of Biological Sciences | University of Auckland |
| Dr Reuben Broom | Department of Medical Oncology | University of Auckland |
| Prof Peter Browett | Department of Molecular Medicine and Pathology | University of Auckland |
| Prof Colin Brown | Department of Physiology | University of Otago |
| Dr Rosemary Brown | Department of Anatomy | University of Otago |
| Dr Christina Buchanan | Department of Molecular Medicine and Pathology | University of Auckland |
| Prof Vicky Cameron | Department of Medicine | University of Otago, Christchurch |
| Assoc Prof Rebecca Campbell | Department of Physiology | University of Otago |
| Prof Richard Cannon | Faculty of Denistry | University of Otago |
| Prof Chris Charles | Department of Medicine | University of Otago, Christchurch |
| Dr Aniruddha Chatterjee | Department of Pathology | University of Otago |
| Prof Lai-Ming Ching | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Davide Comoletti | School of Biological Sciences | University of Auckland |
| Dr Lisa Connor | School of Biological Sciences | Victoria University of Wellington |
| Prof Brent Copp | School of Chemical Sciences | University of Auckland |
| Prof Jillian Cornish | School of Medicine | University of Auckland |
| Prof  Murray Cox | Institute of Fundamental Sciences | Massey University |
| Assoc Prof Margaret Currie | Department of Pathology | University of Otago, Christchurch |
| Assoc Prof Gabriele Dachs | Department of Pathology | University of Otago, Christchurch |
| Prof Nicola Dalbeth | School Medicine | University of Auckland |
| Dr Kirsty Danielson | Department of Surgery and Anesthesia | University of Otago, Wellington |
| Assoc Prof Alan Davidson | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Stephanie Dawes | School of Biological Sciences | University of Auckland |
| Prof Catherine Day | Department of Biochemistry | University of Otago |
| Dr Ofa Dewes | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Sarah Diermeier | Department of Biochemistry | University of Otago |
| Prof Renwick Dobson | School of Biological Sciences | University of Canterbury |
| Prof Paul Donaldson | School of Medical Sciences | University of Auckland |
| Prof Rob Doughty | Department of Medicine | University of Auckland |
| Prof Richard Douglas | Department of Surgery | University of Auckland |
| Dr Catherine Drummond | Department of Pathology | University of Otago |
| Prof Antony Fairbanks | Department of Chemistry | University of Canterbury |
| Dr Vaughan Feisst | School of Biological Sciences | University of Auckland |
| Assoc Prof Vyacheslav Filichev | School of Fundamental Sciences | Massey University |

| | | |
|---|---|---|
| Prof Peter Fineran | Department of Microbiology and Immunology | University of Otago |
| Dr Jack Flanagan | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Nicholas Fleming | Department of Pathology | University of Otago |
| Dr Daniel Furkert | School of Chemical Sciences | University of Auckland |
| Prof Richard Furneaux | Ferrier Research Institute | Victoria University of Wellington |
| Dr Allan Gamble | School of Pharmacy | University of Otago |
| Dr Austen Ganley | School of Biological Sciences | University of Auckland |
| Dr Olivier Gasser | Malaghan Institute of Medical Research | |
| Dr Monica Gerth | School of Biological Sciences | Victoria University of Wellington |
| Prof Michelle Glass | Department of Pharmacology | University of Otago |
| Dr David Goldstone | School of Biological Sciences | University of Auckland |
| Prof Colin Green | School of Medicine | University of Auckland |
| Dr Gus Grey | Department of Physiology | University of Auckland |
| Dr Yongchuan Gu | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Chris Hall | Department of Molecular Medicine and Pathology | University of Auckland |
| Prof Mark Hampton | Free Radical Research Group | University of Otago, Christchurch |
| Dr Kiel Hards | Department of Microbiology and Immunology | University of Otago |
| Dr Lawrence Harris | Ferrier Research Institute | Victoria University of Wellington |
| Assoc Prof Paul Harris | School of Chemical Sciences | University of Auckland |
| Prof Christian Hartinger | School of Chemical Sciences | University of Auckland |
| Dr Joanne Harvey | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Assoc Prof Michael Hay | Auckland Cancer Society Research Centre | University of Auckland |
| Assoc Prof Nuala Helsby | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Joanne Hewitt | Environmental and Food Virology/ Norovirus Reference Laboratory | Institute of Environmental Science & Research |
| Assoc Prof Merilyn Hibma | Department of Pathology | University of Otago |
| Assoc Prof Tony Hickey | School of Biological Sciences | University of Auckland |
| Dr Joanna Hicks | Faculty of Science and Engineering | University of Waikato |
| Dr Kevin Hicks | School of Medical Sciences | University of Auckland |
| Prof Philip Hill | Department of Preventive and Social Medicine | University of Otago |
| Dr Samantha Holdsworth | Department of Anatomy and Medical Imaging | University of Auckland |
| Dr Teresa Holm | Department of Molecular Medicine and Pathology | University of Auckland |

| | | |
|---|---|---|
| Prof Sarah Hook | School of Pharmacy | University of Otago |
| Assoc Prof Julia Horsfield | Department of Pathology | University of Otago |
| Dr Sue Huang | Institute of Environmental Science and Research | |
| Dr Matloob Husain | Department of Microbiology | |
| Prof Brian Hyland | Department of Physiology | University of Otago |
| Dr Karl Iremonger | Department of Physiology | University of Otago |
| Dr Keith Ireton | Department of Microbiology and Immunology | University of Otago |
| Dr Chris Jackson | Department of Medicine | University of Otago |
| Dr Simon Jackson | Department of Microbiology and Immunology | University of Otago |
| Prof Geoff Jameson | Institute of Fundamental Sciences | Massey University |
| Dr Stephen Jamieson | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Wanting Jiao | Ferrier Research Institute | Victoria University of Wellington |
| Dr Jodie Johnston | Department of Chemistry | University of Canterbury |
| Assoc Prof Peter Jones | Department of Physiology | University of Otago |
| Prof Bill Jordan | School of Biological Sciences | Victoria University of Wellington |
| Assoc Prof Rajesh Katare | Department of Physiology | University of Otago |
| Assoc Prof Roslyn Kemp | Department of Microbiology and Immunology | University of Otago |
| Prof Martin Kennedy | Department of Pathology | University of Otago, Christchurch |
| Dr Robert Keyzers | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Dr Richard Kingston | School of Biological Sciences | University of Auckland |
| Dr Joanna Kirman | Department of Microbiology and Immunology | University of Otago |
| Assoc Prof Bronwyn Kivell | School of Biological Sciences | Victoria University of Wellington |
| Assoc Prof Jeremy Krebs | Department of Medicine | University of Otago, Wellington |
| Dr Sharon Ladyman | Department of Anatomy | University of Otago |
| Assoc Prof Anne La Flamme | School of Biological Sciences | Victoria University of Wellington |
| Dr Goetz Laible | AgResearch | |
| Dr Regis Lambert | Department of Physiology | University of Otago |
| Prof Iain Lamont | Department of Biochemistry | University of Otago |
| Dr Ries Langley | Department of Molecular Medicine and Pathology | University of Auckland |
| Prof Dave Larsen | Department of Chemistry | University of Otago |
| Dr Annette Lasham | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Ben Lawrence | School of Medical Sciences | University of Auckland |
| Dr Megan Leask | Department of Biochemistry | University of Otago |

| | | |
|---|---|---|
| Dr Kathryn Lee | Department of Molecular Medicine and Pathology | University of Auckland |
| Prof Graham Le Gros | Malaghan Institute of Medical Research | |
| Dr Elizabeth Ledgerwood | Department of Biochemistry | University of Otago |
| Assoc Prof Klaus Lehnert | School of Biological Sciences | University of Auckland |
| Dr Euphemia Leung | School of Medical Sciences | University of Auckland |
| Dr Ivanhoe Leung | School of Chemical Sciences | University of Auckland |
| Assoc Prof Dong-Xu Liu | School of Science | Auckland University of Technology |
| Dr Jacelyn Loh | Department of Molecular Medicine and Pathology | University of Auckland |
| Assoc Prof Kerry Loomes | School of Biological Sciences | University of Auckland |
| Dr Jun Lu | Faculty of Health and Environmental Sciences | Auckland University of Technology |
| Dr Donia Macartney-Coxson | Environmental Science and Research | |
| Dr Peter Mace | Department of Biochemistry | University of Otago |
| Prof Rudi Marquez | School of Physical and Chemical Sciences | University of Canterbury |
| Prof Lisa Matisoo-Smith | Department of Anatomy | University of Otago |
| Dr Brya Matthews | Department of Molecular Medicine and Pathology | University of Auckland |
| Prof John McCall | Department of Surgical Sciences | University of Otago |
| Dr Melanie McConnell | School of Biological Sciences | Victoria University of Wellington |
| Prof Sally McCormick | Department of Biochemistry | University of Otago |
| Prof Mark McKeage | Department of Pharmacology | University of Auckland |
| Assoc Prof Alexander McLellan | Deptment Microbiology & Immunology | University of Otago |
| Dr Matthew McNeil | Department of Microbiology and Immuniology | University of Otago |
| Dr Sunali Mehta | Department of Pathology | University of Otago |
| Dr Kim Mellor | School of Medicine | University of Auckland |
| Prof Andrew Mercer | Department of Microbiology and Immunology | University of Otago |
| Dr Troy Merry | Department of Molecular Medicine and Pathology | University of Auckland |
| Assoc Prof Peter Metcalf | School of Biological Sciences | University of Auckland |
| Dr Jennifer Miles-Chan | School of Biological Sciences | University of Auckland |
| Emeritus Prof John Miller | School of Biological Sciences | Victoria University of Wellington |
| Assoc Prof Alok Mitra | School of Biological Sciences | University of Auckland |
| Assoc Prof Brian Monk | Department of Oral Sciences | University of Otago |
| Dr Xochitl Morgan | Department of Microbiology and Immunology | University of Otago |
| Prof Ian Morison | Department of Pathology | University of Otago |

| | | |
|---|---|---|
| Assoc Prof Kathy Mountjoy | Department of Physiology | University of Auckland |
| Dr Andrew Munkacsi | School of Biological Sciences | Victoria University of Wellington |
| Dr Andrew Muscroft-Taylor | Biomolecular Interaction Centre | Callaghan Innovation |
| Dr Yoshio Nakatani | Department of Biochemsitry | University of Otago |
| Prof Martyn Nash | Auckland Bioengineering Institute | University of Auckland |
| Prof Poul Nielsen | Auckland Bioengineering Institute | University of Auckland |
| Assoc Prof Gillian Norris | Institute of Fundamental Sciences | Massey University |
| Assoc Prof Peter Northcote | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Dr Justin O'Sullivan | Liggins Institute | University of Auckland |
| Dr Bjorn Oback | AgResearch | |
| Dr Pawel Olszewski | Faculty of Science and Engineering | University of Waikato |
| Dr Jeremy Owen | School of Biological Sciences | Victoria University of Wellington |
| Prof Gavin Painter | Ferrier Research Institute | Victoria University of Wellington |
| Assoc Prof Brian Palmer | Auckland Cancer Society Research Centre | University of Auckland |
| Assoc Prof Wayne Patrick | School of Biological Sciences | Victoria University of Wellington |
| Dr Grant Pearce | School of Biological Sciences | University of Canterbury |
| Assoc Prof Chris Pemberton | Department of Medicine | University of Otago, Christchurch |
| Dr Lifeng Peng | School of Biological Sciences | Victoria University of Wellington |
| Dr Jo Perry | Liggins Institute | University of Auckland |
| Assoc Prof Anthony Phillips | School of Biological Sciences | University of Auckland |
| Dr Anna Pilbrow | Christchurch Heart Institute | University of Otago, Christchurch |
| Dr Raewyn Poulsen | Department of Medicine | University of Auckland |
| Assoc Prof Thomas Proft | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Frederik Pruijn | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Rachael Purcell | Department of Surgery | University of Otago, Christchruch |
| Prof Miguel Quinones-Mateu | Department of Microbiology and Immunology | University of Otago |
| Dr Fiona Radcliff | Department of Molecular Medicine and Pathology | University of Auckland |
| Assoc Prof Jasna Rakonjac | Institute of Fundamental Sciences | Massey University |
| Assoc Prof Glen Reid | Department of Pathology | University of Otago |
| Dr Dave Rennison | School of Chemical Sciences | University of Auckland |
| Assoc Prof Gordon Rewcastle | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Johannes Reynisson | School of Chemical Sciences | University of Auckland |
| Dr Shakila Rizwan | School of Phamacy | University of Otago |
| Dr Sally Roberts | Department of Molecular Medicine and Pathology | University of Auckland |

| | | |
|---|---|---|
| Prof Stephen Robertson | Dunedin School of Medicine | University of Otago |
| Prof Dame Carol Robinson | School of Chemical Sciences | University of Auckland |
| Dr Euan Rodger | Department of Pathology | University of Otago |
| Prof Franca Ronchese | Malaghan Institute of Medical Research | |
| Assoc Prof Bruce Russell | Department of Microbiology and Immunology | University of Otago |
| Assoc Prof Evelyn Sattlegger | Institute of Natural and Mathematical Sciences | Massey University |
| Dr Sebastian Schmeier | Institute of Natural and Mathematical Sciences | Massey University |
| Assoc Prof Daryl Schwenke | Department of Physiology | University of Otago |
| Prof Andrew Shelling | School of Medicine | University of Auckland |
| Dr Hilary Sheppard | School of Biological Sciences | University of Auckland |
| Dr Dianne Sika-Paotonu | Department of Pathology and Molecular Medicine | University of Otago, Wellington |
| Dr Dean Singleton | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Tania Slatter | Department of Pathology | University of Otago |
| Prof Bruce Smaill | Auckland Bioengineering Institute | University of Auckland |
| Assoc Prof Jeff Smaill | Auckland Cancer Society Research Centre | University of Auckland |
| Prof Russell Snell | School of Biological Sciences | University of Auckland |
| Prof James Sneyd | Department of Mathematics | University of Auckland |
| Dr Jonathan Sperry | School of Chemical Sciences | University of Auckland |
| Dr Julie Spicer | Auckland Cancer Society Research Centre | University of Auckland |
| Assoc Prof Chris Squire | School of Biological Sciences | University of Auckland |
| Prof Lisa Stamp | Department of Medicine | University of Otago, Christchurch |
| Assoc Prof Bridget Stocker | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Dr Hamish Sutherland | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Vinod Suresh | Auckland Bioengineering Institute | University of Auckland |
| Dr John Taylor | School of Biological Sciences | University of Auckland |
| Assoc Prof Mike Taylor | School of Biological Sciences | University of Auckland |
| Assoc Prof Paul Teesdale-Spittle | School of Biological Sciences | Victoria University of Wellington |
| Dr Moana Tercel | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Andrew Thompson | Auckland Cancer Society Research Centre | University of Auckland |
| Assoc Prof Mattie Timmer | School of Chemical and Physical Sciences | Victoria University of Wellington |

| | | |
|---|---|---|
| Dr Penny Truman | School of Health Sciences | Massey University, Wellington |
| Dr Alex Tups | Department of Physiology | University of Otago |
| Prof Peter Tyler | Ferrier Research Institute | Victoria University of Wellington |
| Assoc Prof Joel Tyndall | School of Pharmacy | University of Otago |
| Dr James Ussher | Department of Microbiology and Immunology | University of Otago |
| Dr Andrea Vernall | School of Pharmcay | University of Otago |
| Dr Christopher Walker | School of Biological Sciences | University of Auckland |
| Dr Logan Walker | Department of Pathology | University of Otago. Christchurch |
| Assoc Prof Clare Wall | Department of Nutrition | University of Auckland |
| Prof Vernon Ward | Department of Microbiology and Immunology | University of Otago |
| Dr Wenhua Wei | Department of Women's and Children's Health | University of Otago |
| Dr Robert Weinkove | Malaghan Institute of Medical Research | |
| Dr Phillip Wilcox | Department of Statistics | University of Otago |
| Dr Siouxsie Wiles | Department of Molecular Medicine and Pathology | University of Auckland |
| Prof David Williams | School of Chemical Sciences | University of Auckland |
| Dr Geoff Williams | School of Chemical Sciences | University of Auckland |
| Dr Debbie Williamson | Department of Pathology and Molecular Medicine | University of Otago, Wellington |
| Prof William Wilson | Auckland Cancer Society Research Centre | University of Auckland |
| Prof John Windsor | Department of Surgery | University of Auckland |
| Dr Lyn Wise | Department of Microbiology and Immunology | University of Otago |
| Assoc Prof Tim Woodfield | Department of Orthopaedic Surgery and Musculoskeletal Medicine | University of Otago, Christchurch |
| Dr Paul Young | School of Biological Sciences | University of Auckland |
| Prof Sarah Young | Department of Pathology | University of Otago |
| Dr Shaoping Zhang | School of Biological Sciences | University of Auckland |

## Clinical Associates

| Name | Affiliation |
|---|---|
| Dr Edmond Ang | Auckland District Health Board |
| Dr Rebecca Brandon | Pihanga Health Turangi |
| Assoc Prof Polly Atatota Carr | Waikato District Health Board |
| Dr Sanjeev Deva | Auckland District Health Board |

| | |
|---|---|
| Dr Glen Doherty | Tongan Health Society |
| Dr Rebekah Doran | Pinnacle Midlands Health Network |
| Dr Will Dransfield | Auckland District Health Board |
| Dr Carl Eagleton | Auckland District Health Board |
| Dr Rosemary Hall | Capital and Coast District Health Board |
| Dr Maggie Kalev | Auckland District Health Board |
| Dr Manish Khanolkar | Auckland District Health Board |
| Dr Michelle Locke | Counties Manukau District Health Board |
| Dr Helen Lunt | Canterbury District Health Board |
| Dr Kerry Macaskill-Smith | Pinnacle Midlands Health Network |
| Prof Kerry McCowan | Auckland District Health Board |
| Mrs Tamara Mullaney | Canterbury District Health Board |
| Dr Angela Mweempwa | Auckland District Health Board |
| Assoc Prof Greg O'Grady | Auckland District Health Board |
| Dr Lance O'Sullivan | iMOKO |
| Dr Ryan Paul | Waikato District Health Board |
| Dr Joel Pirini | The Moko Foundation |
| Dr Ashok Raj | Counties Manukau District Health Board |
| Dr Ole Schmiedel | Auckland District Health Board |
| Dr Rosalie Stevens | Auckland District Health Board |
| Assoc Prof Mark Thomas | Auckland District Health Board |
| Dr Ayesha Verrall | Capital and Coast District Health Board |
| Dr Rachel Webb | Waikato District Health Board |
| Dr Michelle Wilson | Auckland District Health Board |
| Dr Andrew Wood | Auckland District Health Board |
| Dr Ryan Yeu | Counties Manukau District Health Board |
| Dr Janak de Zoysa | Waitemata District Health Board |

## Affiliate investigators

| Name | Department | Home Institution |
|---|---|---|
| Dr Maria Abbattista | Auckland Cancer Society Research Centre | University of Auckland |
| Ms Haniyeh Aghababa | Department of Molecular Medicine and Pathology | University of Auckland |
| Ms Marzieh Ahangarpour | School of Chemical Sciences | University of Auckland |
| Mr Antonio Ahn | Department of Pathology | University of Otago |
| Ms Priyadarshana Ajithkumar | Department of Pathology | University of Otago |
| Ms Soumeya Ali Jaballah | School of Biological Sciences | University of Auckland |
| Ms Suzan Al Momani | Department of Pathology | University of Otago |

| | | |
|---|---|---|
| Ms Abeer Al-Zubaidi | School of Biological Sciences | University of Auckland |
| Dr Emma Andrews | Department of Biological Sciences | University of Waikato |
| Mr Hamish Angus | Department of Microbiology and Immunology | University of Otago |
| Dr Jisha Antony | Department of Pathology | University of Otago |
| Ms Shereen Asha Murugayah | Department of Biochemistry | University of Otago |
| Mr Olly Bayley | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Mr Rakesh Banerjee | Department of Pathology | University of Otago |
| Mr Sean Bisset | Institute of Fundamental Sciences | Massey University |
| Mr Sam Blanchett | Department of Molecular Medicine and Pathology | University of Auckland |
| Ms Abigail Bland | Pharmacology and Toxicology Department | University of Otago |
| Dr Adrian Blaser | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Rebekah Bower | School of Biological Sciences | University of Auckland |
| Mr Joe Bracegirdle | School of Physical and Chemical Sciences | Victoria University of Wellington |
| Mr Alistair Brown | School of Biological Sciences | Victoria University of Wellington |
| Mr Matthew Bull | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Esther Bulloch | School of Biological Sciences | University of Auckland |
| Mr Rudy Bundela | Ferrier Research Institute | Victoria University of Wellington |
| Ms Hannah Burden | Department of Molecular Medicine and Pathology | University of Auckland |
| Ms Sophie Burling | School of Fundamental Sciences | Massey University |
| Ms Erica Burns | School of Biological Sciences | University of Auckland |
| Mr Jason Busby | AgResearch Structural Biology Lab/ School of Biological Sciences | University of Auckland |
| Dr Leyla Bustamante | Ferrier Research Institute | Victoria University of Wellington |
| Dr Mark Calcott | School of Biological Sciences | Victoria University of Wellington |
| Dr Rosannah Cameron | Ferrier Research Institute | Victoria University of Wellington |
| Mr Colm Carraher | Plant & Food Research | |
| Ms Aparajita Chakraborty | School of Biological Sciences | University of Auckland |
| Dr George Chang | School of Biological Sciences | University of Auckland |
| Dr Augustine Chen | Department of Biochemistry | University of Otago |
| Dr Ashika Chhana | Department of Medicine | University of Auckland |
| Ms Alice Chin | Department of Pathology | University of Otago |
| Dr Peter Choi | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Hans Choi | School of Chemical Sciences | University of Auckland |
| Ms Clara Chong | Liggins Institute | University of Auckland |

| | | |
|---|---|---|
| Ms Fiona Clow | Department of Molecular Medicine and Pathology | University of Auckland |
| Miss Taylor Cooney | Ferrier Research Institute | Victoria University of Wellington |
| Mr Jack Copping | | Massey University |
| Mr Michael Currie | Biological Sciences | University of Canterbury |
| Dr Rachel Darnell | Department of Microbiology and Immunology | University of Otago |
| Dr Andrew Das | Department of Pathology and Biomedical Sciences | University of Otago, Christchurch |
| Mr James Davies | Biomolecular Interaction Centre | University of Canterbury |
| Ms Naomi Davies | School of Medicine | University of Auckland |
| Dr Emma Davison | School of Chemical Sciences | University of Auckland |
| Mr Paritosh Dayal | School of Biological Sciences | University of Auckland |
| Dr Luis De Leon Rodriguez | School of Chemical Sciences | University of Auckland |
| Ms Cintya Del Rio Hernandez | School of Biological Sciences | Victoria University of Wellington |
| Dr Nikita Deo | Department of Biochemistry | University of Otago |
| Dr Ben Dickson | Auckland Cancer Society Research centre | University of Auckland |
| Dr James Dickson | School of Biological Sciences | University of Auckland |
| Ms Alicia Didsbury | School of Biological Sciences | University of Auckland |
| Dr Ivo Dimitrov | Auckland Cancer Society Research Centre | University of Auckland |
| Ms Waruni Dissanayake | Department of Molecular Medicine and Pathology | University of Auckland |
| Ms Elyce du Mez | School of Biological Sciences | University of Auckland |
| Mr Hamish Dunham | School of Biological Sciences | Victoria University of Wellington |
| Dr Patrick Edwards | Institute of Fundamental Sciences | Massey University |
| Ms Jennifer Eom | School of Biological Sciences | University of Auckland |
| Dr Gloria Evans | Department of Obstetrics & Gynaecology | University of Otago, Christchurch |
| Mr Tayaza Fadason | Liggins Institute | University of Auckland |
| Ms Yifei (Effie) Fan | Ferrier Research Institute | Victoria University of Wellington |
| Dr Scott Ferguson | Microbiology and Immunology | University of Otago |
| Dr Laura Ferrer | Malaghan Institute of Medical Research | |
| Mr Shaun Ferris | School of Chemical Sciences | University of Auckland |
| Dr Vyacheslav Filichev | Institute of Fundamental Sciences | Massey University |
| Mr Mohammad Firoozinia | Department of Chemistry | University of Canterbury, Victoria University of Wellington |
| Mr Matthew Fisk | Ferrier Research Institute | Victoria University of Wellington |
| Ms Sandra Fitzgerald | School of Medical Sciences | University of Auckland |
| Dr Damien Fleetwood | AgResearch Structural Biology Lab/ School of Biological Sciences | University of Auckland |

| | | |
|---|---|---|
| Dr Daniel Foley | School of Physical and Chemical Sciences | University of Canterbury |
| Mr Richard Fong | Institute of Fundamental Sciences and Massey Genome Service | Massey University |
| Mr Jared Freeman | School of Biological Sciences | University of Auckland |
| Mr Zhe (Regan) Fu | Auckland Cancer Society Research Centre | University of Auckland |
| Mr Simon Fung | Auckland Cancer Society Research Centre | University of Auckland |
| Mr Jakob Gaar | School of Chemical Sciences | University of Auckland |
| Mr Mitch Ganley | School of Biological Sciences | Victoria University of Wellington |
| Mr David Goodman | School of Chemical Sciences | University of Auckland |
| Mr Michael Garelja | School of Biological Sciences | University of Auckland |
| Ms Nour Ghamri | Auckland Cancer Society Research Centre | University of Auckland |
| Mr Joseph Gingell | School of Biological Sciences | University of Auckland |
| Mr David Goodman | School of Chemical Sciences | University of Auckland |
| Mr Phillip Grant | School of Chemical Sciences | University of Auckland |
| Dr Natasha Grimsey | Department of Pharmacology | University of Auckland |
| Dr Tracy Hale | Institute of Fundamental Sciences | Massey University |
| Ms Kelsi Hall | School of Biological Sciences | Victoria University of Wellington |
| Dr Cyril Hamiaux | Plant & Food Research | |
| Ms Georgi Hampton | Department of Biochemistry | University of Otago |
| Dr Muhammad Hanif | School of Chemical Sciences | University of Auckland |
| Dr Kiel Hards | Department of Microbiology and Immunology | University of Otago |
| Dr Elena Harjes | Institute of Fundamental Sciences | Massey University |
| Mr Liam Harold | Department of Microbiology and Immunology | University of Otago |
| Ms Jessica Harte | Department of Microbiology and Immunology | University of Otago |
| Dr Chris Hedges | Faculty of Medical and Health Sciences | University of Auckland |
| Dr Kimiora Henare | Auckland Cancer Society Research Centre | University of Auckland |
| Mr Luke Henderson | Department of Pathology | University of Otago |
| Mr Yann Hermant | School of Chemical Sciences | University of Auckland |
| Ms Nicole Herr | School of Biological Sciences | University of Auckland |
| Ms Kerry Hilligan | Malaghan Institute of Medical Research | |
| Dr Colin Hisey | Department of Obstetrics and Gynaecology | University of Auckland |

| | | |
|---|---|---|
| Ms Ngoc Anh Thu (Thu) Ho | AgResearch Structural Biology Lab/ School of Biological Sciences | University of Canterbury |
| Dr Jennifer Hollywood | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Jiwon Hong | School of Biological Sciences | University of Auckland |
| Mr Chris Horne | Biomolecular Interaction Centre | University of Canterbury |
| Ms Anezka Hoskin | Department of Biochemistry | University of Otago |
| Mr Lin Hou | Auckland Cancer Society Research Centre | University of Auckland |
| Mr Amadeus Huang | School of Biological Sciences | University of Auckland |
| Mr Stuart Irwin | School of Medicine | University of Auckland |
| Ms Lupe Isaia | Department of Preventive and Social Medicine | University of Otago |
| Dr Victoria Jackson | Auckland Cancer Society Research Centre | University of Auckland |
| Ms Elsie Jacobson | Liggins Institute | University of Auckland |
| Mr Nadishka Jayawardena | Department of Microbiology and Immunology | University of Otago |
| Dr Jagdish Kumar Jaiswal | Auckland Cancer Society Research Centre | University of Auckland |
| Mr Muhammad Aqfan Jamaluddin | School of Biological Sciences | University of Auckland |
| Mr Aidan Joblin-Mills | School of Biological Sciences | Victoria University of Wellington |
| Dr Jiney Jose | Auckland Cancer Society Research Centre | University of Auckland |
| Ms Maria Kalyukina | School of Biological Sciences | University of Auckland |
| Mr Mohinder Kaplish | Department of Anatomy | University of Otago |
| Mr Johanes Kasim | School of Biological Sciences | University of Auckland |
| Dr Iman Kavianinia | School of Chemical Sciences | University of Auckland |
| Dr Marina Kazantseva | Department of Pathology | University of Otago |
| Dr Sarah Kessans | Department of Chemistry | University of Canterbury |
| Ms Parastoo Khajeaian | Department of Chemistry | Victoria University of Wellington |
| Mr Zin Khant Aung | Department of Anatomy | University of Otago |
| Dr Bronwyn Kivell | School of Biological Sciences | Victoria University of Wellington |
| Mr Nicholas Knowlton | Department of Molecular Medicine and Pathology | University of Auckland |
| Ms Nadiia Kovalenko | School of Chemical Sciences | University of Auckland |
| Dr Andrew Kralicek | Plant & Food Research | |
| Dr Katrin Kramer | Department of Pathology | University of Otago |
| Ms Preeti Kundu | Ferrier Research Institute | Victoria University of Wellington |
| Mr Harikrishan Kurup | School of Fundamental Sciences | Massey University |
| Ms Betty Lee | School of Chemical Sciences | University of Auckland |
| Dr Henry Lee | Biomolecular Interactions Centre | University of Canterbury |
| Dr Kunyu Li | Pathology Department | University of Otago |

| | | |
|---|---|---|
| Dr Lydia Liew | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Khoon Lim | Department of Orthopaedic Surgery and Musculoskeletal Medicine | University of Otago, Christchurch |
| Dr Barbara Lipert | Auckland Cancer Society Research Centre | University of Auckland |
| Dr EJ Loef | School of Biological Sciences | University of Auckland |
| Dr Natalie Lorenz | Department of Molecular Medicine and Pathology | University of Auckland |
| Mr Michael Love | Biomolecular Interaction Centre | University of Canterbury |
| Mr Ben Lu | School of Chemical Sciences | University of Auckland |
| Dr Joanna MacKichan | School of Biological Sciences | Victoria University of Wellington |
| Dr Judith Marsman | Department of Surgical Sciences | University of Otago |
| Mr Stewart Masson | Department of Molecular Medicine and Pathology | University of Auckland |
| Mr Akarsh Mathrani | School of Biological Sciences | University of Auckland |
| Ms Joanna Mathy | School of Biological Sciences | University of Auckland |
| Ms Emma McCafferty | Department of molecular medicine and pathology | University of Auckland |
| Mr Jordan McCone | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Dr Reuben McGregor | Molecular Medicine and Pathology | University of Auckland |
| Ms Rose McLellan | Ferrier Research Institute | Victoria University of Wellington |
| Ms Sarah Meidinger | School of Biological Sciences | University of Auckland |
| Mr Martin Middleditch | Centre for Genomics and Proteomics, School of Biological Sciences | University of Auckland |
| Dr Adam Middleton | Department of Biochemistry | University of Otago |
| Dr Christian Miller | Auckland Cancer Society Research Centre | University of Auckland |
| Ms Jaye Moors | Department of Biochemistry | University of Otago |
| Ms Alexandra Mowday | Auckland Cancer Society Research Centre | University of Auckland |
| Ms Claire Mulholland | Faculty of Science and Engineering | University of Waikato |
| Dr Luis Munoz-Erazo | Department of Microbiology and Immunology | University of Otago |
| Dr David Musson | Department of Medicine | University of Auckland |
| Dr Maran Muthiah | School of Chemical Sciences | University of Auckland |
| Dr Anita Muthukaruppan | Department of Obstetrics and Gynaecology | University of Auckland |
| Dr Dorit Naot | Department of Medicine | University of Auckland |
| Dr Pritika Narayan | School of Biological Sciences | University of Auckland |
| Dr Silke Neumann | Department of Pathology | University of Otago |
| Dr David Nickerson | Auckland Bioengineering Institute | University of Auckland |

| | | |
|---|---|---|
| Mr Denis Nyaga | Liggins Institute | University of Auckland |
| Mr Jake Oh | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Tifany Oulavallickal | Department of Biological Sciences | Victoria University of Wellington |
| Dr Prasanth Padala | Department of Biochemistry | University of Otago |
| Ms Saem Park | School of Biological Sciences | University of Auckland |
| Miss Priyali Patel | Molecular Medicine and Pathology | University of Auckland |
| Ms Danielle Paterson | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Veronica Playle | School of Medicine | University of Auckland |
| Dr Anna Pilbrow | Christchurch Heart Institute | University of Otago |
| Ms Hayley Prescott | Institute of Natural and Mathematical Sciences | Massey University |
| Mr Chris Puliuvea | Department of Molecular Medicine and Pathology | University of Auckland |
| Ms Zohaib Rana | Department of Pharmacology and Toxicology | University of Otago |
| Ms Marina Rajic | Institute of Fundamental Sciences | Massey University |
| Ms Hannah Read | Department of Molecular Medicine and Pathology | University of Auckland |
| Mr Martin Rennie | School of Biological Sciences | University of Auckland |
| Dr Ali Reza Nazmi | Department of Chemistry | University of Canterbury |
| Dr Janet Rhodes | Department of Microbiology and Immunology | University of Otago |
| Dr Mohammed Rizwan | Department of Anatomy | University of Otago |
| Ms Tamsin Robb | School of Medical Sciences | University of Auckland |
| Dr Ilva Rupenthal | Department of Ophthalmology | University of Auckland |
| Mr Euan Russell | Department of Microbiology and Immunology | University of Otago |
| Mr Soroush Safaei | Auckland Bioengineering Institute | University of Auckland |
| Dr Veronika Sander | Department of Molecular Medicine and Pathology | University of Auckland |
| Ms Alessandra Santana | Institute of Environmental Science and Research | |
| Ms Kristiana Santoso | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Dr Viji Sarojini | School of Chemical Sciences | University of Auckland |
| Mr William Schierding | Liggins Institute | University of Auckland |
| Ms Megan Schischka | School of Biological Sciences | University of Auckland |
| Dr Kevin Schuster | Department of Pathology | University of Otago |
| Ms Swapnoleena Sen | Department of Pathology | University of Otago |
| Mr Vahid Seyfoddin | Department of Molecular Medicine and Pathology | University of Auckland |

| | | |
|---|---|---|
| Ms Shamim Shadfar | Institute of Natural and Mathematical Sciences | Massey University |
| Ms Abby Sharrock | School of Biological Sciences | Victoria University of Wellington |
| Mr Jeffrey Sheridan | School of Biological Sciences | Victoria University of Wellington |
| Mr Shevan Silva | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Jonathan Singh | Ferrier Research Institute | Victoria University of Wellington |
| Mr Nathan Skinner | Department of Physiology | University of Otago |
| Dr Tamsyn Stanborough | Biomolecular Interaction Centre | University of Canterbury |
| Ms Tasha Steel | School of Chemical Sciences | University of Auckland |
| Mr Oliver Sterritt | Department of Chemistry | University of Canterbury |
| Dr Aaron Stevens | Department of Pathology and Biomedical Science | University of Otago, Christchurch |
| Mr Luke Stevenson | School of Biological Sciences | Victoria University of Wellington |
| Dr Louise Stubbing | School of Chemical Sciences | University of Auckland |
| Ms Stephanie Stuteley | School of Biological Sciences | University of Auckland |
| Mr Eugene Sun | School of Biological Sciences | University of Auckland |
| Ms Bo Sun | Department of Physiology | University of Auckland |
| Dr Simon Swift | Department of Molecular Medicine and Pathology | University of Auckland |
| Mr Pipat Tangjaidee | School of Chemical Sciences | University of Auckland |
| Ms Zoe Tasma | School of Biological Sciences | University of Auckland |
| Dr Tamasin Taylor | Auckland University of Technology | |
| Ms Evie Templeton | Molecular Biology and Genetics | University of Otago, Christchurch |
| Mr Petr Tomek | Auckland Cancer Society Research Centre | University of Auckland |
| Mr Kelvin Tong | School of Chemical Sciences | University of Auckland |
| Mr Khan Tran | Department of Molecular Medicine and Pathology | University of Auckland |
| Mr William Tremlett | School of Chemical Sciences | University of Auckland |
| Ms Catherine Tsai | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Paulo Urbano | Department of Microbiology and Immunology | University of Otago |
| Mrs Zakieh Vahdati | Molecular Medicine and Pathology | University of Auckland |
| Mr Wouter van Leeuwen | Auckland Cancer Society Research centre | University of Auckland |
| Ms Essie Van Zuylen | Department of Microbiology and Immunology | University of Otago |
| Mr Sai Shyam Vasantharajan | Department of Pathology | University of Otago |
| Dr Claire (Qian) Wang | Department of Molecular Medicine and Pathology | University of Auckland |
| Mr Kyle Webster | School of Biological Sciences | University of Auckland |

| | | |
|---|---|---|
| Ms Alana Whitcombe | Department of Molecular Medicine and Pathology | University of Auckland |
| Mr Thomas Wiggins | Department of Biochemistry | University of Otago |
| Dr Anna Wiles | Department of Pathology | University of Otago |
| Ms Elyse Williams | School of Chemical Sciences | University of Auckland |
| Ms Jessika Wise | Department of Pathology | University of Otago |
| Mr Jonathon Woodhead | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Adele Woolley | Department of Pathology | University of Otago |
| Mr Ethan Woolly | School of Biological Sciences | Victoria University of Wellington |
| Dr Helen Woolner | School of Biological Sciences | Victoria University of Wellington |
| Ms Sanaz Vakili | Department of Molecular Medicine and Pathology | University of Auckland |
| Mr Horace (Ho) Yeung | School of Chemical Sciences | University of Auckland |
| Ms Hannah Zhu | Department of Molecular Medicine and Pathology | University of Auckland |

**CoRE funded research technicians**

| Name | Department | Institution |
|---|---|---|
| Ms Areezah Ali | | University of Auckland |
| Ms Astrid Authier-Hall | Malaghan Institute of Medical Research | |
| Ms Sandra Barre | Department of Molecular Medicine and Pathology | University of Auckland |
| Mr Olly Bayley | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Ms Rebecca Brandon | Faculty of Medical and Health Sciences | University of Auckland |
| Mr Shanan Chand | School of Biological Sciences | University of Auckland |
| Mr James Cheung | Department of Microbiology and Immunology | University of Otago |
| Mr Ben Clarkson | Department of Biochemistry | University of Otago |
| Ms Sarah Draper | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Mr Sebastian Dunn | | University of Auckland |
| Ms Kathryn Farrand | Malaghan Institute of Medical Research | |
| Mr Shalinda Fernando | Department of Molecular Medicine and Pathology | University of Auckland |
| Ms Crystal Gerring | Department of Molecular Medicine and Pathology | University of Auckland |

| | | |
|---|---|---|
| Ms Phoebo Harmos | Malaghan Institute of Medical Research | |
| Mrs Sharada Kolekar | Department of Molecular Medicine and Pathology | University of Auckland |
| Ms Michelle Krause | Department of Biochemistry | University of Otago |
| Mr Xiaojing (Shaun) Lin | Auckland Cancer Society Research Centre | University of Auckland |
| Ms Karen Liu | Faculty of Medical and Health Sciences | University of Auckland |
| Ms Mandy Phipps-Green | Department of Biochemistry | University of Otago |
| Mr Mathew Powell | Department of Biochemistry | University of Otago |

**CoRE funded research fellows**

| Name | Department | Institution |
|---|---|---|
| Dr Maria Abbatista | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Matthew Bull | Auckland Uniservices Limited | University of Auckland |
| Dr Alan Cameron | School of Chemical Sciences | University of Auckland |
| Dr Scott Cameron | Ferrier Research Institute | Victoria University of Wellington |
| Dr Benji Compton | Ferrier Research Centre | Victoria University of Wellington |
| Dr Rachel Darnell | Department of Microbiology and Immunology | University of Otago |
| Dr Ivo Dimitrov | Auckland Cancer Society Research Fellow | University of Auckland |
| Dr Waruni Dissanayake | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Laura Ferrer-Font | Malaghan Institute of Medical Research | |
| Dr Jagdish Jaiswal | Auckland Cancer Society Research Centre | University of Auckland |
| Dr Iman Kavianinia | School of Chemical Sciences | University of Auckland |
| Dr Nicholas Knowlton | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Tanya Major | Department of Biochemistry | University of Otago |
| Dr Gerd Mittelstadt | Ferrier Research Institute | Victoria University of Wellington |
| Dr Luis Munoz-Erazo | Department of Microbiology and Immunuology | University of Otago |
| Dr Erica Prentice | Faculty of Science and Engineering | University of Waikato |
| Dr Jeremy Raynes | Department of Molecular Medicine and Pathology | University of Auckland |
| Dr Jon Swain | School of Chemical Sciences | University of Auckland |

**CoRE funded postgraduate students**

| Name | Department | Home institution |
|---|---|---|
| Mr Antonio Ahn | Department of Pathology | University of Otago |
| Ms Abeer Al-Zubaidi | School of Biological Sciences | University of Auckland |
| Mr Michael Barnett | School of Biological Sciences | University of Auckland |
| Mr Sean Bisset* | School of Fundamental Sciences | Massey University |
| Mr Joe Bracegirdle | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Ms Hannah Burden | Department of Molecular Medicine and Pathology | University of Auckland |
| Ms Linda Buss | Department of Pathology | University of Otago |
| Mr Ho Chuen (Alex) Chan | Faculty of Medical and Health Sciences | University of Auckland |
| Ms Alice Chin | Department of Pathology | University of Otago |
| Ms Taylor Cooney* | Ferrier Research Institute | Victoria University of Wellington |
| Mr James Davies | School of Biological Sciences | University of Canterbury |
| Ms Naomi Davies* | School of Medicine | University of Auckland |
| Ms Alicia Didsbury | School of Biological Sciences | University of Auckland |
| Mr Shalinda Fernando | Faculty of Medical and Health Sciences | University of Auckland |
| Mr Shaun Ferris* | School of Chemical Sciences | University of Auckland |
| Mr Matthew Fisk | School of Chemical and Physical Sciences | Victoria UnIversity of Wellington |
| Mr Jared Freeman | School of Chemical Sciences | University of Auckland |
| Mr Zhe (Regan) Fu* | Auckland Cancer Society Research Centre | University of Auckland |
| Mr Jakob Gaar | School of Chemical Scuiences | University of Auckland |
| Mr Michael Garelja | School of Biological Sciences | University of Auckland |
| Ms Nour Ghamri* | Auckland Cancer Society Research Centre | University of Auckland |
| Ms Jessica Harte | Department of Microbiology and Immunology | University of Otago |
| Mr Luke Henderson | Department of Pathology | University of Otago |
| Ms Erica Hendrikse | School of Biological Sciences | University of Auckland |
| Mr Yann Hermant | School of Chemical Sciences | University of Auckland |
| Peng Hou | School of Biological Sciences | Victoria University of Wellington |
| Kim Jee Hyun | | University of Auckland |
| Ms Lupe Isaia | Centre for International Health | University of Otago |
| Mr Muhammad Aqfan Jamaluddin* | School of Biological Sciences | University of Auckland |

| | | |
|---|---|---|
| Ms Maria Kalyukina* | School of Biological Sciences | University of Auckland |
| Ms Sarada Ketharnathan | Department of Pathology | University of Otago |
| Ms Ayesha Khan | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Ms Nadiia Kovalenko | School of Chemical Sciences | University of Auckland |
| Ms Preeti Kundu | Ferrier Research Institute | Victoria University of Wellington |
| Mr Rajesh Lamicchane | Department of Microbiology and Immunology | University of Otago |
| Mr Steven Li | School of Chemical Sciences | University of Auckland |
| Mr Benjamin Lu | School of Chemical Sciences | University of Auckland |
| Ms Kathleen Lucere | Department of Biochemistry | University of Otago |
| Ms Caitlin McRae | Faculty of Medical and Health Sciences | University of Auckland |
| Ms Evie Mansfield | School of Biological Sciences | University of Auckland |
| Mr Akarsh Mathrani | School of Biological Sciences | University of Auckland |
| Ms Joanna Mathy* | School of Biological Sciences | University of Auckland |
| Mr Jordan McCone* | School of Chemical and Physical Sciences | Victoria University of Wellington |
| Ms Rose McLellan | Ferrier Research Institute | Victoria University of Wellington |
| Mr Daniel Mulholland | School of Medical Sciences | University of Auckland |
| Mr Jake Oh* | Department of Molecular Medicine and Pathology | University of Auckland |
| Mr Connor O'Rourke | Department of Chemistry | University of Canterbury |
| Mr Daniel Palmer | Department of Biochemistry | University of Otago |
| Ms Danielle Paterson* | Faculty of Medical and Health Sciences | University of Auckland |
| Ms Veronica Playle | Department of Microbiology and Immunology | University of Otago |
| Ms Andra Popa | School of Biological Sciences | University of Auckland |
| Ms Hayley Prescott* | School of Natural and Computational Sciences | Massey University |
| Ms Marina Rajic | School of Fundamental Sciences | Massey University |
| Mr Oscar Shepperson | School of Biological Sciences | University of Auckland |
| Mr Nathan Skinner* | Department of Pathology | University of Otago |
| Ms Karla Sousa | Faculty of Medical and Health Sciences | University of Auckland |
| Mr Luke Stevenson | School of Biological Sciences | Victoria University of Wellington |
| Mr Eugene Sun | School of Biological Sciences | University of Auckland |
| Mr Jamie Taka | School of Biological Sciences | University of Auckland |
| Dr Bao Khanh Tran | Department of Molecular Medicine and Pathology | University of Auckland |

| | | |
|---|---|---|
| Mrs Sanaz Vakili | Faculty of Medical and Health Sciences | University of Auckland |
| Mrs Yue Wang | Liggins Institute | University of Auckland |
| Ms Lauren Watson | Facuty of Medical and Health Sciences | University of Auckland |
| Ms Melissa Webby | School of Biological Sciences | University of Auckland |
| Ms Alana Whitcombe | Facuty of Medical and Health Sciences | University of Auckland |
| Ms Elyse Williams | School of Chemical Sciences | University of Auckland |
| Ms Jessika Wise | Department of Pathology | University of Otago |
| Akazong Wonake | Department of Chemistry | University of Canterbury |
| Mr Johnathan Woodhead | Facuty of Medical and Health Sciences | University of Auckland |
| Mr Ethan Woolly* | School of Chemical Sciences | Victoria University of Wellington |
| Ms Hanting Yong | Auckland Cancer Society Research Centre | University of Auckland |

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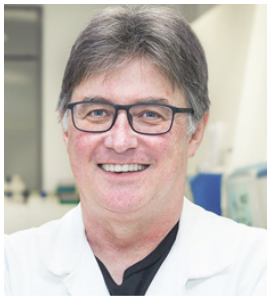
**CoRE Funded Management**

| Name | Department | Institution |
|---|---|---|
| Ms Jessica Fitch | Maurice Wilkins Centre | University of Auckland |
| Mrs Rachael Goldstone | Maurice Wilkins Centre | University of Auckland |
| Mr Peter Lai | Maurice Wilkins Centre | University of Auckland |
| Ms Wendy Li | Maurice Wilkins Centre | University of Auckland |
| Ms Indigo Matisi | Maurice Wilkins Centre | University of Auckland |
| Ms Rochelle Ramsay | Maurice Wilkins Centre | University of Auckland |
| Mr Greg Town | Maurice Wilkins Centre | University of Auckland |

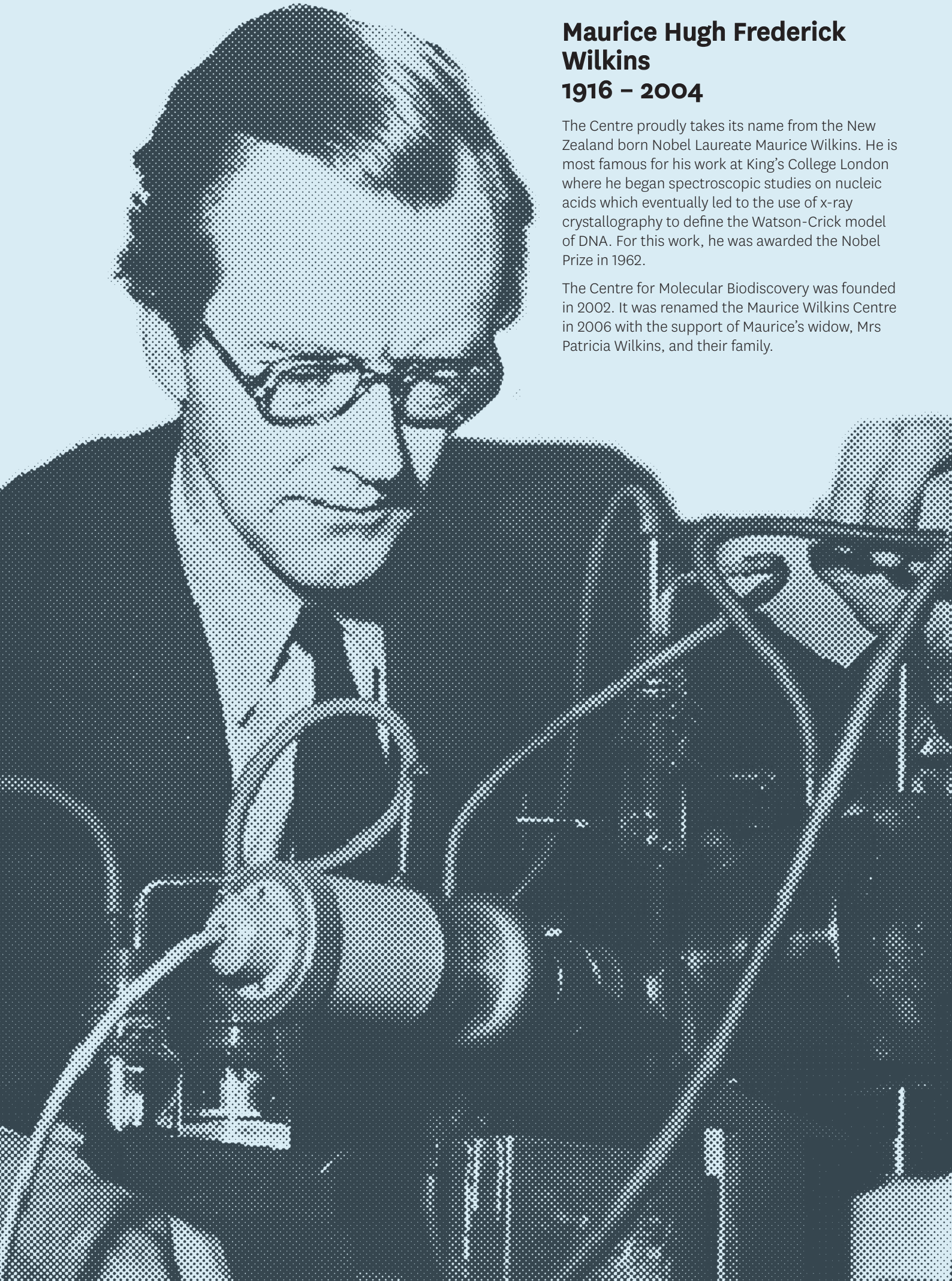
# Contact Details

Director/Principal investigator
Professor Rod Dunbar
School of Biological Sciences
Faculty of Science
The University of Auckland
Private Bag 92019
Auckland 1142, New Zealand
Phone: +64 9 923 5765
Email: r.dunbar@auckland.ac.nz



Deputy Director/Principal investigator
Professor Peter Shepherd
Department of Molecular Medicine and Pathology
Faculty of Medical and Health Sciences
The University of Auckland
Private Bag 92019
Auckland 1142, New Zealand
Phone: + 64 9 923 9891
Email: peter.shepherd@auckland.ac.nz

Research Manager
Ms Rochelle Ramsay
Maurice Wilkins Centre
c/o School of Biological Sciences
Faculty of Science
The University of Auckland
Private Bag 92019
Auckland 1142, New Zealand
Phone: +64 9 923 5533
Email: rj.ramsay@auckland.ac.nz



# Maurice Hugh Frederick Wilkins
# 1916 – 2004

The Centre proudly takes its name from the New Zealand born Nobel Laureate Maurice Wilkins. He is most famous for his work at King's College London where he began spectroscopic studies on nucleic acids which eventually led to the use of x-ray crystallography to define the Watson-Crick model of DNA. For this work, he was awarded the Nobel Prize in 1962.

The Centre for Molecular Biodiscovery was founded in 2002. It was renamed the Maurice Wilkins Centre in 2006 with the support of Maurice's widow, Mrs Patricia Wilkins, and their family.