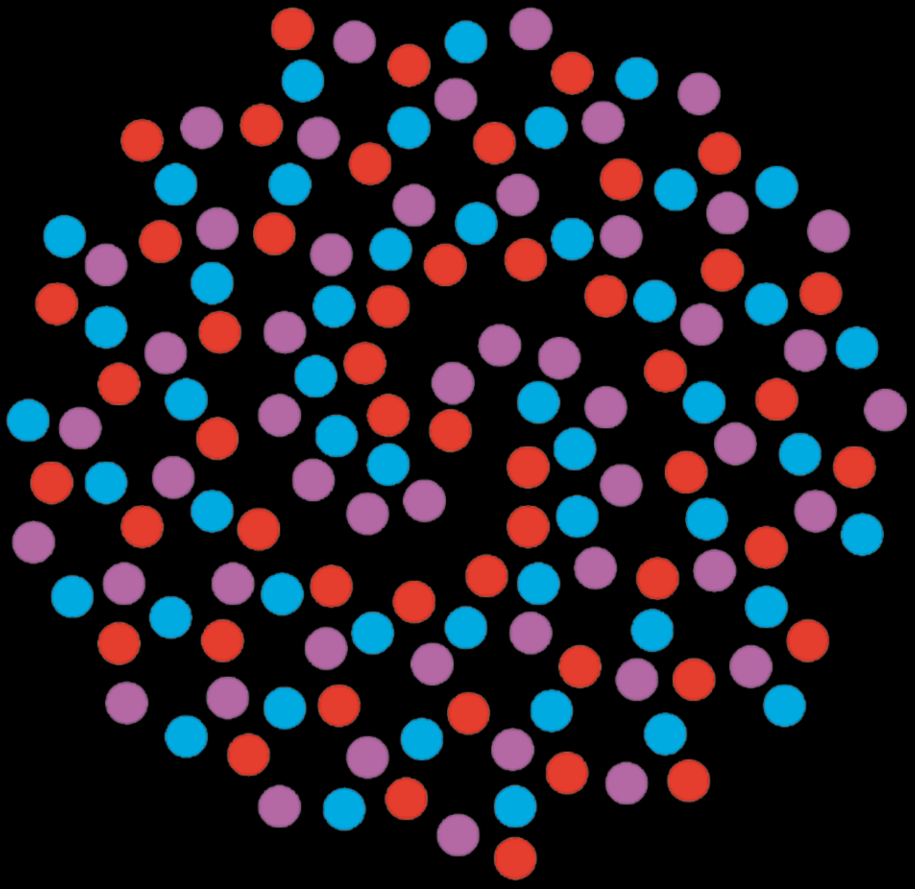

MAURICE WILKINS CENTRE

New Zealand's Centre of Research Excellence
targeting human disease

Annual Report 2014

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 2014 it comprised 148 investigators throughout the country, and over 160 early-career affiliates, linking researchers from six Universities, three Crown Research Institutes and two private research institutes. These investigators represent most of New Zealand's expertise in discovering new drugs, vaccines and diagnostic tools that proceed to clinical trials.

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

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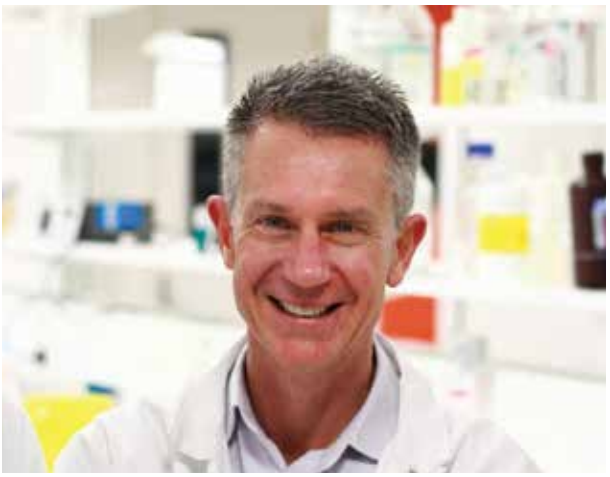
MAURICE WILKINS CENTRE
FOR MOLECULAR BIODISCOVERY

Director's Report



We begin our 2014 report with the news that the Maurice Wilkins Centre has been awarded six more years of funding under the NZ government's Centres of Research Excellence (CoRE) programme (see the story on p9). This follows a rigorous external review of our achievements to date, and of our strategy for the future. Naturally we are delighted.

External reviews always sharpen researchers' focus, and our planning for the next six years reinvigorated our network and its sense of purpose. Of the many adjustments we made to our modus operandi, the most notable are probably the new leadership, the selection of focused flagship programmes, and the new mechanisms for providing our investigators with access to leading technology.

At Board level, we are very pleased that Bill Falconer has agreed to continue as Chair of the Board. Bill has chaired the MWC Board since its inception, and shaped the governance systems that proved central to our recent success. His work with MWC is also recognised as providing a blueprint for governance of other CoREs, a contribution for which he was honoured in 2011 by appointment as a Fellow of the University of Auckland. From 2015 two new Board members will join us representing the University of Canterbury and Victoria University Wellington, and we will lose the representative of the University of Auckland's Faculty of Medical and Health Sciences. Professor Louise Nicholson has served brilliantly in this role since 2013, and we thank her for her strong strategic thinking, her sharp attention to detail, and her warm support.

The new management team includes five new Principal Investigators – Emily Parker, Greg Cook, Ian Hermans, Dave Grattan and Antony Braithwaite. These outstanding researchers have already made huge contributions to MWC – and to global science – and it's a great pleasure to now meet with them regularly to execute our research plan.

To provide additional leadership of our flagship research programmes, we also welcome six new Principal Investigators outside the management committee. Vic Arcus, Rinki Murphy, Shaun Lott, Adam Patterson, Cris Print and Mike Eccles each played crucial roles in developing our research strategy, especially in the flagship themes they now co-lead, and they bring bright new innervation to the brains trust at the head of our CoRE.

Three of the MWC's founding Principal Investigators, Ted Baker, Peter Hunter, and Garth Cooper, move to emeritus roles within the Centre, providing advice and mentoring to the management committee and to our emerging leaders. The MWC quite simply would not exist without these three founders, and we salute their vision, their energy and their sheer hard work in leading the Centre to its current status. Later in this report Ted reflects on his time with MWC, and we look forward to sharing Peter and Garth's thoughts in future. In the meantime we extend particular congratulations to Peter in winning funding to establish the MedTech CoRE. This new CoRE will offer wonderful collaborative opportunities for MWC investigators and will also open up many new pathways for translating NZ science for the benefit of patients.

In fact all the CoREs funded in the recent round intersect very neatly with our aims, and MWC investigators are relishing the prospects of collaborating with the networks of world-leading scientists the new CoREs comprise. As we report on p25, these interactions have already begun in earnest, and will undoubtedly lead to highly innovative approaches to current challenges in medicine.

Our own approach to these challenges has been to review our existing programmes, and prioritise those where our investigators feel we can have most impact. So while the new research programme maintains openness to new ideas and diversity, it also focuses increased resources around flagship themes chosen by our investigators. These major themes cover: cancer therapy, from targeted drugs to immune therapy and genomics; streptococcal disease, especially rheumatic fever; tuberculosis; diabetes genetics; and engineering new protein-based drugs. The process by which these programmes were selected and refined was long and rigorous yet fascinating. Groups of our country's top experts in each field met several times, reviewing both the challenges ahead and New Zealand's potential contributions to global progress. To the great credit of all involved, the approaches of individual investigators were set aside in favour of consensus on the most promising routes to impact on disease burden. In many cases this meant investigators committing to changing course in their own work as they recognised opportunities to contribute to larger scale programmes. The research programme we are about to undertake is therefore distinguished by its scale and ambition, its integration of multidisciplinary skills from investigators across the country, and its focus on delivering impact on major health problems we face.

Even so, the NZ biomedical research community still faces substantial challenges, not least of which is under-resourcing relative to our international peers. One particular issue is access to fast-breaking technology that is necessary to move as rapidly and as effectively as labs overseas, yet often comes at a price our individual research institutions find difficult to absorb. The MWC has previously supported sharing of leading technology

and expertise throughout its national network by incentivising collaborative projects between different disciplines and institutions, and disseminating technical expertise through workshops and symposia. The next step will be the launch of a major programme in 2015 to provide our investigators with access to leading technology platforms wherever they are found in the country. This competitive programme will not only accelerate progress in research that addresses our strategic goals, but we believe will also help drive more efficient deployment of new biomedical technology in the country, by reducing geographical barriers to access. Plainly put, we hope that all technology resources in our institutions will eventually be seen as accessible national resources, and institutions will be able to more clearly strategise about their own investments in biomedical technology with the national map in mind.

In the most strategically compelling cases, this concept will be extended to technical resources only held overseas. In these cases our investigators will carry out collaborative experiments using cutting edge technology at leading international centres, generating world-class experimental results and then bringing home working knowledge of the technology's transformative potential. Pilot projects we have funded have already shown the strong benefits of enabling such technology access, as documented on p14 of this report.

In summary, there is much to celebrate – and now even more to look forward to.

Finally, of the many scientific highlights this year, one (as reported on p13) deserves special commendation: the Orphan Drug status assigned by the FDA to the drug Trofinetide, invented by Margaret Brimble and Paul Harris. For those outside drug discovery, the FDA is the most important drug regulator in the world and its processes determine the fate of most drugs in the journey from the lab to the clinic. Orphan Drug status means Trofinetide goes into a special accelerated development pathway, as the first drug to have potential impact on Rett Syndrome – the first time a drug discovered in NZ has achieved such status. As well as a tremendous testament to the skills of Margaret and Paul, this marks yet another milestone in NZ's strong history of innovation in drug discovery. We look forward to many more such milestones over the coming years.

Rod Dunbar
Director

Contribution to National Goals

The Centres of Research Excellence (CoREs) are collectively charged with making a contribution to national goals including fostering innovation and social and economic development. The CoREs will each contribute to these goals in different ways and in different proportions, depending on their particular research focus. The Maurice Wilkins Centre has its own unique place in this spectrum. Our focus on human disease is based on a multidisciplinary platform that extends across chemistry, biology and medicine and combines key approaches and technologies from physics, engineering and mathematics.

Innovation

The Maurice Wilkins Centre conducts highly innovative research and enables innovation in the wider research and business sector. Its goal is to become New Zealand's engine for the discovery of new therapies and diagnostic tests. Innovation in research is often to be found at the interface between disciplines, through cross fertilisation of ideas and technology.

The Maurice Wilkins Centre brings together researchers from a range of disciplines to tackle complex questions that no one field alone could address. It also encourages a more collegial approach within the biomedical research sector in New Zealand. The Centre's work leads to the establishment of new spin-out companies and contributes directly to innovation within established companies through contract research, consultancy, and sharing of facilities and expertise. Fundamental scientific discoveries, novel technologies and management developed within the Centre enable new lines of research that advance understanding of human health and disease and also enable innovation in other sectors including New Zealand's primary industries.

Social development

One of the Maurice Wilkins Centre's contributions to social development in New Zealand is through improvements to human health. Our major focus is to improve the diagnosis and treatment of diseases such as cancer, diabetes, and infectious disease – all increasing challenges for New Zealand society. At the same time, science is an important aspect of our culture, and the Maurice Wilkins Centre plays a role in increasing the impact of science within New Zealand, as well as connecting us strongly to the international scientific community. The multi-disciplinary and collaborative ethos of the Maurice Wilkins Centre ensures an excellent training environment for graduate students and younger scientists, including exposure to the ethical, managerial and entrepreneurial aspects of translational science. It is particularly important for students at all levels of education to see that scientific research of the highest international quality can be done in New Zealand, and that it can make major contributions to the social and economic well-being of their country. The example set by Maurice Wilkins Centre leaders in choosing to return from research posts overseas, committed to carrying out world-class research in New Zealand, provides a powerful incentive for our top students to do likewise in future.

Economic development

The Maurice Wilkins Centre's focus on new approaches to human disease has dual importance for the New Zealand economy, in both improving health and providing direct economic gains. Centre investigators have to date been responsible for bringing a large portfolio of drugs to clinical trial, with a deep pipeline of new projects in pre-clinical development. This strong portfolio means that New Zealand maintains its exciting potential in the biopharmaceutical sector, one of the few economic sectors capable of driving explosive economic growth. The links between the Maurice Wilkins Centre research programme and industry demonstrates that research findings can and will be developed for the national good. Direct economic gains also come from international research contracts, and milestone and licensing revenue from overseas partnerships – effectively a "weightless" export industry. Less direct economic gains come from Maurice Wilkins Centre investigators' significant impact on the international rankings of our educational institutions, which affect their ability to attract international students.

The Centre also plays an important role in promoting and validating our national scientific capabilities abroad, increasing the reputation of New Zealand as a source of high-value research.

Principal Investigators (management): Professor Rod Dunbar (Director), Professor Peter Shepherd (Deputy Director), Professor Antony Braithwaite, Distinguished Professor Margaret Brimble, Professor Greg Cook, Distinguishe Professor Bill Denny, Professor John Fraser, Professor Dave Grattan, Associate Professor Ian Herman, Professor Emily Parker,,
Principal Investigators (non-management): Professor Vic Arcus, Professor Michael Eccles, Associate Professor Shaun Lott, Dr Rinki Murphy, Associate Professor Adam Patterson, Professor Cris Print.

Highlights

MWC funding renewed

Maurice Wilkins Centre is one of two Centres for Research Excellence to have their funding renewed.

Maurice Wilkins Centre is delighted to see its funding renewed until 2020, with a significant lift in investment from the government to $42.6 million over six years, from $23 million previously. “This is a huge vote of confidence in our achievements, our strategy and our people,” MWC Director Professor Rod Dunbar says. “The new funding allows us to expand our programme substantially, and increase our impact on major health issues affecting New Zealanders. We’ll also be able to support a larger scientific workforce, especially our most promising early career scientists.”

MWC Governing Board Chair Bill Falconer says the continuation of the MWC’s funding recognises the principle characteristics of the Centre: collaboration and focus.

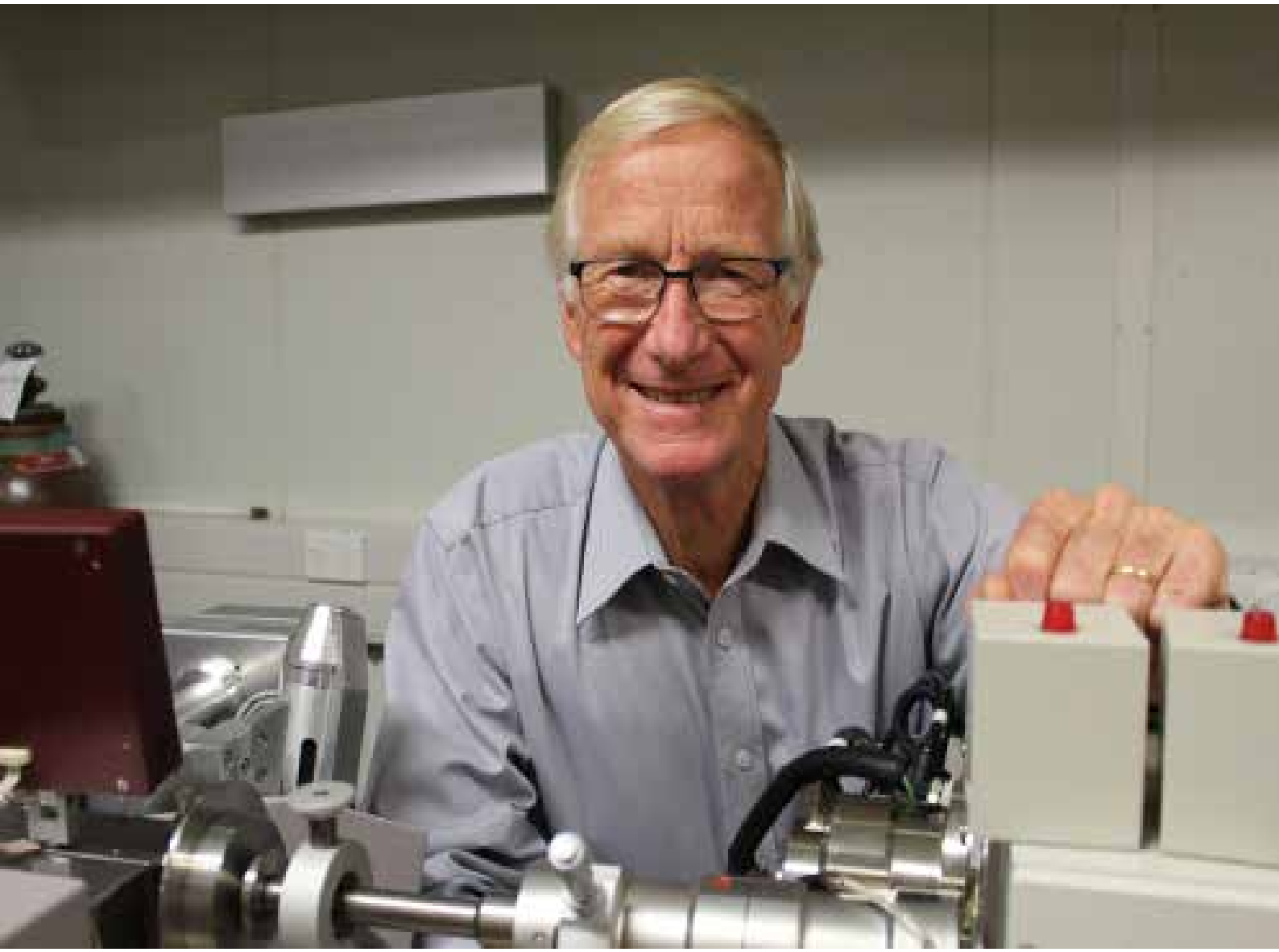
Founded in 2002, MWC is one of seven original Centres of Research Excellence (CoREs) established by the Government to underpin world-class research efforts in New Zealand. MWC was created by linking five high-performing research groups at the University of Auckland in biology, chemistry, engineering and medicine, with collaborating researchers around the country. Since then MWC has strategically expanded its network to incorporate most of the country’s expertise in discovering new therapies and diagnostics for cancer, infectious disease, and diabetes.

This nationwide reach is reflected in the new management committee which includes five new principal investigators (PIs) – Professors Antony Braithwaite, Greg Cook, and Dave Grattan from the University of Otago; Associate Professor Ian Hermans of the Malaghan Institute of Medical Research and Victoria University Wellington; and Professor Emily Parker of the University of Canterbury. Emily says she’s proud to be part of the refreshed leadership. “It’s a diverse group of people who are dead-set on delivering on our mission and creating opportunities for new therapeutics in New Zealand.”

In the latest funding round, MWC competed against 26 other applicants, and underwent both rigorous international scientific review, and a site visit from a panel of leaders drawn from science, education, and business. Six CoREs were funded – four new Centres, and two existing CoREs, the MWC and the MacDiarmid Institute (see story on p25 on the first meeting of all these CoREs).

“As we move into this third funding period, I am sure we can expect to see MWC scientists continuing to make a significant contribution to the wellbeing of New Zealanders, and extending their collaborative model internationally,” Bill says.

Building on the work described elsewhere in this report, the re-invigorated MWC will focus particularly on developing new cancer drugs, including immune therapies, and targeting rheumatic fever and tuberculosis – all areas of research crucial to New Zealand with potential global impact.



Professor Ted Baker, founding director of the Maurice Wilkins Centre.
Image courtesy of Pauline Curtis

Eminent founding Director looks back

As the founding director of the MWC moves into retirement, he talks of the triumph of relationships and the importance of simply "getting started".

Professor Edward Neill Baker, or Ted as he's best known, is proud of the relationships MWC has forged internationally; essential given New Zealand's small population. The networking achieved within New Zealand is also a triumph.

"I think what MWC has done best is to extend its excellent science into strong, collaborative relationships involving people who have never worked together before," he says.

"I am also thrilled to see how our fundamental research is now being translated within the MWC into real advances in human health and wellbeing. So long as we maintain both aspects there are many exciting developments ahead," Ted says.

A good example is the structure of the bacterial proteins known as pilins (see story on p17). "The unique protein structures our fundamental work has discovered turn out to be very useful in the design of new vaccines. It's a great pleasure to see this science now being picked up and developed by the next generation of our scientists."

Ted saw MWC through its first eight years as Director, before handing the reins to current Director Rod Dunbar in 2009. He has remained deeply involved in the management of the MWC as one of eight Principal Investigators, but from 2015 moves to a mentoring role as an Emeritus Principal Investigator. He continues to lead projects in his laboratory while easing into a retirement that includes frequent international travel at the invitation of colleagues overseas.

Ted is internationally renowned as the first person outside Europe and the US to complete a protein structure, and has received many scientific honours including New Zealand's highest scientific award, the Rutherford Medal.

During Ted's post-doctoral studies in Oxford in the 1960s, he worked with Nobel Prize winner Dorothy Hodgkin on the structure of insulin.

"She asked me what I was going to do when I came back to New Zealand. I told her, and that I expected to have little equipment or resources. She said, 'you shouldn't worry about that, the important thing is to just get started and it will all fall into place in the end'."

Despite those who thought New Zealand was too small for structural biology, Ted's area of interest, he was successful, first establishing his lab at Massey University then moving to the University of Auckland and founding the MWC.

He has established an outstanding legacy for his country. "Our area of research is still growing in its importance. We have a very healthy New Zealand community today with a new generation of impressive young leaders to build on what I began."

His advice to the next generation: just get started.

Distinguished Professor Margaret Brimble.
Image courtesy of Margaret Brimble

New drug discovery a New Zealand first

Distinguished Professor Margaret Brimble is proud of her discovery, for women, by a woman.

MWC Distinguished Professor Margaret Brimble is excited about the new synthetic peptide drug that she has developed and its potential to treat Rett Syndrome and other disorders.

The drug, now named Trofinetide (formerly NNZ-2566), is being developed by Neuren Pharmaceuticals after being granted Orphan Drug status for Rett Syndrome by the Food and Drug Administration (FDA) in the USA following Phase 2 clinical trials.

Rett syndrome is a rare medical condition affecting about one in 12,000 people almost exclusively females. In New Zealand, this means three or four cases a year. Babies exhibit no outward signs of the syndrome at birth and seemingly achieve developmental milestones as expected. Symptoms of the severe neurodevelopmental disorder manifest at around six to 18 months with the loss of acquired motor and language skills.

“When I first began work on this I wasn’t even aware of Rett syndrome,” says Margaret. Having since observed young patients she says, “As a mother I know now how devastating it must feel.”

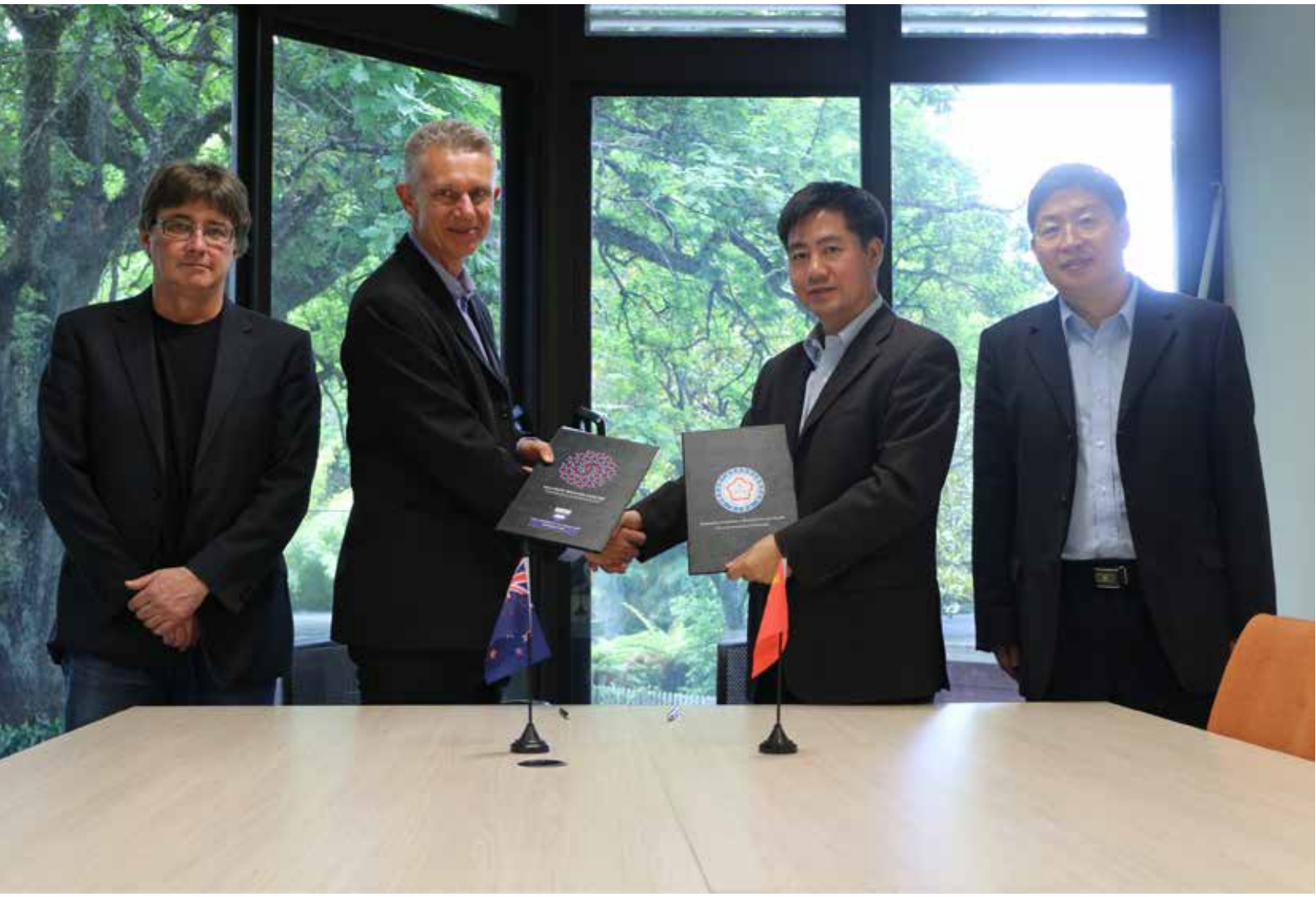
A leading expert in medicinal and natural products chemistry, Margaret was in Paris this year attending the L’Oréal-UNESCO Women in Science Awards. She is proud that as a recipient of this prestigious prize she can give back to the female community a drug that promises to transform lives.

“It’s been 14 years in the making, from the discovery of the molecule followed by a series of clinical trials in animals, healthy human volunteers and finally Phase 2 clinical trials on patients with Rett Syndrome,” Margaret says.

“The molecule proved challenging to make but we battled away... We first came up with about 140 different compounds and whittled these down to four before finding the magic one to take to clinical trial,” she says. MWC Associate Investigator Dr Paul Harris carried out the chemistry under Margaret’s supervision.

The medical implications of Margaret’s discovery are momentous enough but there is added cause for congratulations. Margaret is the first female scientist in New Zealand to have a drug registered with the FDA.

“It’s an amazing story. I’m so proud that this is a drug for women, developed by a woman, and discovered in an academic scientist’s medicinal chemistry laboratory!”



From left to right: Deputy Director Professor Peter Shepherd and Director Rod Dunbar from the Maurice Wilkins Centre (MWC), and Professor Guanghao Chen and Professor Donghai Wu from the Guangzhou Institutes of Biomedicine and Health (GIBH) sign the Memorandum of Coopoeration between MWC and GIBH.
Image courtesy of Peter Lai

Expanding NZ's international reach

Relationships with prestigious research institutes overseas continue to strengthen.

In 2014 MWC continued to play a central role in developing the scientific relationship between New Zealand and China. Chinese President Xi Jinping visited New Zealand in November, and commented that co-operation in bio-medicine was one of the "new bright spots" in relations between the two countries. During his visit, he confirmed more than 20 agreements aimed at strengthening ties, including one between the MWC and the Guangzhou Institutes of Biomedicine and Health, part of the Chinese Academy of Sciences.

"This agreement provides an excellent mechanism for synergy and collaboration since it enjoys a high level of backing from both governments," says MWC Deputy Director Professor Peter Shepherd.

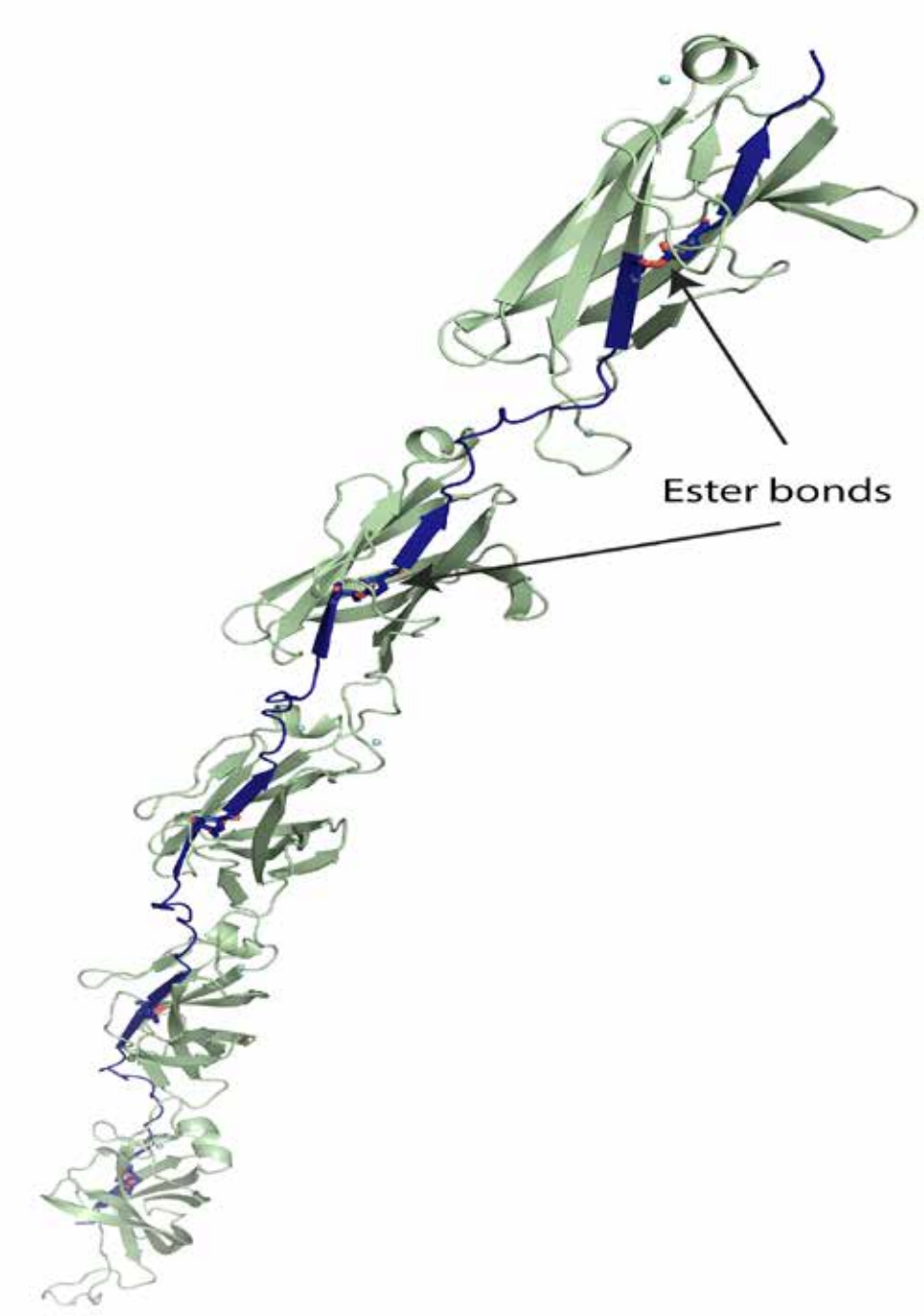
Through the agreement, New Zealand and China have the opportunity to work jointly on stem cell therapies, diabetes, immune therapy for cancer, and drug discovery projects. "These are fields where the world is advancing extremely rapidly. New Zealand needs to be up to speed and well-positioned, and this alliance helps us stay at the forefront," Peter says.

The agreement enables MWC to act as a conduit for researchers throughout New Zealand to access research collaborations in China. It also allows New Zealand biomedical research to present a united face in China, facilitating scientific exchange and development of deep institutional and governmental partnerships. The agreement builds on successful collaborations with China initiated by the MWC, which include two research grants to develop anti-cancer drugs awarded in 2013 through the inter-government Strategic Research Alliance.

Meanwhile relationships with key institutions in the USA also strengthened in 2014. An MWC delegation drawn from five New Zealand universities met with leading researchers at Albert Einstein College of Medicine (AECOM) in New York (see p27 for details of the delegation). The group held two research symposia with US teams led by Professors Bill Jacobs and Vern Schramm. Also present were Drs Shivali Gulab and Scott Cameron from Victoria University Wellington who are on secondments to AECOM, and Gert-Jan Moggré, a visiting student from Professor Emily Parker's group at the University of Canterbury. New joint projects in tuberculosis and cancer were initiated, building on the strong links already established between MWC investigators and AECOM staff.

Four of the MWC delegates also travelled to Colorado State University at Fort Collins to visit the Mycobacterial Research Laboratories, where Associate Professor Shaun Lott from the University of Auckland was already based on a sabbatical exchange.

"Colorado State University has extensive expertise and facilities for tuberculosis research, and leads US academic efforts in this field, so building and extending existing collaborations is really important for MWC's tuberculosis programme," says Emily.



A model showing how ester bonds form part of a single chain or string (blue) that runs continuously from the bottom to the top of the long bacterial protein.

The intriguing matter of cracking bacterial bonds

Maurice Wilkins Centre investigators at the University of Auckland are world leaders in discovery of new cross-links in proteins.

Research fellow Dr Paul Young loves delving beyond the visible to see not just the microscopic detail of bacteria, but the atomic detail of their proteins. Not only is this immensely satisfying for this young scientist, but he and his colleagues' explorations are leading to unprecedented discoveries that have been published in leading journals including *Science*.

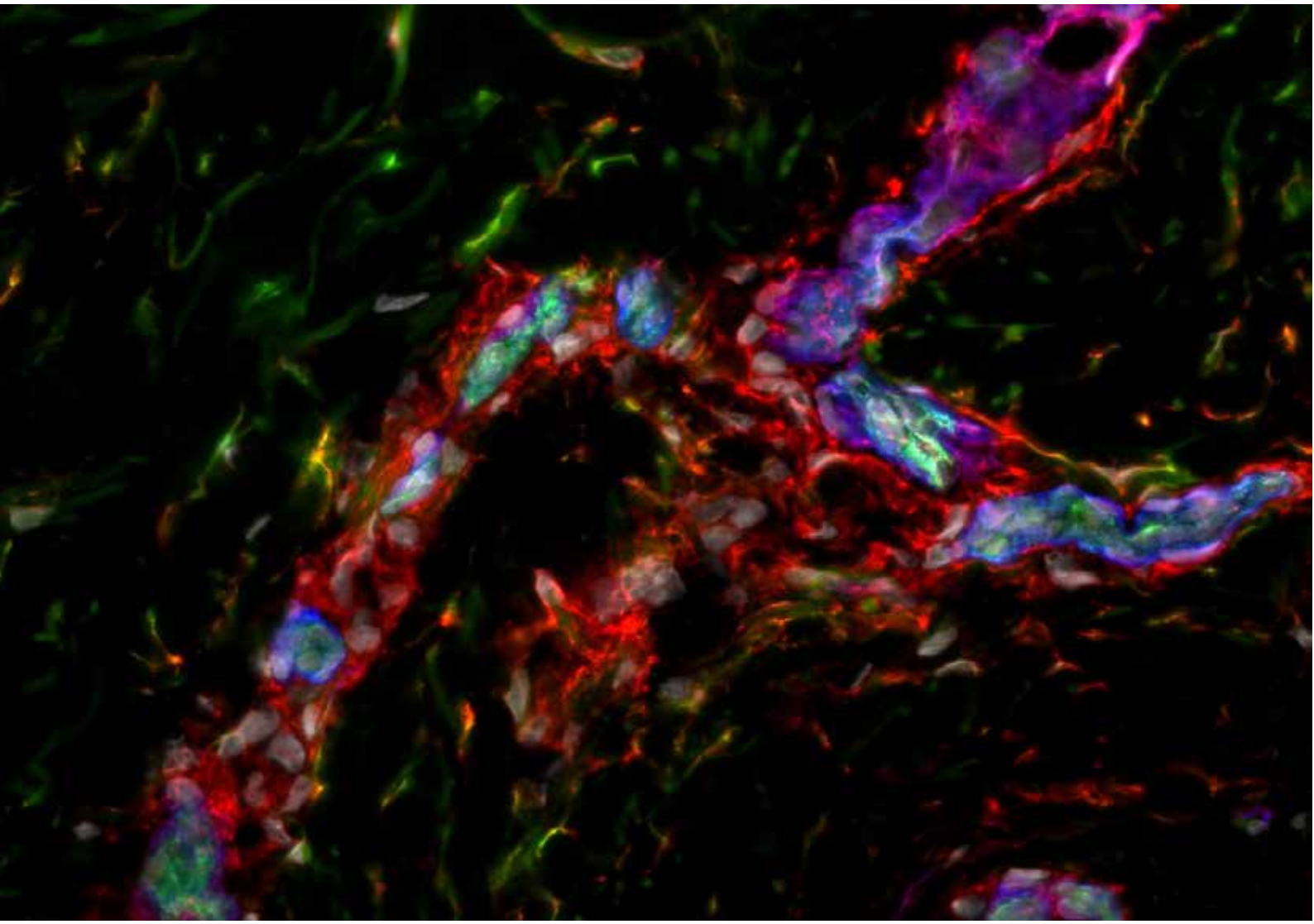
The scientists are part of a structural biology group led by Professor Ted Baker, and affiliated to the MWC, that is funded to research bacterial structures. They recently discovered two different and unusual kinds of cross-links inside the elongated proteins (pili) that gram-positive bacteria use to cling to surfaces. These bonds between amino acid side chains greatly strengthen the proteins, and the team is working to understand how and why they form, and how widely they occur.

These discoveries build on initial work by a team of researchers in Ted's group using X-ray crystallography to solve the structures of proteins involved in pili formation in *Streptococcus pyogenes*, the organism responsible for many serious human diseases including rheumatic fever.

"Unlike gram-negative bacteria, which have comparatively thick pili that are fairly easy to see, gram-positive bacteria were thought to lack pili. Our structures explained why these pili had never been observed - they are just one protein thick" Paul says. "The structures also explained why, even when so thin, they are incredibly strong. The pilus proteins contain internal covalent bonds between amino acid side chains (isopeptide bonds)."

The team then wanted to know what other proteins might contain these bonds and, during this search, discovered another completely novel kind of covalent bond. "They were ester bonds with completely different chemistry to isopeptide bonds," Paul explains. Just as interesting, he adds, was the placement of the bonds. "Like isopeptide bonds they are between the first and last strands of the protein, where the most stress is. We are witnessing convergent evolution here, with bacteria using different mechanisms to stabilise the same position that receives the most mechanical stress."

In November 2014, Paul and Ted, along with Drs Chris Squire and Paul Harris, were awarded a Marsden Fund grant to fully understand the nature of these bonds. In the future they aim to be able to engineer super-stable artificial proteins capable of assembling into nanoparticles for industrial applications. They are also using their knowledge of streptococcal protein structures to help Associate Professor Thomas Proft and Dr Nikki Moreland at the University of Auckland develop a new vaccine candidate for the prevention of rheumatic fever.



Cutting through human skin reveals the stem cell niche, around the walls of blood vessels. The cells that form the walls of blood vessels, pericytes, stain positive for pericyte marker CD146 (Blue), and are surrounded by cells that stain for mesenchymal cell marker CD90 (Red). Some of these cells are also positive for the marker CD34 (Green), and it is these cells, that appear yellow due to the combination of CD90 and CD34 (Red and Green), that are the stem cells.
Image courtesy of Vaughan Feisst

Advanced technology leads to discovery of a new cell in human skin

MWC scientists have developed new methods to identify the different types of cells in human tissues – including very rare ones.

Their latest exciting research led to a cover article in the journal *Stem Cells and Development* that is already being cited in a host of leading international publications.

MWC Research Fellow Dr Anna Brooks, working in the laboratory of MWC Director Professor Rod Dunbar, has pioneered analysis of the cells in human tissues using a technique called flow cytometry. Part of her work has focussed on the cells that make the connective tissues holding the body together. Dr Vaughan Feisst in Rod's lab has been studying the stem cells that give rise to these cells and, using Anna's flow cytometry techniques, the team went looking for such stem cells in human skin.

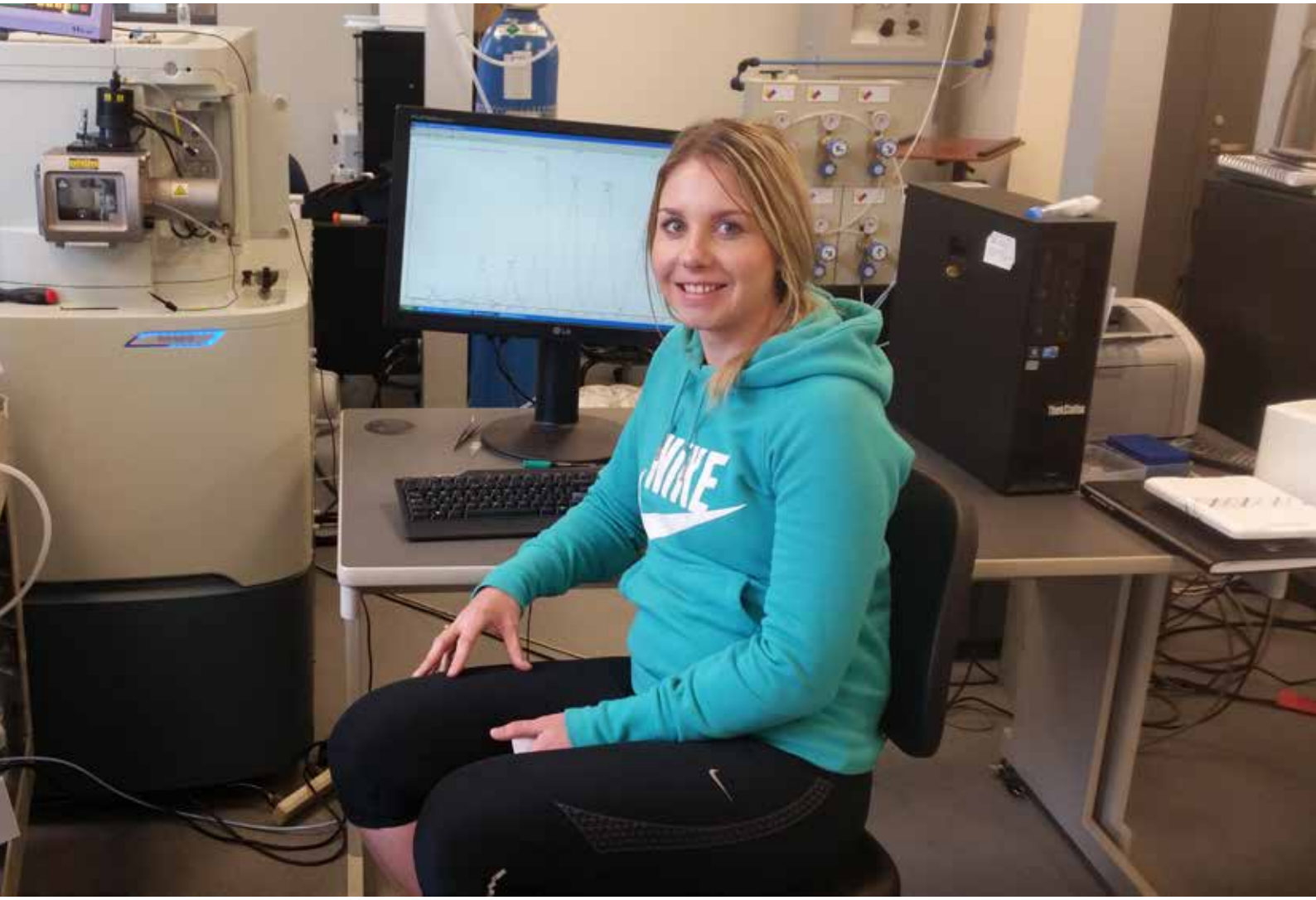
Flow cytometry allowed the team to first identify these rare cells in human skin samples and then to determine molecules that could be used to locate them. Working with the lab's microscopy expert Jenni Chen, they discovered these cells are located on the edge of blood vessels, just as they are in some other human tissues.

"This discovery is pretty fundamental. It opens the door to advances in both skin healing and treatment of skin diseases where we suspect these cells malfunction," Rod says.

The team is now working with Dr Michelle Locke, Senior Lecturer in Plastic and Reconstructive Surgery at the University of Auckland, to understand how this knowledge can be used to improve treatment of skin injury and the impaired healing that many surgical patients suffer. Plastic surgeons and their patients at Middlemore Hospital in Auckland have also been crucial in generously donating tissue for the research.

"This is a good example of the new type of work that the MWC has enabled," says Rod. "The investment in technical capability over many years has led to unique methods that generate exciting new research results. And the interface between bench scientists and clinicians that the MWC has fostered ensure the work stays highly relevant to patient care."

The team began analysing the cells in human skin to understand how to design better vaccines for use in immune therapy for cancer patients. While analysing the immune cells in human skin, the team realised they could apply similar techniques to other medical problems.



PhD student Katherine Donovan at the mass spectrometry facility in the chemistry department of Toronto's York University.
Image courtesy of Katherine Donovan

International scheme brings top technology home

Since 2011, MWC's international training programme has given young New Zealand researchers access to facilities across the world. Young scientists benefit from exposure to the latest technological advances, and we benefit when they bring those experiences back.

Through MWC, young research scientists are able to expand on their specific projects while being mentored by international specialists. Not only are they able to work alongside these renowned experts in their field, they have the latest technology and top facilities at their fingertips.

One of four scientists to travel overseas under the programme in 2014, Dr Harriet Watkins of the University of Auckland spent a month at Rockefeller University in New York working under the guidance of Professor Thomas Sakmar. "I learnt the cutting edge photo-crosslinking technique and how to test for a positive result using an adapted form of immunoblotting," Harriet says.

"This technique searches for interactions between proteins, in our case a receptor and its ligand, and was not carried out in New Zealand previously," she says.

Harriet was able to establish the technique upon her return, which meant she could begin generating publishable results almost immediately. The benefits of Harriet's trip are not solely confined to academic progress though. Harriet says the connection she has established with Professor Sakmar's lab will keep her aware of cutting edge developments and allow her to bring the research home. "I formed close contacts which will be invaluable for the future development of ongoing collaborations through the course of my career," she says.

PhD student Katherine Donovan of the University of Canterbury who also travelled overseas under the programme in 2014, agrees. Katherine spent two months with Dr Derek Wilson in the mass spectrometry facility in the chemistry department of Toronto's York University.

"My visit was invaluable. I was able to learn a very powerful technique for measuring dynamic changes to proteins on a milliseconds to seconds timescale. This technology is currently unavailable in New Zealand," Katherine says. "The information gained and the skills learnt will be helpful throughout the remainder of my PhD and for future employment."

Students who are part of the scheme must engage with MWC networks on their return to New Zealand to share their newly acquired knowledge and demonstrate new skills and techniques.Harriet and Katherine both spoke of their experiences at MWC's Future Science Day in November at the University of Auckland, disseminating their new knowledge while at the same time forming new collaborations within the MWC.

Lytton High School students Samantha Holmberg (left) and Charis Walker exploring science with teacher Erin Sycamore.
Image courtesy Erin Sycamore, Head of Science, Lytton High School.

Teacher programme reignites passion for science

Biology teacher Erin Sycamore is a big fan of MWC teacher professional development days and the annual biological conference in Queenstown. She shares her experiences and delight over how the programme is expanding to smaller centres.

When MWC's professional development programme was run in Napier, Gisborne-based Erin Sycamore and a colleague were more than happy to drive the three hours there and back to attend the course.

"The programme is great for networking and I was able to provide fellow staff with information that we may not have previously known about, particularly the MWC website and resources that can be found there," Erin says. "I am also in touch now with like-minded individuals who are also passionate about biological sciences."

So when MWC expanded the programme Erin, Head of Science at Lytton High School, was delighted. "Gisborne is a very isolated area so it's not very often that we have access to such good quality professional development in our own home town!"

Erin also attended the Queenstown Molecular Biology meeting in 2013, supported by an MWC travel scholarship.

"The conference was amazing! It reignited the passion that I have for science in general and showed me how much is going on in the world of research. I came back to school and shared the passion with my students encouraging them to look at the different pathways available to them.

"When I was at high school I discovered biology. I happened to have two really cool teachers who helped to further develop my interests."

The teacher professional development programme, run by MWC Deputy Director Professor Peter Shepherd and Epsom Girls' Grammar School teacher Rachel Heeney, expanded in 2014 to include smaller centres throughout New Zealand, such as Gisborne and Greymouth.

"When the idea of expanding was first mooted we had a huge amount of interest from teachers wanting us to come to every point in the country," Peter says.

"The feedback has been really good on multiple fronts. Presentations are directly aimed at the NCEA curriculum, but we are providing the correct and most up-to-date information to standardise teaching over the entire country. Teachers are also getting hooked up with the real world of science."

In 2014, MWC professional development days were attended by 300 teachers nationwide, with events held in Tauranga, Gisborne, Auckland, New Plymouth, Wellington, Nelson, Greymouth and Christchurch.


CoRE
symposium
scientists
research
collaboration
imaging
evaluating
connections
drug-screening
Cross-fertilising
primary-industries
cells
nanoparticles
Inter-CoREs
biosensors
disease
cancer
engage
outreach
spectrometry
informatics
end-users
infectious
korero
DNA
learn
tissues
inform
healthcare
modelling

Cross fertilising the new CoREs

In November 2014, the Maurice Wilkins Centre worked with the MacDiarmid Institute to organise a Centres of Research Excellence symposium at the University of Auckland.

The MacDiarmid Institute for Advanced Materials and Nanotechnology and the MWC had recognised there were a number of synergies across their research programmes that should be explored and, in 2014, the stars aligned. The two centres successfully gained renewed CoRE funding in the latest round, so it made sense to get together in 2014. "And we were also delighted to welcome the new CoREs, all of which have substantial intersections with our interests," says MWC Director Rod Dunbar.

The full-day symposium, held at the University of Auckland, was attended by delegates from all six CoREs, with a focus on technology with potential to advance human health. Professor David Williams, MacDiarmid Institute Deputy Director, says such meetings are a great place to make new connections. "There was just so much energy and so much interesting stuff going on."

He emphasises that developing connections across quite disparate disciplines is essential to the international competitiveness of New Zealand research. "We are geographically isolated, and we have to work like we're a city of four million people," David says. "My personal attitude is you do the best science when you are having fun connecting with other people," he adds. "This kind of collaboration is where you ferment ideas. You never know where the next cool idea is going to come from."

For example, David is now working on a new project with Distinguished Professor Peter Hunter, Prof Maan Alkaisi and Dr Volker Nock (University of Canterbury) on making microstructures for 3D cell cultures, aiming to provide measurement data that will inform new models for organ function.

At the conclusion of the symposium, the CoRES had identified a number of areas with exciting potential for collaboration. Two major new opportunities for the MWC are accessing new nanotechnology approaches to develop highly specific diagnostics for infectious disease; and using new imaging, measurement and delivery systems in skin to improve vaccine delivery and track the effects of new treatments. The CoREs also agreed to co-ordinate their efforts in other areas, especially in outreach to schools, building on the success of programmes run by the MacDiarmid Institute and the MWC at both primary and secondary school levels.

But as Rod notes, this is only the beginning. "Whether we think of new molecules and materials from the MacDiarmid, studying complex signalling pathways with Te Pūnaha Matatini, new photonic measurement systems from the Dodd-Walls Centre, or more disease-focused projects with the MedTech CoRE and Brain Research New Zealand, it's clear we have a very powerful cluster of expertise within these CoREs that we can all draw on to tackle major problems in medicine."




Outreach

International engagement

The Maurice Wilkins Centre 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 p46), the Centre is building strategic relationships with institutions and government agencies at city, provincial and national level, in particular in the Asia-Pacific region.

China

The MWC continued its programme of engagement with China in 2014 by building on relationships initiated over 2012 and 2013:

- February: Professor Peter Shepherd and Associate Professor Alan Davidson travelled to Guangzhou to explore collaborative projects with Guangzhou Institutes of Biomedicine and Health, Chinese Academy of Sciences (GIBH).
- March: a session of the Queenstown Molecular Biology Meeting was held in Shanghai alongside the 6th National Forum on New Technologies in Drug Discovery and the 3rd Meeting of Chinese Network for Drugs and Diagnostics Innovation. The meeting was jointly chaired by Maurice Wilkins Centre Deputy Director Professor Peter Shepherd and Professor Ming-Wei Wang, Director of the National Centre for Drug Screening at the Shanghai Institute of Materia Medica. Over 1000 delegates attended the joint meetings from many parts of China and around the world. In addition to Professor Shepherd, the MWC enabled three of its investigators to attend the meeting to speak about their research, Associate Professor Debbie Hay, Associate Professor Alan Davidson, and Dr Jack Flanagan.
- May: Associate Professor Adam Patterson, Dr Jeff Smaill and Mr Peter Lai travelled to Guangzhou to engage with key GIBH personnel and update progress on their project funded by the Strategic Research Alliance (China/New Zealand) with key senior management of the Institute. They also met with Ms Rebecca Needham - New Zealand's Consul-General in Guangzhou.
- August: MWC hosted scientists from China and Singapore who visited the University of Auckland and also gave invited presentations at Queenstown Research Week.

The scientists were: Professor Richard Dequan Ye, Dean, School of Pharmacy, Shanghai Jiao Tong University; Professor Weiping Han, Deputy Director, Institute of Molecular Cell Biology, A*STAR (Singapore); Professor Ming Wei Wang, Director of the National Centre for Drug Screening at the Shanghai Institutes of Materia Medica; Professor Ke Ding, Director, Chemical Biology Institute, Guangzhou Institutes of Biomedicine and Health; and Professor Donghai Wu, Guangzhou Institutes of Biomedicine and Health.

- October: Professor Rod Dunbar, Professor Peter Shepherd and Mr Peter Lai travelled to Guangzhou to discuss future collaborations and to sign an agreement of co-operation between the MWC and GIBH. During their visit they met key leaders of the GIBH including: Professor Duanqing Pei, Professor and Director General; Professor Guanghao Chen, Party Secretary and Deputy Director General; Professor Hong Ming Hou, Deputy Director and Deputy Party Secretary to GIBH; Professor Lai Liangxue, Director South China Institute for Stem Cells and Regeneration Medicine; and Professor Pan Guangjin, Assistant Director General.
- November: the agreement of co-operation between MWC and Guangzhou Institutes of Biomedicine and Health was confirmed by President Xi Jinping of China. In conjunction, MWC hosted Professors Guanghao Chen and Donghai Wu..
- December: MWC Director Professor Rod Dunbar delivered a keynote lecture at the 7th International Conference on Stem Cell and Regenerative Medicine in Guangzhou, China.
- December: the MWC hosted the President Xi Jinping's delegation from the Chinese Academy of Sciences (CAS) to explore collaborative fields between Guangzhou Institutes of Biomedicine and Health (GIBH) and Maurice Wilkins Centre. During their visit, the President of CAS, Prof Bai Chunli, endorsed the Agreement of Cooperation between GIBH and MWC.

USA

The MWC has a strategy to strengthen linkages to key institutes in the USA that have complementary areas of research expertise and where it is likely that collaborative research projects could be initiated or further developed to benefit the MWC research programme.

To initiate this strategy a delegation of MWC investigators travelled to the USA in November 2014 and visited the Albert Einstein College of Medicine of Yeshiva University (AECOM) in New York and Colorado State University (CSU) in Fort Collins.

The delegation members were: Professor Greg Cook (University of Otago), Professor Emily Parker (University of Canterbury), Professor Vic Arcus (University of Waikato), Dr Gary Evans (Victoria University of Wellington) and Associate Professor Shaun Lott (University of Auckland). Dr Jack Flanagan (University of Auckland) also joined the delegation in New York.

The delegation spent three days in New York. During this time they gave presentations at a research symposium in the TB laboratory of Professor Bill Jacobs (Department

of Microbiology and Immunology, AECOM) and met with staff from the Biochemistry Department of AECOM, including HoD Professor Vern Schramm as well as Professors John Blanchard, Steven Almo, Ian Willis, Michael Brenowitz, as part of a second full-day symposium. Members of the delegation also took the opportunity to visit collaborator Dr David Alland at Rutgers New Jersey Medical School to discuss TB diagnostics and Dr Chris Cooper, Senior Director of Chemistry at the Global Alliance for TB Drug Development.

At Colorado State Univeristy (CSU) the delegation met with members of the Mycobacteria Research Laboratories to identify areas for future collaborative interactions. In addition, discussions were held with a number of senior members of the staff including the President of CSU, Dr Tony Frank.

The delegation members identified a number of areas and projects where the MWC could facilitate closer linkages with these institutions to advance the MWC research programme. These will be reviewed in 2015 by the MWC Management Committee.

Japan

As part of an MBIE supported collaborative programme, the MWC has an ongoing relationship with RIKEN and Chiba University in Japan in the area of immunology. In 2014 Malaghan Institute PhD student Ms Naomi Daniels, supervised by Prof Franca Ronchese, spent 6 weeks in the laboratory of Dr Takaharu Okada at RIKEN Institute for Integrated Medical Sciences in Yokohama, Japan, as part of the collaborative programme.

The visit allowed Naomi to advance her work on the interactions between dendritic cells and T cells in the inflamed lung by using the RIKEN expertise and facilities for fluorescent microscopy, and to access strains of mice that express fluorescent markers in dendritic cell and cytotoxic T cell populations.

Asian Chemical Biology Initiative

In early 2014 Deputy Director Professor Peter Shepherd represented the MWC and New Zealand at the third annual meeting of the Asian Chemical Biology Initiative (ACBI) held in Manila, the Phillipines. The ACBI meeting provides a great opportunity for the Maurice Wilkins Centre to build new collaborative relationships with scientists from the Asian region including Japan, Korea, China, and Singapore.

For more information about the ACBI see asianchembio.jp

Industry engagement

The Maurice Wilkins Centre supports innovation in the biotechnology and drug development sector by providing companies with the expertise and facilities that their research and development programmes require. Centre investigators also provide consultancy to industry as described on page 64.

In 2014 the Centre provided expertise and/or facilities to:

- **Auckland Clinical Studies Ltd.:** This company provides Phase I and II clinical research to local and international pharmaceutical and biotechnology companies. In 2014 Maurice Wilkins Centre investigators Professor Rod Dunbar, Dr Anna Brooks and Dr Vaughan Feisst continued to work with Auckland Clinical Studies, providing analytical services to support ongoing clinical trials sponsored by a major pharmaceutical company.

- **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 Margaret Brimble is working with the company on designing and synthesizing new molecules as humane rodenticides to replace the toxin 1080.

- **Neuren Pharmaceuticals:** This is a biopharmaceutical company headquartered in Melbourne, Australia, developing new therapies for brain injury, neurodevelopmental and neurodegenerative disorders. The synthetic peptide drug NNZ-2566 (recently named Trofinetide) was discovered in Maurice Wilkins Centre investigator Professor Margaret Brimble's laboratory, and is now being developed by Neuren Pharmaceuticals in both intravenous and oral formulations for use in traumatic brain injury, fragile X syndrome and Rett syndrome.

- **Threshold Pharmaceuticals, Inc.:** This NASDAQ listed biotechnology company, based in San Francisco, USA, is focussed on discovery and development of drugs targeting tumour hypoxia. Threshold Pharmaceuticals are working with Maurice Wilkins Centre investigators Dr Adam Patterson and Dr Jeff Smaill, from the Auckland Cancer Society Research Centre, to launch the Phase 2 clinical trials of TH-4000 (previously known as PR610). TH-4000 was created in the laboratories of Dr Patterson and Dr Smaill, and is a hypoxia-activated prodrug targeting certain tumour types that are resistant to conventional therapies.

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 (see page 64).

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. In 2014 Maurice Wilkins Centre investigators were involved in a number of science education initiatives, including;

- **Biology Teacher Professional Development days:** In 2014 the Centre ran eight Biology Teacher Professional Development days, building on the successful programme run in 2012 and 2013. Professor Peter Shepherd, Maurice Wilkins Centre Deputy Director, and Ms Rachel Heeney, Head of Biology at Epsom Girls Grammar School, organised events in Auckland, Tauranga, Gisborne, New Plymouth, Wellington, Nelson, Greymouth and Christchurch. These days featured presentations from scientists on key topics relevant to the NCEA Level 3 curriculum and were attended by over 300 teachers. See the highlights story on page 23 for more details of the programme.

- **Maurice Wilkins Centre biology teacher development scholarships:** In 2014 the MWC provided sponsorship for scholarships for high school biology teachers to attend the Queenstown Research Week in August. The aim of the scholarships are to 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 2014, the fifth year of the programme, were Katherine Haines from Wellington East Girls' College; Dick Pirie from Logan Park High School, Dunedin; Richard Hendra from Tauranga Girls' College; and Eva Cornforth from Otahuhu College, Auckland.

- **Katoa New Zealand 'Metagenomics 2014':** The MWC provided sponsorship for 'Metagenomics 2014', a day where high school students from across New Zealand are able to take part in a scientific experiment that aims to describe how bacterial populations are changing over time in New Zealand soils and get 'hands on' experience with genomics in the lab. The programme was run on 27 September 2014 at seven university locations across New Zealand: University of Auckland, Massey University (Albany and Palmerston North), University of Waikato, Victoria University of Wellington, University of Canterbury and the University of Otago. The event was run by Katoa New Zealand, a group of scientists, businesses, educators and community members who wish to inform and educate New Zealanders about our environment and the power of genomics.

- **L'Oréal Girls in Science Forum:** The MWC partnered with L'Oréal New Zealand to run a Girls in Science forum at the University of Auckland on August 14. Over 120 year 11 and 12 secondary schoolgirls from across the Auckland region attended the event which aimed to inspire and demystify science as a profession for young women. The forum was chaired by University of Auckland Distinguished Professor Margaret

Brimble, a 2007 L'Oréal For Women In Science Laureate. Professor Brimble was joined on an expert panel by 2012 International Fellow Dr Zoe Hilton from the Cawthron Institute in Nelson, and the the 2014 L'Oréal Australia For Women in Science Fellow Dr Elena Tucker from Melbourne. The panellists all spoke about their careers to date and answered questions from the audience. At the end of the forum the students had the opportunity to have smaller group discussions with MWC investigators and students about science and careers.

- **Asian Science Camp 2014:** The MWC provided support for Ms Julie Harrisson, a science teacher from Kerikeri High School, to attend the 8th Asian Science Camp in Singapore in August 2014. This camp aims to enlighten talented science students through discussion and dialogue with top scholars in the world, including Nobel Laureates. Julie accompanied five New Zealand senior school students to the camp where they attended plenary lectures by five Nobel Laureates and a Fields Medallist as well as master classes each afternoon where they were able to interact with these eminent scientists. Nobel Laureate Professor Ada Yonath also made time for a special breakfast meeting with the New Zealand and Australian teams!

  Julie says, "The camp showed our students are innovative with sound scientific structures. They have the confidence to ask questions and to relate confidently with diverse groups of people." Of her own experience she says, "It has given me the confidence to be even more passionate and I fervently hope that I can pass on some of the experiences to my teaching colleagues and the students of the Far North."

- **Other science education initiatives over 2014:** MWC investigators were involved in science education initiatives and programmes led by other organisations, including the LENScience 'Meet-a-Scientist' sessions, the Rotary National Science and Technology Forum, the Eureka Trust and the Royal Society Teacher Fellowship programme, as well as many school visits and presentations to students and teachers.

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 via visits by school students. In 2014 MWC investigators generated national and regional media coverage on a variety of scientific topics. Examples include:

- Professor Bill Denny featured on Radio NZ *Nine to Noon* in June after receiving the 2014 American Chemical Society's 2014 Medicinal Chemistry Award. He spoke about the last four decades of cancer drug development. Professor Denny also gave an overview of cancer drug development to the Science Media Centre.
- News that an MWC team had discovered a new type of cell in human skin with stem cell properties was profiled in a story on *ONE News* in March. The story featured Auckland surgeon Ms Michelle Locke, Professor Rod Dunbar, Dr Vaughan Feisst and Dr Anna Brooks. The story was also covered on a number of websites.
- The Girls in Science forum run in partnership with L'Oréal New Zealand in August received coverage on both *ONE News* and in the *New Zealand Herald*. Professor Margaret Brimble, who chaired the forum, spoke on science as a career choice for young women.
- Research by Professor Rod Dunbar and Dr Vaughan Feisst to engineer new skin for burns patients was profiled in the *New Zealand Herald* in August as part of Red Nose Day. Professor Dunbar also featured in a video interview as part of the Red Nose Day TV special which can now be found on the CureKids Facebook page.
- News that a potential new drug to treat Rett Syndrome, discovered by Professor Margaret Brimble and Dr Paul Harris and developed by Neuren Pharmaceuticals, had successfully passed Phase 2 clinical trials was covered by Radio New Zealand, and *Mindfood* magazine ('Professor Margaret Brimble Leads Pioneering Drug Breakthrough'), as well as a number of international and national websites.
- *North and South Magazine* featured a number of articles on cancer in the August 2014 issue involving MWC investigators. 'The Whizz-Bang theory' covered the development of cancer treatments and featured a number of MWC investigators: Associate Professor Adam Patterson, Dr Jeff Smaill, Professor Bill Denny, Professor Rod Dunbar and Associate Professor Ian Hermans. An article titled 'Making it Personal' featured MWC investigator Professor Cris Print commenting on the potential use of genome sequencing to target cancer treatment. In another article '(Fishing for clues') Professor Phil Crosier, also an MWC investigator, commented on the use of zebrafish to investigate how cancer spreads.
- Professor Margaret Brimble won the MasterCard Innovation and Science category at the Women of Influence Awards 2014 in October. An interview with Professor Brimble regarding the award was featured on the Westpac REDnews website and the event was covered by other print and web media. Her work was also profiled in a November article in the *Dominion Post* ('Never-Ending Quest for the Right Answer').

- MWC investigator Dr Siouxsie Wiles, one of New Zealand's top science communicators, was involved in a number of public engagement initiatives in 2014. She teamed up with artist Rebecca Klee again to create an installation featuring bioluminescent bacteria for the Auckland Art in the Dark festival. The work was supported by the MWC and the Faculty of Medical and Health Sciences at the University of Auckland. She was invited to be a guest speaker at Australia's National Science Week in August and at TEDxChristchurch in September. Dr Wiles also regularly comments on topical issues through television, radio, print and online media. In May 2014 she spoke out in an opinion article in the *New Zealand Herald* about the need for more resources to be put into research into antibiotic resistance in response to a World Health Organisation report on the topic.
- MWC investigators Professor Margaret Brimble, Dr Siouxsie Wiles and affiliate Dr Kate Angel were featured in a March 2014 *New Zealand Herald* article on women in science and the proportion of women in senior science roles in New Zealand.
- Research published by Professor Garth Cooper and his group that found both type-1 and type-2 diabetes are likely to be caused by the formation of toxic clumps of a hormone called amylin was reported by *3News* and in the *New Zealand Herald* in May 2014. A number of international websites also commented on the published research.
- Dr Tim Woodfield appeared in a feature on 3D printing and regenerative medicine on TV3's *3rd Degree* programme in September. He was also interviewed on Radio NZ and gave a number of public lectures on the topic.
- In June, the *National Business Review* reported research published by Dr Chis Hall and Professor Phil Crosier in *Nature* about how skin cells deal with inflammation.
- Several MWC investigators were featured in radio interviews about their work, including: Prof Colin Green, Dr Bridget Stocker, Associate Professor David Ackerley and Associate Professor Kathy Mountjoy.
- MWC investigators also gave numerous public presentations about their research to public fora, schools and community groups throughout 2014.

Supporting the New Zealand science community

Thematic research symposia and workshops

During 2014 the Centre ran the following thematic research symposia and workshops:

- **Inter-CoRE Symposium**

  The MWC teamed up with the MacDiarmid Institute to run an Inter-CoRE symposium in November 2014 that also involved the four new CoREs that were awarded funding in the 2013/2014 CoRE round: Te Pūnaha Matatini - The Centre for Complex Systems and Networks, the Medical Technologies CoRE, Brain Research New Zealand - Rangahou Roro Aotearoa and The Dodd-Walls Centre for Photonics and Quantum Technologies. The purpose of the two day symposium was to identify areas of research where there were synergies. On the first day 32 speakers presented snapshots of research areas and expertise in four sessions: biosensors and imaging, cells and devices, cells and materials, and biomaths and informatics. On the second day the programme focussed on the possible synergies in educational and training programmes, as well as strategies for making inter-CoRE collaborations work.

  See the highlights story on p25 for more details.

- **Maurice Wilkins Centre Flagship workshops**

  During 2014 the Maurice Wilkins Centre held three 'flagship' workshops on specific research topics of relevance to the Centre. The aim of these workshops is to bring together New Zealand researchers and clinicians in each research area to brainstorm future directions and decide how best to work together to achieve outcomes that benefit New Zealand. Many of the ideas that came from these workshops have been incorporated into the Centre's proposed research programme from 2015 to 2020.

  Workshops were held on the following topics;

  - Molecular targets in cancer – 13th October
  - Diabetes and metabolic disorders – 4th November
  - Cancer Genomics – 14th November

Technology workshops

During 2014 Maurice Wilkins Centre investigators ran three technology based workshops:

- **New Molecular Technologies**

  The purpose of this workshop was to introduce new molecular technologies and techniques and outline how they can be applied. Topics covered included somatic cell nuclear transfer, transgenics, iPS cells and CRISPR-Cas gene editing with talks from Dr Paul Verma (South Australian Research and Development Institute), Dr Bjorn Oback and Dr Goetz Laible (AgResearch Ltd), Dr Teresa Holm, Dr Anower Jabed and Andrew

Brown (University of Auckland).

The workshop, held in April and attended by over 100 people, was organized by MWC investigators Associate Professor Alan Davidson and Professor Peter Shepherd and run as a joint MWC and School of Medical Sciences (University of Auckland) event.

- **Distilling useful information from genomic data**

  This workshop, which was attended by approximately 75 people, was organised by Associate Professor Cris Print and run by the Bioinformatics Institute at the University of Auckland in partnership with the MWC in November.

  As the amount of genomic data available to researchers continues to increase, so too does the need for more effective ways to analyse large data sets. The workshop featured presentations of methods for analysis of genomic data, from both academic and commercial scientists, including: Dr George Asimenos, a 'cloud data analysis' expert from DNAnexus (dnanexus.com); University of Auckland researchers Mr Gene Soudlenkov (big data computing, NeSI) and Dr Klaus Lehnert (inherited mutation analysis from next generation sequence data); Associate Professor Cris Print (genomic analysis in cancer), and Drs Tony Lough (CEO) and Dan Jones (bioinformatician) from New Zealand Genomics Limited; and Mr Steven Stones-Havas (genomics analysis programmer) and Dr Brett Ammundsen (CEO) from Biomatters (biomatters.com).

- **International CellML workshop**

  The 2014 International CellML Workshop was organised by MWC investigator Dr David Nickerson and held at Goldie Estate on Waiheke Island, Auckland, in March.

  CellML is an open standard language developed by the Auckland Bioengineering Institute and international collaborators to store and exchange computer-based mathematical models of biological processes.

  The workshop provides an opportunity to update users on recent developments and discuss future work on the CellML standard with the user community. Delegates at the workshop in 2014 included visitors from the Netherlands, the United States, Belgium, Australia, Germany, Singapore, Spain, the United Kingdom and France, as well as MWC investigators, and staff and students from the University of Auckland.

  The MWC provided support for the meeting and guest speaker Dr Alan Garny from Inria, France.

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 (see pages 34 and 35) the Maurice Wilkins Centre supports national and international scientific meetings held in New Zealand, as well as smaller local scientific meetings and networks.

In 2014 the Maurice Wilkins Centre provided support for:

- **Queenstown Research Week 2014**

  This event incorporated the Queenstown Molecular Biology Meeting and satellite meetings focussed on: cancer biology & drug discovery; diabetes, obesity & metabolism; kidney biology; plant molecular biology and reproduction & developmental biology. The scientific meetings attracted almost 1000 registrations from national and international delegates and speakers, including a large number of Maurice Wilkins Centre investigators. The Centre 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. The Centre also provides sponsorship for New Zealand secondary school teachers to attend the Queenstown Molecular Biology meeting (see page 30).

- **New Zealand Society for Oncology 2014 Conference**

  This annual national conference was held in Tauranga in October 2014 and brings together oncologists and cancer researchers. The MWC provided sponsorship for keynote speaker Associate Professor Ian Campbell from the Peter MacCallum Cancer Centre.

- **New Zealand Structural Biology Meeting**

  The New Zealand Structural Biology Meeting is a national meeting that brings together all New Zealand researchers with an interest in this discipline, almost all of whom are MWC investigators. The 2014 meeting was held at Hanmer Springs in Canterbury and attracted 114 registrants. Topics covered at the meeting included infectious diseases, cancer, signalling, rational drug design and the modelling of protein interactions. The MWC provided sponsorship for a Structural Chemistry session and student registrations.

- **Workshop: A cohesive ethical framework for tissue-based cancer research in New Zealand**

  The MWC supported a national workshop organised by Associate Professor Cris Print, Dr Annette Lasham and Ms Megan Putterill. The workshop was held at the University of Auckland in April and was attended by 39 clinicians, researchers and representatives from universities, district health boards across New Zealand and the Ministry of Health.

This was a working meeting to define current tissue banking ethical issues in New Zealand and to start discussions about the generation of an approach that enables research while better protecting stakeholder groups. By bringing together almost all of the key stakeholders for tissue banking in New Zealand, the meeting was able to compare current practices across the country and investigate whether a cohesive national ethical framework for collecting and storing human cancer tissues for future research could be developed. The group is collectively working on a strategy for progressing a national framework.

- **Stem Cell Research Network**

  This network, initiated in 2012, aims to foster a collegial and collaborative network among researchers with an interest in all aspects of stem cell research. In 2014 the MWC provided support for Dr Mirella Dotteri from the University of Melbourne to speak at the network's annual meeting.

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 2014 Maurice Wilkins Centre investigators served in advisory and governance roles in many New Zealand organisations including;

- AgResearch Ltd
- Australasian Lung Cancer Trial Group
- Australasian Society for Biomaterials & Tissue Engineering
- Australasian Society for Immunology
- Australasian Society of Free Radical Research
- Biomolecular Interaction Centre (University of Canterbury)
- Breast Cancer Foundation
- Callaghan Innovation
- Cancer Society of New Zealand
- Cancer Trials New Zealand
- Freemasons Roskill Trust
- Genesis Oncology Trust
- Health Research Council of New Zealand
- Institute of Environmental Science and Research
- Kea World Class NZ Awards Selection Panel
- L'Oreal-UNESCO Women in Science Fellowships in Australia and NZ
- Landcare Research Ltd
- Leukaemia and Blood Cancer NZ
- Maurice and Phyllis Paykel Trust
- Middlemore Tissue Bank Scientific Advisory Board
- Ministry of Business Innovation & Enterprise
- Ministry of Health

- National Bowel Cancer Working Group
- National Ethics Advisory Committee
- National Institute of Water & Atmospheric Research
- New Zealand Biosafety Risk Management Advisory Committee, EPA
- New Zealand Chemical Education Trust
- New Zealand Genomics Ltd
- New Zealand Health Quality & Safety Commission
- New Zealand Institute for Rare Diseases Research Ltd
- New Zealand Microbiology Society
- New Zealand Society for Biochemistry and Molecular Biology
- New Zealand Society for Oncology
- NZ Cancer Registry
- NZ Outing Gout
- OBodies Ltd Scientific Advisory Board
- Royal Society of New Zealand
- Wellington Health and Biomedical Research Society
- Wellington Medical Research Foundation

International roles

In 2014 members of the Maurice Wilkins Centre served in more than 60 advisory, editorial and governance roles in international organisations based in the United States of America, Australia, the United Kingdom, Netherlands, Canada, France, Germany, Sweden, Switzerland, Qatar and Romania.




Organisational Development

Research seeding programme

One of the Maurice Wilkins Centre's main objectives is to encourage early-stage research collaborations between investigators from different scientific disciplines, achieved through its contestable research seeding programme. One round of the programme was held in 2014 and 15 new projects were approved.

New initiatives

The Maurice Wilkins Centre fosters new multidisciplinary collaborative research involving Centre investigators, by providing working expenses to initiate work on ground-breaking projects. The aim is to spark projects that will grow into highly innovative and sustainable research programmes.

Projects awarded funding in 2014:

- Chemical synthesis of putative human specific oncogene SHON to test whether disulphide bonds are required for activity: Brimble, Harris, Shepherd and Squire, University of Auckland.
- Establishing a platform to develop new diagnostics for Group A Streptococcus disease: Moreland, Proft, Williamson, Fraser, Dunbar and Brooks, in collaboration with Profs Julian Crane and Michael Baker, University of Otago.
- Derivation of New Zealand's first iPS cell lines: Davidson, Holm, Shepherd, Sorenson, University of Auckland in collaboration with Assoc Prof Trevor Sherwin, Dr Richard Naylor and Ms Aneta Przepiorski, University of Auckland.
- Fragment based drug discovery technology for tuberculosis respiratory chain targets: Cook, Heikal, Kleffmann and Nakatani, University of Otago in collaboration with Prof Ted Baker and Assoc Prof Shaun Lott, University of Auckland, and Dr Chris Wilson, University of California.
- Development of enzyme inhibitors based on transition state design: Parker, Moggre and Mittelstaedt, University of Canterbury in collaboration with Prof Peter Tyler, Victoria University of Wellington.
- Studies of human thoracic duct lymph - physiology composition and cannulation: Phillips, and Windsor, University of Auckland in collaboration with Dr Silas Boas, Dr Katya Ruggiero and Dr KianLiun Phang, University of Auckland and Mr Rajan Patel, Dr Brigid Connor, Assoc Prof Andrew Holden and Dr Colin McArthur, Auckland District Health Board.

- A platform to study the structural and molecular effects of EGFR mutations: Squire, Flanagan and McKeage, University of Auckland.

Access to advanced equipment

The cost of accessing advanced equipment can be a barrier to scientific discovery. Through this category, Maurice Wilkins Centre investigators can access the Centre's advanced equipment anywhere in New Zealand to initiate exciting new projects.

Projects awarded funding in 2014:

- SNPing the full sequence of an important cardiovascular gene: McCormick, Merriman, University of Otago, in collaboration with Assoc Prof Gregory Jones, University of Otago.
- Functional characterisation of long non-coding RNA SOX2OT in breast cancer by next generation sequencing: Leung, University of Auckland, in collaboration with Assoc Prof Klaus Lehnert, University of Auckland.
- Identifying DNA methylation (epigenetic) difference between primary and metastatic melanomas: Eccles, University of Otago and Print, University of Auckland, in collaboration with Dr Aniruddha Chatterjee and Dr Peter Stockwell, University of Otago.
- Development of an optimised multicolour panel to monitor antigen presenting cell activity in human blood: Brooks, University of Auckland.
- Characterisation of granulovirus polyhedral membrane: Busby, Oliver, Metcalf, Middleditch and Turner, University of Auckland.
- Characterisation of the dermal cells involved in the formation of Keloid scars: Feisst, Brooks, Sheppard and Locke, University of Auckland.
- MicroRNAs for the diagnosis of non-occlusive mesenteric ischaemia: Windsor, Phillips and Blenkiron, University of Auckland, in collaboration with Dr KianLiun Phang, University of Auckland and Dr Michael Gillham, Auckland District Health Board.
- Role of p53 isoforms in ALT-mediated immortalisation of cancer cells: Print and Mehta, University of Auckland, Braithwaite, University of Otago in collaboration with Dr Hamish Campbell and Prof Roger Reddel, University of Sydney.
- Does melanocortin system regulate body weight through alterations in the gut?: Mountjoy and Murphy, University of Auckland.

Equipment & facilities

As part of the CoRE funding, the Maurice Wilkins Centre was awarded $4.3 million of capital equipment funding in 2002 and a further $2.7 million in 2007 to purchase capital equipment. This investment in capital equipment has enabled new research to be undertaken, fostered national collaborations and contributed to many research publications.

While primarily used by Centre investigators, this capital equipment has also provided services for New Zealand biotechnology companies, CRIs and Health Boards.

In 2014 the Centre client list included:

- Auckland Clinical Studies Ltd
- Living Nature
- Plant and Food Research Ltd
- Waitemata District Health Board
- Auckland District Health Board
- Waikato District Health Board
- Hawkes Bay District Health Board

In 2014 the University of Auckland purchased a new state-of-the-art TripleTOF 6600 LC-MS/MS mass spectrometer to replace the QSTAR mass spectrometer which was the first major item of capital equipment purchased by the MWC in 2002. The TripleTOF 6600 has a mass accuracy of 2ppm, variable window SWATH acquisition for comprehensive proteomic analysis and high resolution Multiple Reaction Monitoring (MRM-HR) for accurate quantitation of target peptides in highly complex samples.

The QSTAR will continue to be available for sample analysis and both instruments will be operated by the ASAS Mass Spectrometry Centre at the University of Auckland. See www.science.auckland.ac.nz/en/for/business-employers-and-community-2/analytical-services/mass-spectrometry for details.

Human capability

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.

PhD student support

The Centre supports a large cohort of PhD and MSc students within its associated research groups by providing funds for stipends, working expenses and travel, as well as opportunities to access specialised research equipment and facilities. In 2014 the MWC provided full or partial scholarships for 29 PhD students. Eleven MWC supported PhD students completed their studies in 2014.

Future Science Day

In November, the Centre once again convened a successful Future Science Day incorporating career advice for young scientists and research presentations from PhD students.

The two morning sessions of the programme included research presentations from eleven senior Maurice Wilkins Centre PhD students: Julia MacDonald, Karima Medini, Imogen Roth, Meder Kamalov, Harveen Kaur, Jingshu Xu, Inken Kelch, Lin Hou, Matilda Newton, Saem Park and Soroush Safaei.

The first afternoon session was themed “Your future opportunities through the MWC” and featured MWC Director Rod Dunbar updating everyone on the current MWC initiatives and future plans. Deputy Director Peter Shepherd provided an introduction to scientific publishing, and incoming MWC Principal Investigator Emily Parker presented about the opportunities for engaging with the MWC from 2015 onwards.

The last session of the day was a chance to hear from some of those MWC investigators that were enabled through the Centre’s Flexible Research Seeding Programme to either develop their own personal expertise and skills or to develop new independent research (see following section).

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 Centre provides support for staff and students to travel to conferences and technical workshops, and to visit other laboratories in New Zealand and overseas to acquire new skills and techniques.

In late 2011 the Centre launched a new scheme to help its early-career scientists train in cutting-edge technology and share what they learn with their New Zealand colleagues. The contestable programme supports investigators’ travel to 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 on their return to other members of the New Zealand science community.

During 2014, five investigators travelled under the scheme:

- Dr Ghader Bashiri, research fellow in the Structural Biology Laboratory at the University of Auckland, investigates the roles of coenzyme F420 in the biology and pathogenesis of *M. tuberculosis*. Ghader visited the laboratory of Dr Luiz de Carvalho at the Mycobacterial Research Division of the National Institute for Medical Research (NIMR), London, UK in early 2014. Here he used the activity-based metabolomics profiling methodology in use in Dr de Carvalho's laboratory to characterise the substrates for a number of enzymes of interest. The preliminary data generated during this work was further extended once Ghader returned to New Zealand, and formed part of a grant application to the Auckland Medical Research Foundation in collaboration with Dr de Carvalho. Ghader presented the research from his trip at both the 2014 New Zealand Structural Biology Meeting in Hanmer Springs and the MWC Future Science Day.

- Ms Katherine Donovan, a PhD candidate at the Biomolecular Interaction Centre, University of Canterbury. Katherine's studies of mutants in the bacterial gene PykF revealed dramatically different enzyme functions that correlated to only minor structural differences between the enzymes. To investigate, Katherine spent two months in the laboratory of Dr Derek Wilson at the Mass Spectrometry facility at York University, Canada. During this time Katherine learnt how to engineer a time-resolved protein-exchange mixing device to allow mass detection on the millisecond to second timescale using an electrospray ionisation mass spectrometer (ESI MS). She then coupled this device to a microfluidic chip, creating a 'bottom-up' workflow: a capillary mixer for sub-second hydrogen/deuterium exchange (HDX) labelling, a static mixer for HDX quenching, and a microreactor for rapid protein digestion, and on-chip electrospray. This allowed collection of global HDX kinetic data on a number of mutant enzymes, confirming that the functional differences correlated with significant differences in overall flexibility of the different variations of the enzyme. Katherine described the development of skills from her visit as "invaluable" for both her PhD and future career.

- Dr Jack Flanagan and Ms Grace Gong visited Roger Williams' structural biology laboratory at the MRC Laboratory of Molecular Biology in Cambridge, UK, in late 2014. Jack is a senior research fellow, and Grace a PhD candidate, at the Auckland Cancer Society Research Centre, University of Auckland. The focus of their work is the oncogenic PI3K signallosome. While working in the Williams laboratory, they developed skills in FRET based assays for studying protein-membrane interactions, which were used to investigate the PI3K-membrane interaction. The data generated during this work led not only to the development of a manuscript (co-authored by both centres), it also formed the basis of a grant application to the Marsden Fund and had direct input in a short-listed HRC proposal. When asked about the trip Jack stated, "The benefit on multiple fronts was immeasurable."

- Dr Harriet Watkins is a research fellow working with Assoc Prof Debbie Hay in the field of adrenomedullin receptors at the University of Auckland. In the second half of 2014 Harriet spent four weeks working in the laboratory of Prof Thomas Sakmar at the Rockefeller University, New York, learning "new time saving methods for transfection of receptor DNA into mammalian cells when the incorporation of unnatural amino acids adds a new level of complexity". On her return, Harriet has been able to successfully optimise these techniques for use in the adrenomedullin receptor system used in the Hay laboratory, and started to generate some exciting results. Harriet also spoke about her experience in the Sakmar laboratory at the MWC Future Science Day in November 2014, which led to further collaborations within the University of Auckland.

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 2014 this involved MWC investigators travelling to China and the USA and hosting visiting delegations in New Zealand (see p15). The Centre also hosts visits from international and national scientists and officials.

International Scientists

The Maurice Wilkins Centre hosts visits from international scientists. The visiting scientists can then 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 2014:

- Prof Anthony Barrett, Imperial College London, UK
- Associate Professor Richard Callaghan, Australian National University, Australia
- Professor Vicki Chen, University of New South Wales, Australia
- Associate Professor Mark Coster, Griffith University, Australia
- Professor Phil Dawson, The Scripps Research Institute, USA
- Professor Jeff De Brabander, The University of Texas Southwestern Medical Center, USA
- Professor Lea Delbridge, University of Melbourne, Australia
- Professor Ke Ding, Guangzhou Institute of Biomedicine and Health, China
- Professor Peter Doherty, University of Melbourne, Australia
- Professor Chris Easton, Australian National University, Canberra, Australia
- Dr John Flygare, Genentech, San Francisco, USA
- Professor Weiping Han, Institute of Molecular Cell Biology, A*STAR, Singapore
- Associate Professor Craig Hutton, University of Melbourne, Australia
- Professor Dale Laird, Western University, Canada
- Professor Stephen McGarvey, Brown University, USA
- Associate Professor John Moses, The University of Nottingham, UK
- Professor David Paterson, University of Oxford, UK
- Associate Professor Richard Payne, University of Sydney, Australia

- Professor Jerry Pelletier, McGill University, Canada
- Dr Andrew Polson, Genentech, San Francisco, USA
- Professor Richard Dequan Ye, Shanghai Jiao Tong University, China
- Dr David Roper, University of Warwick, UK
- Dr Brian Safina, Genentech, San Francisco, USA
- Professor John Spencer, University of Sussex, UK
- Professor Ming Wei Wang, Shanghai Institutes of Materia Medica, China

External funding

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

New Zealand funding

In 2014 Maurice Wilkins Centre investigators were awarded new grants worth more than $27 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 $18 million from the Health Research Council of New Zealand and $5 million from the Marsden Fund.

International funding

In 2014 Maurice Wilkins Centre investigators secured new funding of over $4 million from international sources to support future research.

Governance and management

Governing Board

The 2014 Maurice Wilkins Centre Board members were; Mr Bill Falconer (Chair), Professor Jane Harding (University of Auckland), Professor Louise Nicholson (University of Auckland), Ms Maxine Simmons (Biocatalyst Ltd) and Professor Warren Tate (University of Otago). Professor Greg Anson (Acting Dean of Science, University of Auckland) participated in the March meeting of the Board. Professor John Hosking joined the Board on his appointment as Dean of Science at the University of Auckland in mid-2014.

During 2014 the Board met three times - in March, July and December. The Board monitored progress of the MWC research programme and its compliance with the funding mandate and budget. The Board provided advice and direction to the management team throughout the selection process for renewed CoRE funding in early 2014, and the MWC is especially grateful to Mr Bill Falconer, Professor Louise Nicholson and Professor Jane Harding for their additional support and guidance during this process. In the July and December meetings the Board reviewed and provided advice on the MWC's strategic plans for the 2015 to 2017 period.

Professor Louise Nicholson's term with the Board ended in 2014. Professor Nicholson joined the Board in 2012 as the representative of the Faculty of Medical and Health Sciences at the University of Auckland. During her term she provided considerable advice and guidance, and the MWC gratefully acknowledges her contribution.

Management Committee

The Maurice Wilkins Centre Management Committee consists of the principal investigators; Professors Rod Dunbar (Director), Peter Shepherd (Deputy Director), Ted Baker, Margaret Brimble, Garth Cooper, Bill Denny, John Fraser and Peter Hunter.

The Management Committee controls the operation of the Centre, under the guidance of the Governing Board and the Scientific Advisory Board. The Committee met seven times during 2014. The committee's focus in 2014 was on the strategic and operational plans for both the new CoRE contract from 2015 and the successful completion of the CoRE contract ending on the 31st December 2014.

In 2014 committee meetings that focussed on the new CoRE contract were also attended by the following principal investigators elect: Professors Anthony Braithwaite, Greg Cook and Dave Grattan (University of Otago), Professor Emily Parker (University of Canterbury) and Associate Professor Ian Hermans (Malaghan Institute of Medical Research).

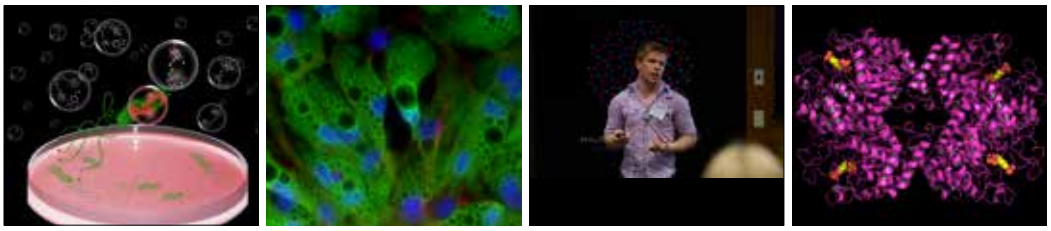
A strategic meeting involving the majority of existing and elect management and non-management principal investigators was held on August 17-18 to refine the strategic plan for 2015 -2017.

Investigator Forum

The MWC held a special forum for principal and associate investigators on September 24-25 to go over the implementation plan for the new MWC programme from 2015.

Over the two days theme leaders presented their outlines of each sub-theme in the MWC programme and led discussions on how investigators could get involved in each sub-theme.

The meeting was attended by over 70 investigators.



Research Outputs

Publications

In 2014 research outputs from Maurice Wilkins Centre investigators included more than 500 peer-reviewed scientific papers published in international journals, and numerous patents granted, published or filed. Research directly supported by the Maurice Wilkins Centre generated the following 88 scientific papers and 4 patents published or filed.

Papers and reviews

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Patents

Patents published

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2. Brimble, M.A., Dunbar, P.R., Williams, G. W. and Wright, T. H. Preparation of Amino acid and Peptide Conjugates as Self-Adjuvanting Vaccines and Conjugation Process. PCT International Application WO 2014207708, 2014.

3. Green, C.R., Nicholson, L.F.B., Danesh-Meyer, H.V. Methods for the treatment of cancer. PCT International Application WO2014129914, 2014.

Patents filed

1. Brimble, M.A., Dunbar, P.R., Williams, G.W. and Verdon, D. Amino Acid and Peptide Conjugates and Uses Thereof. US Provisional Patent Application 62/096,106, filed 23 December 2014.

Presentations

The international significance of the research being done by Maurice Wilkins Centre investigators and their teams is demonstrated by more than 200 invitations to give international and national presentations in 2014. The presentations included invited lectures at conferences and seminars at academic institutions in Australia, Canada, China, France, Germany, Hungary, India, Iran, Ireland, Korea, Malaysia, the Netherlands, Norway, the Phillipines, Portugal, Singapore, South Africa, Sweden, Switzerland, Thailand, the United Arab Emirates, the United Kingdom, the United States of America and New Zealand, as shown in the diagram below.

Presentation highlights

Significant presentations given by Maurice Wilkins Centre investigators in 2014 include:

- Professor Ted Baker was invited to give the first M Vijayan Lecture, entitled "Foundations of X-Ray Crystallography and its Ability to Transform Biology and Chemistry" at the Indian Institute of Science, Bangalore, India, in December 2014. Professor Baker was also invited to give the plenary lecture "Seeing molecules: a bridge between genes and drugs" to the NZ Society for Biochemistry and Molecular Biology's 'Frontiers of Biology: From protein structure and function to drugs' meeting.

- Professor Margaret Brimble was invited to give the plenary lecture at the Peptide Symposium in Singapore, giving a lecture entitled "Development of Peptide and Peptidomimetic Therapeutic Agents from a New Zealand Perspective". She was also invited to give the plenary lecture "Synthesis of Natural Products Containing Aromatic Spiroketals" at the Mander Symposium in Canberra, Australia. Professor Brimble was also invited to give presentations at the 28th International Symposium on the Chemistry of Natural Products in Shanghai, China, and at the 20th International Conference on Organic Synthesis in Budapest, Hungary.

- Professor Bill Denny was the recipient of the American Chemical Society's 2014 Medicinal Chemistry Award, and as part of the presentation of this prestigious award, he gave the keynote at the American Chemical Society National Medicinal Chemistry Meeting held in May in Charleston, South Carolina, USA. His talk was titled "Drug development in a University setting". Professor Denny was invited to give the plenary lecture at the 6th National Forum on New Technologies in Drug Discovery in Shanghai, China. The lecture was entitled "Drug development for infectious diseases; persistent tuberculosis and leishmaniasis". He was also invited to give the plenary lecture "From protein structure to drug: design examples from the Auckland Cancer Society Research Centre" to the NZ Society for Biochemistry and Molecular Biology's 'Frontiers of Biology: From protein structure and function to drugs' meeting.

- Professor Peter Hunter was invited to give multiple keynote lectures at meetings held in 2014. The first, at the Nicholas Ayache Symposium, Paris, France was entitled "Computational Physiology: Connecting Molecular Systems Biology with Clinical Medicine". At the Victor Chang Symposium, Sydney, Australia, in October, Professor Hunter gave the keynote lecture "Computational Modelling of the Heart". He was invited to give the keynote lecture "Reproducible modelling: Standards, databases and software tools" at the Virtual Physiological Human Conference 2014, held in Trondheim, Norway. Professor Hunter also gave keynote lectures at the 15th International Conference on Systems Biology, Melbourne, Australia and at the Gold Coast Health and Medical Research Congress, Brisbane, Australia.

- Dr Siouxsie Wiles was invited to give the Cam Reid Oration (keynote address) at the Australian and New Zealand Council for the Care of Animals in Research and Teaching (Queenstown, NZ). Her address was entitled "How being nice to mice made my research career".

- Dr Tim Woodfield was invited to give two keynote lectures at the NZ-Korea Bioforum held in Christchurch, New Zealand. These lectures were titled “3D Printing and Modular Tissue Assembly Platforms for Musculoskeletal Regenerative Medicine” and “New Frontiers in Musculoskeletal Regenerative Medicine: Biomaterials, Biofabrication and Stem Cell Biology”.

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

- McGill University (Canada)
- Brandeis University (USA)
- Emory University (USA)
- Fralin Life Science Institute (USA)
- Georgia Institute of Technology (USA)
- Hendrix College (USA)
- Indiana University School of Medicine (USA)
- Johns Hopkins University (USA)
- La Jolla Institute for Allergy and Immunology (USA)
- Lawrence Berkeley National Laboratory (USA)
- Ludwig Institute for Cancer Research (USA)

- Mount Sinai Hospital (USA)
- National Institute of Allergy and Infectious Diseases (USA)
- National Institutes of Health (USA)
- Robert Wood Johnson Medical School (USA)
- Stony Brook University (USA)
- University of Oklahoma (USA)
- University of Tennessee (USA)
- Vanderbilt University (USA)
- Western Kentucky University (USA)
- Vienna University of Technology (Austria)
- Hambrug University of Applied Sciences (Germany)
- Max Planck Institute for Molecular Genetics (Germany)
- Max Planck Institute of Complex Systems (Germany)
- RWTH Aachen University (Germany)
- University of Bergen (Norway)
- Karolinska Institute (Sweden)
- Paul Scherrer Institute (Switzerland)
- Swiss Federal Institute of Technology (ETH; Switzerland)
- University of Bern (Switzerland)
- Bangor University (UK)
- Boston University (UK)
- MRC Laboratory of Molecular Biology (UK)
- MRC Mitochondrial Biology Unit (UK)
- The Wellcome Trust Sanger Institute (UK)
- University of Bristol (UK)
- University of Nottingham (UK)
- University of Reading (UK)
- Commonwealth Scientific and Industrial Research Organisation (CSIRO; Australia)
- Griffith University (Australia)
- MD Anderson Cancer Center (Australia)
- Melanoma Institute of Australia (Australia)
- Royal Melbourne Institute of Technology (Australia)
- University of Newcastle (Australia)
- University of Technology Sydney (Australia)
- University of Western Australia (Australia)
- University of Wollongong (Australia)
- Jiangnan University (China)
- Tsinghua University (China)
- Hokkaido University (Japan)
- Kumamoto University (Japan)
- Kyushu University (Japan)
- National Centre for Biological Sciences (India)
- Agency for Science Technology and Research (A*STAR; Singapore)

Continuing academic collaborations

North America

- University of British Columbia (Canada)
- Colorado State University (USA)
- Duke University (USA)
- Fox Chase Cancer Centre (USA)
- Global Alliance for TB Drug Development (USA)
- Harvard University (USA)
- Houston Methodist Research Institute (USA)
- J Craig Venter Institute (USA)
- Medical College of Wisconsin (USA)
- Mercer University School of Medicine (USA)
- New York University (USA)
- Pennsylvania State University (USA)
- Rochester Institute of Technology (USA)
- Sanford Burnham Institute of Medical Research (USA)
- Stanford University (USA)
- Texas Medical Center (USA)
- The Rockefeller University (USA)
- The Scripps Research Institute (USA)
- The University of Chicago (USA)
- The University of Illinois (USA)
- University of Arizona (USA)
- University of California (USA)
- University of Massachusetts Dartmouth (USA)
- University of Michigan (USA)
- University of Pennsylvania (USA)
- University of Pittsburgh (USA)
- University of Washington (USA)
- Yeshiva University (USA)

South America

- Federal University of Sao Paulo (Brazil)

UK and Europe

- Technical University of Denmark (Denmark)
- Inria, Paris (France)
- Pasteur Institute (France)
- Centre for Free-Electron Laser Science (Germany)
- Charité Medical University Berlin (Germany)
- Hannover Medical School (Germany)
- Johannes Gutenberg University (Germany)
- The Philipp University of Marburg (Germany)
- University of Leipzig (Germany)
- University of Rostock (Germany)
- Universidad Politécnica de Madrid (Spain)
- University of Gothenburg (Sweden)
- Maastricht University (The Netherlands)
- Aston University (UK)
- Imperial College London (UK)
- Manchester Metropolitan University (UK)

- Nottingham University (UK)
- Queen Mary University of London (UK)
- The John Innes Centre (UK)
- University of Liverpool (UK)
- University of Manchester (UK)
- University of Oslo (Norway)
- University of Oxford (UK)
- University of Sheffield (UK)
- University of St Andrews (UK)

Asia Pacific

- Australian National University (Australia)
- Burnett Institute (Australia)
- Children's Medical Research Institute (Australia)
- Monash University (Australia)
- Murdoch Children's Research Institute (Australia)
- Peter MacCallum Cancer Centre (Australia)
- Queensland Institute for Medical Research (Australia)
- Queensland University of Technology (Australia)
- The University of Melbourne (Australia)
- University of Adelaide (Australia)
- University of New South Wales (Australia)
- University of Queensland (Australia)
- University of Sydney (Australia)
- Walter and Eliza Hall Institute (Australia)
- Fujian University of Traditional Chinese Medicine (China)
- Guangzhou Institute of Biomedicine and Health (China)
- Shanghai Institute of Ceramics (China)
- Shanghai Institute of Materia Medica (China)
- Tianjin University (China)
- Indian Institute of Science (India)

Middle East

- Israel Oceanographic and Limnological Research (Israel)

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 29 of this report. The Centre's investigators also act as consultants for a number of national and international companies.

In 2014 the expertise of Maurice Wilkins Centre investigators was sought by:

- A2 Corporation (Australia)
- ADInstruments Ltd
- Alder Biopharmaceuticals Inc (USA)
- Allergan Pharmaceuticals (USA)
- Auckland Clinical Studies Limited
- Bayer Animal Health Ltd (Germany)
- Bayer Crop Science (Germany)
- Biomatters Ltd
- Biotelliga Ltd
- BLIS Technologies Ltd
- Boutiq Science Ltd
- Callaghan Innovation Research Ltd
- Cancer Research Technology Ltd (UK)
- Cancer Therapeutics CRC Pty Ltd (Australia)
- Canterbury Scientific Ltd
- Comvita Ltd
- Connovation Ltd
- Dairy Goat Co-operative Ltd
- Enztec Ltd
- Fonterra Co-operative Group Ltd
- Innate Therapeutics Ltd (Australia)
- Janssen Research & Development (France and Belgium)
- L2 Diagnostics LLC (USA)
- Landcare Research NZ Ltd
- Medtronic NZ Ltd
- Mesynthes Ltd
- Nestlé (Switzerland)
- Neuren Pharmaceuticals Ltd (Australia)
- New Zealand Leather and Shoe Research Association
- New Zealand Pharmaceuticals Ltd
- New Zealand Genomics Ltd

- Novartis Vaccines and Novartis Vaccines for Global Health (NVGH) (Italy)
- Oroboros Instruments (Austria)
- Ossis Ltd
- Polybatics Ltd
- Proacta Inc (USA)
- Reata Pharmaceuticals Inc (USA)
- Seattle BioMed (USA)
- Seeka Kiwifruit Industries Ltd
- Threshold Pharmaceuticals (USA)

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, researchers associated with the Centre and based at the Auckland Bioengineering Institute are paid to work on the “Human Physiome Project”, along with their European collaborators, under the European Commission Framework Programme. Maurice Wilkins Centre investigators are also involved with international organisations such as the Global Alliance for TB Drug Development.

Awards and Honours

International, national, and institutional honours won by Maurice Wilkins Centre investigators, affiliates, and students in 2014:

- **New Zealand Order of Merit**

  Professor Graham le Gros, from the Malaghan Institute for Medical Research, became a Companion of the New Zealand Order of Merit, for his services to science and medicine, while Dr Gary Evans, from Victoria University, became a Member of the New Zealand Order of Merit for his services to science.

- **Fellows of the Royal Society of New Zealand**

  Two Maurice Wilkins Centre Associate Investigators, Professor John Windsor and Professor Catherine Day, were amongst 12 top New Zealand researchers and scholars to be elected as Fellows of the Royal Society of New Zealand. This distinguished election recognises researchers for "showing exceptional distinction in research or in the advancement of science, technology or the humanities".

- **Westpac Trust Women of Influence Award**

  Maurice Wilkins Centre Principal Investigator Professor Margaret Brimble, has been acknowledged for Inspiring Leadership with a Westpac Trust Women of Influence Award for Science and Innovation. The Woman of Influence Awards are designed to support, promote, and celebrate the invaluable contribution women make to New Zealand.

- **University of Auckland Commercialisation Medals**

  Maurice Wilkins Centre Associate Investigators, Professor David Williams and Professor Colin Green, were awarded Vice-Chancellor's Commercialisation medals. These medals recognise researchers who have demonstrated high impact and excellence in sponsored research and research application over a number of years.

- **Distinguished Research Medal**

  Professor Greg Cook is the first microbiologist to win Otago University's Distinguished Research Medal. The medal is Otago's highest research honour and is awarded for outstanding scholarly achievement, including the discovery and dissemination of new knowledge, the development of innovative technology, or the development of concepts that lead to significant advances.

- **Animal Ethics Committee (AEC) Service Award**

  Professor John Miller received an Animal Ethics Committee Service Award for his long-standing contribution to managing animal ethics at Victoria University. The AEC service award is given by the National Animal Ethics Advisory Committee (NAEAC) in recognition of "meritorious service for at least five years on the basis of outstanding contributions to the AEC on which a nominee has served"

- **The Custom Science NZSBMB Award**

  Associate Professor Dave Ackerley was awarded the NZSBMB Custom Science Award for Research Excellence, the top honour of the NZ Society for Biochemistry & Molecular Biology.

Financial Report 2014

Operating Fund[a]

	$ 2014	$ 2013
Income		
CoRE grant	3,815,126	3,867,777
Equipment User charges[b]	86,738	242,030
Other income[c]	0	34,915
Balance from previous year[d]	1,527,083	2,211,815
Total Income	5,428,947	6,356,537
Expenditure		
Salaries[e]	1,526,693	1,218,260
Overheads	1,307,616	831,232
Project costs[f]	1,412,341	1,480,128
Student support (PhD and other)[f]	545,974	613,717
Travel	222,375	156,701
Depreciation	413,948	529,416
Total Expenses	5,428,947	4,829,454
Income less expenditure	0	1,527,083

Notes

a. This financial report is for the period 1st January to 31st December 2014.This report only details income and expenditure relating to the CoRE grant funding that the MWC receives from the Tertiary Education Commission. It does not contain details of operating funding to MWC investigators from other funding agencies.

b. These equipment user charges are collected by the MWC from users of the large items of capital equipment purchased with funding from the MWC capital equipment fund. The charges are used to offset the operational and depreciation costs of the equipment.

c. This income is from UniServices and was used to balance costs incurred by the MWC in 2014 for salaries and working expenses associated with contract research.

d. An adjustment has been made to the 2014 brought forward balance due to prior year re-statement of brought forward balances. No expenditure or income totals were affected.

e. Summary: Maurice Wilkins Centre supported research staff FTEs 2014

Principal Investigators	0.50
Research Fellows	8.46
Research Technicians	7.77
Total	16.73

f. These costs include the costs of subcontracts for associate investigators' research projects during 2014.

Directory

Governing Board

Mr Bill Falconer (Chair)
Prof Grant Guilford
Prof Jane Harding
Prof Louise Nicholson
Ms Maxine Simmons
Prof Warren Tate

Scientific Advisory Board

Dr Jim Watson (Chair)
Prof Peter Andrews
Prof Sir Tom Blundell
Prof Suzanne Cory
Dr Jilly Evans
Prof Shankar Subramaniam
Prof Dick Wettenhall

Principal investigators

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 Ted Baker	School of Biological Sciences	University of Auckland
Prof Margaret Brimble	School of Biological Sciences	University of Auckland
Prof Garth Cooper	School of Biological Sciences	University of Auckland
Prof Bill Denny	Auckland Cancer Society Research Centre	University of Auckland
Prof John Fraser	Dean, Faculty of Medical and Health Sciences	University of Auckland
Prof Peter Hunter	Auckland Bioengineering Institute	University of Auckland

Associate investigators

Assoc Prof David Ackerley	School of Biological Sciences	Victoria University of Wellington
Assoc Prof Iain Anderson	Auckland Bioengineering Institute	University of Auckland
Prof Vic Arcus	Department of Biological Sciences	Waikato University
Prof Paul Atkinson	School of Biological Sciences	Victoria University of Wellington
Dist Prof Bruce Baguley	Auckland Cancer Society Research Centre	University of Auckland
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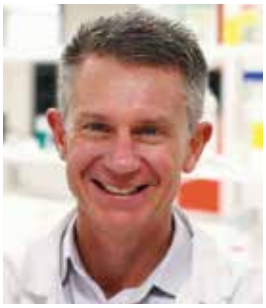

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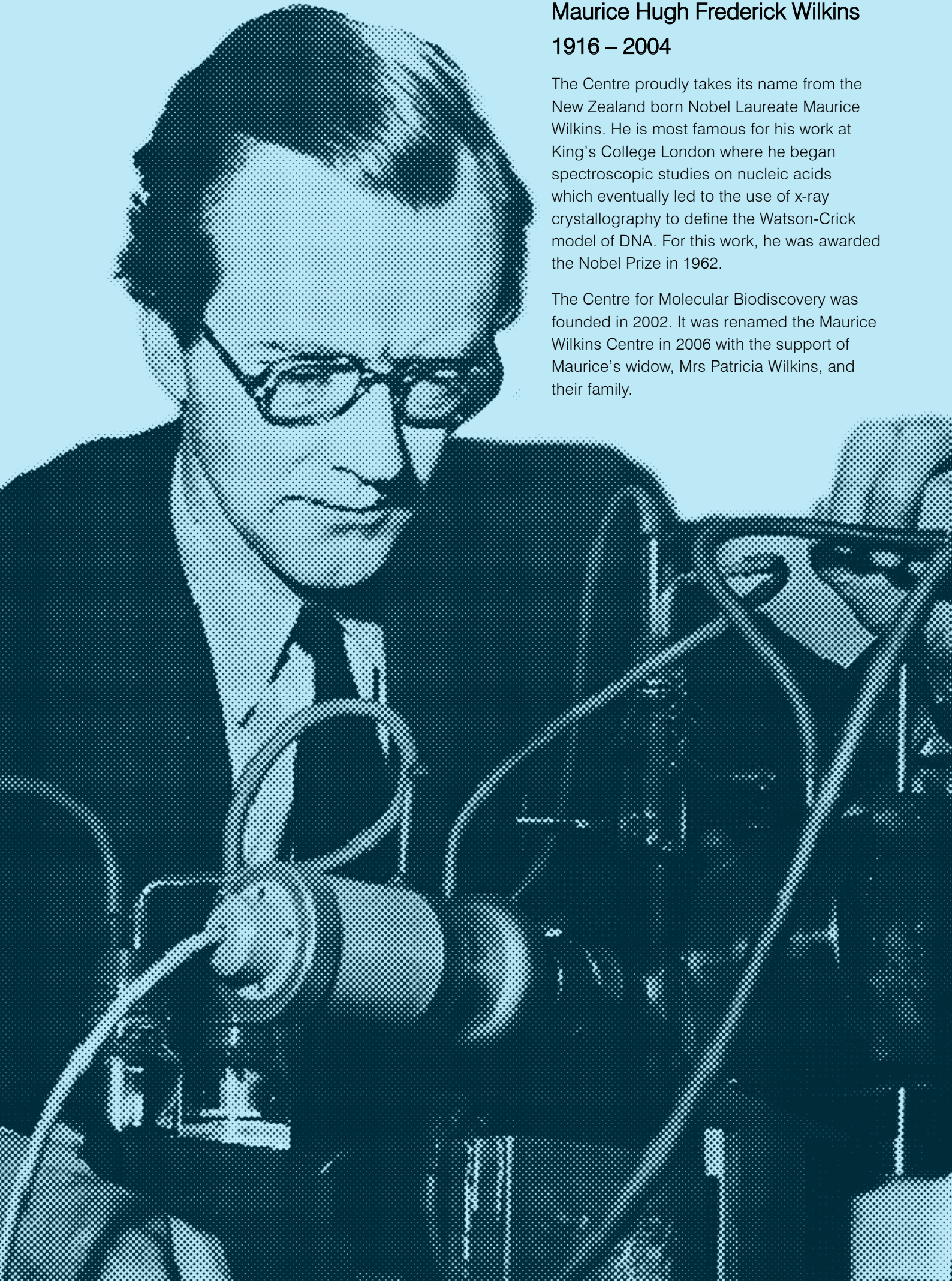

Maurice Hugh Frederick Wilkins
1916 – 2004

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.