SCOPE 54
A MALAGHAN INSTITUTE PUBLICATION

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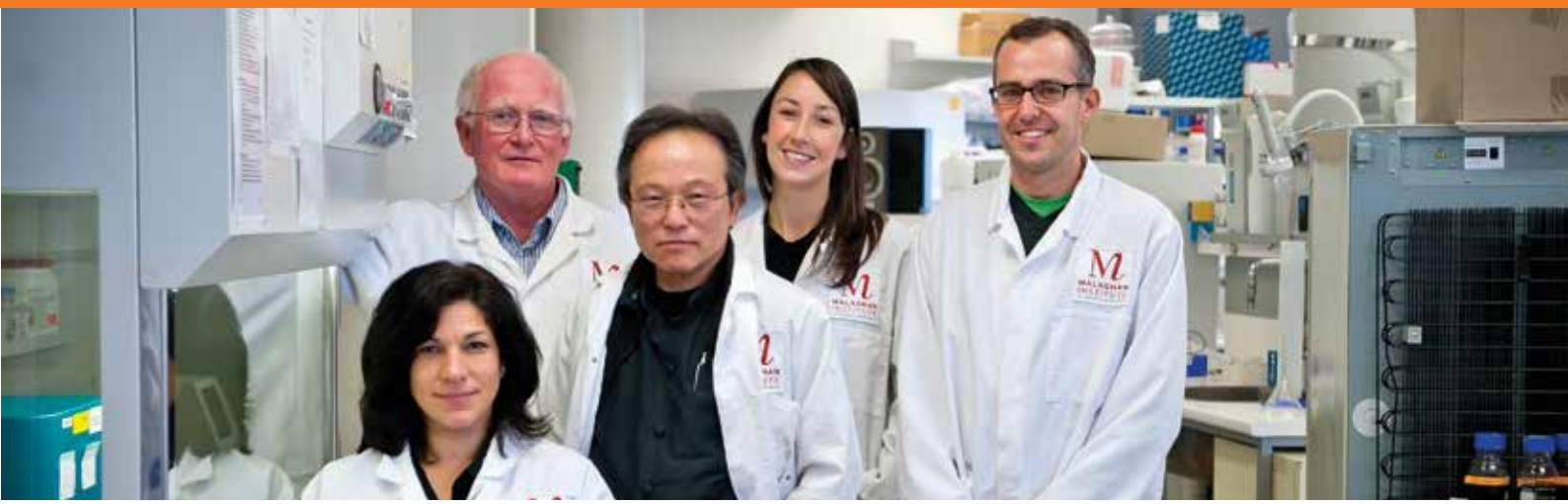


Together we will beat diseases

Many of the life-threatening diseases and debilitating conditions of our parents' day are now little more than faded memories. Take smallpox. As recently as 1967 it affected 15 million people worldwide, with a 30 percent mortality rate and disfiguring scars, but a major vaccination campaign saw smallpox officially eradicated by 1980. We have much for which to thank previous generations of health professionals and researchers.

The insights of today's medical research promise to lessen the impact of our generation's health challenges, such as multiple sclerosis, asthma, allergies and cancer. Science is gradually unveiling the molecular workings that underpin disease and offering hope for better treatments.

Medical science and technology are now inseparable. The Malaghan Institute is investing in the best technology to drive medical discoveries from the lab into therapeutic use. Our expertise in this area was recognised at the Wellington Gold Awards in June, where we were delighted to win the Cyber Gold Award for the best use of technology. (We also won the Supreme Gold Award – the very first charity to do so.)

In this issue of Scope we highlight how this new wave of technology is helping our medical researchers build the future of medicine.

Today whole genomes can be sequenced for a very low cost. Now, for example, instead of viewing melanoma as a single type of cancer, we have the ability to sequence an individual tumour and compare its genome with a database of past specimens. This detailed information offers huge potential for targeted treatments, but also poses new questions and challenges for our researchers.

Technology, innovation, and most importantly, dedicated people, will continue to fuel our progress in improving human health. You have helped set this vision in motion. Thank you

OUR RESEARCH
Using technology to speed breakthroughs

OUR PEOPLE
Kylie Price

GOLF EVENTS
Enjoyable days out on the green

From the Director

We have a vision to transform medical discoveries into improved health outcomes for New Zealanders.

To translate scientific knowledge into medicine, we must continue to build an experienced multi-disciplinary team here at the Institute. Only this combination of knowledge, experience and technology will provide a foundation for success in medical research.

In this issue, we are showcasing our new technology and explaining how it is transforming medical research now and into the future.

And that technology is producing results. In April 2013, in collaboration with our partners at the Centenary Institute in Australia, we announced the discovery of a unique type of immune cell (ILC2) in the skin. These cells may yield clues to the development of allergic skin disease.

Our excitement at a discovery is always tempered by recognising that there is much still to learn. While technology helps us reach a tipping point, human beings are essential in every small step forward. It takes dedicated workers and the backing of a supportive community to make the best use of new information and improve the quality of life for us all.

Graham Le Gros

Professor Graham Le Gros

Innovation (No.8 Wire)

Perhaps because we live so far from any other country, New Zealanders have always had to invent things we could not easily obtain. This seemingly innate ability to innovate is not just a myth; Kiwi innovation has made substantial contributions to the world's scientific and medical development.

Kiwis like Colin Murdoch, who invented the disposable hypodermic syringe, still used by millions of people every day, provide inspiration for us at the Malaghan Institute.

Our medical researchers need to innovate to push forward the pace and scope of our research. In 2006 Dr Melanie McConnell established a research programme here at the Malaghan Institute focused on understanding cancer stem cells – a rare population of cells found within tumours that are thought to be the main cause of relapse and metastasis. Cancer stem cells have the unique ability to renew themselves and use an extensive network of survival mechanisms to evade chemotherapy and radiotherapy treatments.

As her understanding of these survival pathways grew, Dr McConnell realised that cancer stem cells might just hold the secret to extending the life of cells that die prematurely. Now based at Victoria University of Wellington, Dr McConnell is working with Malaghan researchers in applying this knowledge to the development of ways to prolong the survival of neurons for the treatment of motor neurone disease.

Understanding how the immune system induces, enhances, or supresses an immune response is a crucial component of immunology. Engaging the ability of the immune system to "beat" diseases is our great challenge.

To put it simply, our researchers aim to find a way in which they can harness specific immune responses and turn them 'on' or 'off' like a light switch.

Whilst our tools may be changing, Kiwi innovation lives on at the Institute.

Dr Melanie McConnell.

Accelerating the pace of medical research by 10,000 cells a second

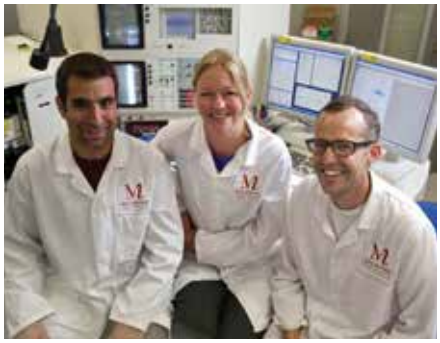
We're able to research different diseases at the same time thanks to the expertise of our senior scientists, and our technical prowess in Flow Cytometry, a technique that underpins all of our research.

Flow Cytometry is essential for all of our health research, whether we're researching new treatments for cancer, asthma or allergies. It give us the ability to pick out and analyse in great detail the individual immune cell causing diseases from all the other normal immune cells that are doing their job. This analysis runs at lightning speeds of tens of thousands of cells per second.

This increases the pace of health research, and is so important that almost 90% of our researchers use Flow Cytometry to develop immune-based therapies for the treatment of diseases such as cancer, asthma and allergy, multiple sclerosis and arthritis.

Generous support from the Hugh Green Foundation has enabled the Malaghan Institute's Flow Cytometer to become one of the most advanced platforms in Australasia, and the busiest flow cytometry suite in New Zealand. Flow cytometers are unique because of the speed and sheer volume of information you can obtain from each cell.

This cutting edge technology needs highly skilled staff, and Kylie Price, our Cell Technology Suite Manager & Hugh Green Flow Cytometry Fellow, leads this vital team of specialists. The recent investment of the Hugh Green Foundation has been essential in growing Kylie's expertise in Flow Cytometry, enabling Kylie to connect with and learn from the world's experts in this exciting field of science.



Our Cell Technology Suite Team - Alfonso Schimdt, Kylie Price, James Baty.

THE SCIENTIST BEHIND THE RESEARCH

Kylie Price has dedicated her career to harnessing technology to improve medical research. Kylie says growing up in rural New Zealand meant she saw the hardships of disease on animals, "These experiences created a passion for understanding what creates wellness. I wanted to find a career where I could improve the health of people and believed that science was the tool I could use to achieve this goal."

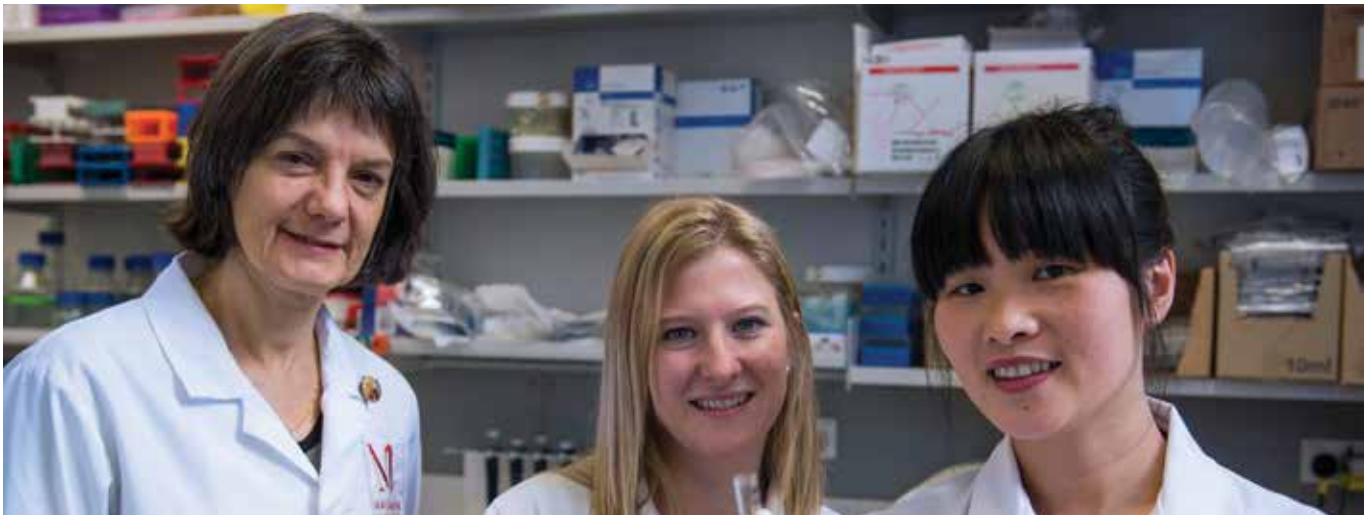
"As my career developed, I realised that we could accelerate medical research through faster generation of results. This got me thinking, 'how much faster could I push medical research using my skills and passion for technology?' Ultimately, this question led to my role as Hugh Green Flow Cytometry Fellow."

The investment of the Hugh Green Foundation has been essential in growing Kylie's expertise in Flow Cytometry, enabling Kylie to connect with and learn from the world's experts in this exciting field of science.

Kylie Price.

"Part of the reason for our recent growth in our understanding of the immune system is due to our growing expertise in Flow Cytometry. I am immensely grateful for the unbelievable support of the Hugh Green Foundation. Their support of my development means that we're able to do big science with a big aim – developing better treatments for our loved ones."

Bioinformatics: a new era of digital research



Some of our Immune Cell Biology Programme - Professor Franca Ronchese, Lisa Connor, Shiau-Choot Tang.

Medical research is entering an exciting phase, where new technologies are playing a critical role in revealing the causes of human disease. Bioinformatics – the analysis of biological data to glean useful information – is one of these pioneering technologies.

Powerful new genetic sequencing techniques offer a detailed look into many biological systems but produce a vast array of data that is too large to be analysed by conventional methods. The science of bioinformatics uses computing power and people with expertise in mathematics and statistics to gain meaningful information from that data.

At the Malaghan Institute, we are growing a bioinformatics team made up of people with expertise in molecular biology and computer science, to work alongside our medical researchers. We have also invested in the computer hardware needed to process the large data sets.

Professor Franca Ronchese is already using bioinformatics to explore the role of a type of immune cells called dendritic cells, in the initiation of allergies. "I am very excited by the new opportunities we have with this technology. We know we are asking difficult questions, but we are also confident that we have the best possible set-up to find the answers."

New Zealand has one of the highest rates of allergic disease in the developed world, so any information on how allergies might be prevented or better treated has the potential to improve the quality of life for thousands of people.

"Unfortunately, there is still a lot we don't understand about allergies. We don't know when or where people were first exposed to allergens, or how this first exposure develops into an allergic response and then disease. We believe that understanding the beginning of an allergic response will be useful in trying to prevent the spread of allergy, and perhaps also in finding treatments to switch it off."

Professor Ronchese and her team are researching the precise role of dendritic cells in allergies. They are sequencing the whole transcriptome (all the molecules of RNA rather than DNA) of dendritic cells in a mouse that hasn't been exposed to an allergen and a mouse that has.

"If our research so far is correct, there is something in the dendritic cell of an allergic mouse that starts the allergy, which is not present in a normal dendritic cell. There must be some subtle difference between the dendritic cells in allergic and non-allergic mice."

Pinpointing that difference, however, is like finding a proverbial needle in a haystack. "That's where we rely on our bioinformatics team, who will compare the dendritic cells at a molecular level and hopefully find a result for us."

The search for a switch to turn off unwanted immune responses has been a long-term project at the Institute. Understanding an allergic response at this molecular level has the potential to open up new areas of research as well as leads for immune therapies.

A new insight into the immune system

A stunning new microscope made possible by our Hawke's Bay supporters.

Biomedical innovation makes its greatest impact when research skills, collaboration, technology, and people are brought together. This is where philanthropy plays a powerful and transformative role.

Individual donations collectively have a huge impact. A small donation can help us purchase a petri dish – a key element of our research.

In 1928, bacteriologist Alexander Fleming made a chance discovery from an already discarded, contaminated petri dish. The mould that had contaminated the experiment turned out to contain a powerful antibiotic, penicillin. Over a decade later, penicillin became the miracle drug for the 20th century.

Fast forward to today, and the petri dish remains a key tool for Alfonso Schmidt, a Research Assistant within our Cell Technology Team. Alfonso is at the cutting edge of our advanced technology such as our new confocal microscope. This fantastic new tool was made possible by the support of our Hawke's Bay Friends and a generous donor. The confocal microscope is already bringing a new level of precision to our research.

We still use the humble petri dish for our confocal microscope. The petri dish helps us to incubate cells and view a complete biological process using the new confocal microscope. Because the cells are still alive, for the first time at the Institute we can see a process occurring in real time. Professor Mike Berridge is already using this new capability to better understand how cells are able to transfer mitochondrial information, which has implications for our cancer research.

In addition to helping us "see" living cancer cells, we are learning how to construct three-dimensional models from the obtained images. In cancer, cells accumulate genetic mutations believed to impart a competitive advantage over normal cells in surrounding tissue, helping the disease to take hold. We are already witnessing stunning images of mutant cancer cells mingling amongst normal cells within living tissue. Very few people in the world have seen this vista of cancer before and it is a game changing tool in helping our scientists better understand how cancer spreads.

This new, powerful tool and the humble petri dish will help advance our immunology research and we will share outcomes with you in future editions of Scope. As Alfonso says of the incubator for our confocal microscope, "you might see a box, but what happens inside that box is the magical part."

Bringing immune cells into focus

Our new confocal microscope will benefit all of our research teams, including helping our Gut Inflammation Team understand the dynamic interplay between immune responses and the microbiota in the gut. We can now visualise with superior accuracy the tight junctions of the epithelial cells, which are the gatekeepers of the gut tissue. These cells create a physical barrier between the contents of the gut and the tissue. It is important that we can understand changes in this barrier function, as it is likely the initiator of chronic inflammatory diseases of the gut.

With this new technology we can quantify the cells involved in the immune response, but also understand their location and potential interaction with other immune cells. This powerful new tool will become a key platform for our research programmes.

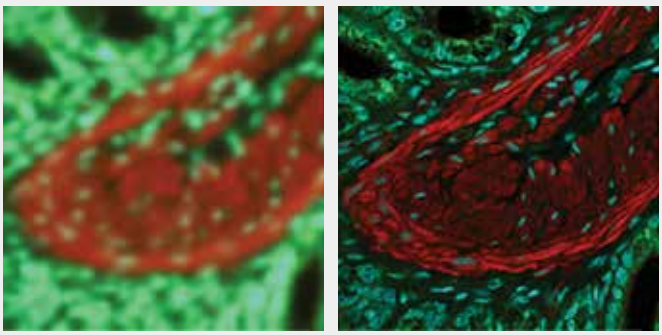
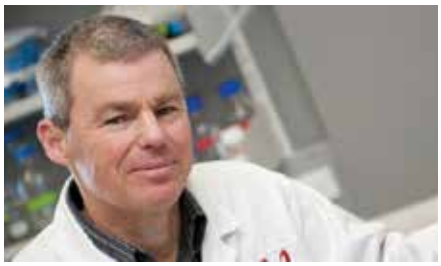


Image above: A fluorescently stained section of intestine cut 20µm thick (or 0.002 centimetres). On the left, an image captured with a wide-field fluorescence microscope (identical to previous technology at the Malaghan Institute). On the right is the same slide imaged using a confocal microscope. This clarity brings a new precision to our research.
Image Credit: Carl Zeiss Microscopy.

News under the microscope

Professor Graham Le Gros a recipient of Queen's Birthday Royal Honour 2014



Director Professor Graham Le Gros was recognised for his contribution to medical research when he was appointed a Companion of the New Zealand Order of Merit (CNZM) for his services to science and medicine.
Professor Le Gros wishes to acknowledge all the supporters and staff who have made the Institute what it is today.
"I feel honoured to have received the recognition on behalf of the Malaghan Institute of Medical Research and its many supporters in New Zealand.
"I would like to thank my wife, Professor Franca Ronchese, as my equal partner in this achievement.
We're on the brink of an exciting new era in immunotherapy and I hope this honour makes Kiwis realise Kiwis can achieve high tech goals and make it happen here."

Swing in behind the Friends of the Malaghan Institute Charity Golf Tournaments 2014

Our very loyal and willing Friends of the Malaghan Institute are hosting their Annual Charity Golf Tournaments at 3 North Island locations in October / November. This year we see the 17th year of these events, for which nearly $1.5 million has been raised to support the work of our scientists, a magnificent effort from a team of very loyal supporters.

2014 Events dates:

- Hawkes Bay – Friday 31 October at Hastings Golf Club
- Auckland – Monday 3 November at Remuera Golf Club
- Wellington – Friday 7 November at Manor Park Golf Club

Acurity Health Team.

For more information on how to be a sponsor or participate in these events please contact:

Jenny Sim 04 4996914
or jsim@malaghan.org.nz

Recent Grants (Arp 2014 – Jun 2014)

We would like to acknowledge the following Trusts and Foundations for their recent support:

- Heartland Trust
- New Zealand Community Trust
- Pegasus Sports Foundation
- Albert (Pat) Devine Charitable Trust
- Hugh Green Foundation
- BEA Trust
- Jennifer Smith Family Trust

We'd like to know what you are most interested in reading about in future editions of Scope.

Please email us at: info@malaghan.org.nz with your ideas.

Help us to accelerate the pace of research

We're proud that New Zealand has a wonderful reputation as a country that leads the world in innovation. The Malaghan Institute is part of this story and our research has the potential to benefit people in New Zealand and around the world. There are several ways you can join us.

To find out more, contact Shannon Eydt on 04 499 6914 x 895 or email seydt@malaghan.org.nz alternatively, visit our website www.malaghan.org.nz

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