Welcome to the 100th edition of LIFELAB!

To celebrate this milestone, our lead article shines a light on immunotherapy, the great new hope for treating cancer and other diseases. We are world leaders in this field and are currently engaged in clinical trials treating patients with brain cancer, head and neck cancers, multiple sclerosis and post-organ transplant infections, such as cytomegalovirus (CMV). This article is a ‘must read’ on page 4.

On page 6, we investigate the innovative research underway to fast-track treatments for Alzheimer’s disease. Researchers have created a 3D model brain, which is leading the way for testing new drug treatments. We hope this 3D brain simulation will help bridge the gap and bring personalised medicine to Alzheimer’s patients.

Did you know we also have researchers dedicated to predicting risk of and preventing glaucoma? Vision loss from this eye disease affects approximately 300,000 Australians, with early detection the only way to prevent permanent damage. Without early detection, people may lose their sight completely. Read about the latest findings on page 10.

LIFELAB has certainly evolved over the past 28 years—from the humble four-page newsletter first printed back in 1991 to the magazine you see today. Read more about the history of our publication on page 14.

As a registered charity, we rely on the generous support of people like you to support our scientists’ vital work. Much of the research conducted at QIMR Berghofer simply would not be possible without your generosity—we greatly appreciate every donation.

Professor Frank Gannon
Director and CEO
On the cusp of a cure?

The medical research sector is energised by the exciting new results immunotherapy is achieving for the treatment of some cancers and other diseases. Nearly 49,000 Australians are predicted to lose their lives to cancer this year and it’s timely that we shine a light on this emerging field of cancer treatment and the hope it provides for human health around the world.

Few people and families are not touched in some way by cancer. Mothers and fathers, sons and daughters—cancer doesn’t discriminate. Every four minutes, one Australian will hear the words, ‘I’m sorry, it’s cancer’.

Existing cancer treatment options are invasive and generally take the form of three primary methods—surgery, chemotherapy and radiotherapy—or a combination of all three. Now, immunotherapy is emerging as a fourth pillar for treating cancer and disease, with QIMR Berghofer researchers at the forefront of these exciting new developments.

Immunotherapy is the umbrella term for an innovative approach to treatment that uses a patient’s own immune system to fight cancer and other diseases. Scientists have known for some time that a type of white blood cell, known as a T cell, supports the body’s immune function: immunotherapy harnesses the power of these T cells.

One type of immunotherapy being pioneered at QIMR Berghofer works by removing T cells from a patient’s blood sample and activating them with a combination of all three. Now, immunotherapy is an industry leader in the revolutionary field of immunology. He has dedicated more than 20 years to working on immunotherapy-based treatments and has conducted multiple clinical trials at QIMR Berghofer since 1999.

I have worked all my life in immunology and the study of immune systems. Immunotherapy is a field that is completely revolutionising the treatment of cancer and QIMR Berghofer is at the cutting edge,’ Professor Khanna said.

Professor Khanna and his team are currently leading four world-first clinical trials in immunotherapy to treat patients with brain cancer, head and neck cancers, multiple sclerosis and post-organ transplant infections, such as cytomegalovirus (CMV).

‘The immunotherapies are safe, trusted and provide patients with a quality of life while undergoing treatment. We have not seen any side-effects after treating over 100 patients around the world in Australia, New Zealand, Hong Kong and the United States of America,’ Professor Khanna said.

Immunotherapy is already saving the lives of patients participating in clinical trials. Gary Dover has received immunotherapy in a clinical trial to treat CMV, which he developed after receiving a kidney transplant in 2014.

Gary explains the process:

‘They extracted 350 ml of my blood and some was combined with a CMV antigen for about two to three weeks. This process turned my immune-suppressed blood into blood with strong killer T cells that attack the CMV exclusively.

‘I felt no side effects at all. Then within a week or so, I just began improving until finally all symptoms of CMV disappeared.

‘During my seven plus years on dialysis, I would spend every second night in my bedroom on the dialysis machine, with my wife and children at the other end of the house having their meals and doing their homework. I felt so helpless.

‘The whole process of the kidney transplant was almost redundant due to contracting CMV from the transplanted kidney. Unfortunately, being resistant to the drug commonly used to treat the condition meant almost certain removal of the transplanted kidney. I then agreed to this experimental immunotherapy treatment.

‘This revolutionary treatment saved my transplanted kidney and possibly my life.

‘I now spend every night with my family. I can also go on holidays within Australia without spending alternate days at the hospital and I have also been able to go on overseas trips! It has changed my life in so many ways I don’t even realise or fully understand,’ he said.

Gary is so grateful for the group he calls the ‘medical geniuses’ involved in his immunotherapy treatment: Professor Rajiv Khanna, as well as his medical team, nephrologist Dr John Burke and the nurses and doctors from the Princess Alexandra Hospital.

Gary has endless gratitude towards the donor’s family for their invaluable gift of organ donation. He is overwhelmed by the fact he is alive and well after such serious illness.

Pioneering treatments need funding

Clinical trial patients, like Gary, receive all of their immunotherapy treatments free of charge. These pioneering treatments continue to be developed locally, in-house at QIMR Berghofer’s cell therapy manufacturing facility, Q-Gen Cell Therapeutics (Q-Gen).

Further advances are only possible with financial support from generous members of the community. Q-Gen has doubled its production in the last two years, with the costly immunotherapy treatments supplied free of charge to clinical trial patients.

More clinical trials are needed before immunotherapy treatments become readily available for patients suffering from cancer and other diseases. Join us by donating and have a direct impact on the lives of future generations.

It is an exciting time to be involved with QIMR Berghofer. Be a part of the cure. ●

▲ A glimpse into Q-Gen Cell Therapeutics manufacturing facility (opposite). Gary Dover photographed with his wife at QIMR Berghofer (above).
Can a 3D model brain fast-track treatments for Alzheimer’s?

QIMR Berghofer researchers say ‘Yes’.

There are currently no effective treatments for dementia but mental health researchers at QIMR Berghofer are working hard to change this paradigm. They have created a 3D model brain, which is leading the way for testing new treatments for Alzheimer’s disease.

Did you know Alzheimer’s disease affects about 1 in 10 people over 65 years and almost 1 in 4 people over 85 years? This is an alarming statistic, especially when modern medicine has evolved at a rate that gives Australians the chance to live well into their ninth decade.

Alzheimer’s is a complex disease and there are currently no effective treatments to stop its progression. Unlike viruses, where one vaccine works for everyone, complex disorders are unlikely to have one drug that will cure everyone.

Thankfully, researchers at QIMR Berghofer are dedicated to exploring prevention, prediction and treatments for Alzheimer’s disease.

Associate Professor Anthony White, head of the Cellular and Molecular Neurodegeneration Laboratory, and his team have produced new tools to model a 3D brain in a laboratory setting. Scientists call this a ‘cell assay’. The 3D brain is essentially a ‘brain on a dish’, incorporating the key cell types within a functioning brain and is being used to fast-track the testing of potential Alzheimer’s treatments.

‘Until now the majority of cell assays for Alzheimer’s disease have involved growing a single brain cell type on a two-dimensional surface and studying its function but we know that this is not representative of how the brain cells function. This can lead to failed clinical drug trials.

‘The way human brain cells function largely depends on the whole environment and their interactions with a variety of brain cells, including neurons, astrocytes and microglia, which cannot be replicated in a two-dimensional model,’ Associate Professor White said.

‘Therefore, to understand how each cell type behaves normally and changes in Alzheimer’s disease and other brain diseases like motor neuron disease, we must study them together in a 3D environment. The 3D model is able to replicate the interrelated cell functions more closely, as they occur in the human brain,’ he said.

The brain has its own immune system called the microglia, which is a key component for growing the 3D brain model. The team have shown they can grow microglia cells from white blood cells obtained from any patient and have created numerous models for both Alzheimer’s patients and people who are at risk of Alzheimer’s disease.

‘We have been able to detect that Alzheimer’s patients’ brain immune cells, or microglia, differ from person to person, as we have seen the various samples respond differently to stimulus in culture. ‘This means that we have a great opportunity to recommend a tailored treatment for each patient with the prior knowledge that it is more likely to be effective for them,’ Associate Professor White said.

There is hope that this 3D brain simulation will help bridge the gap and bring personalised medicine to Alzheimer’s patients, making a difference to the lives of individual patients and their families.

Associate Professor White explains a personalised approach to medicine is needed to treat Alzheimer’s disease, because an individual’s genetic background and other environmental factors influence which treatments will be effective.

‘At present, clinical trials for Alzheimer’s drug treatments have a 90 per cent failure rate. A major reason for this is that we can’t identify the right treatments for the right patient, because everyone’s disease and genetic background varies,’ Associate Professor White said.

‘This assay will hopefully allow us to target a particular treatment for a specific patient and select the most suitable patients to participate in clinical trials testing new drug treatments.’

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Hookworms: Friend or foe?

A Queensland scientist has developed the first ever live vaccine against hookworm, a parasitic disease that causes anaemia in children and pregnant women in many developing countries. Meanwhile, in another lab, researchers investigate the potential benefits that hookworms can offer the human race with new drug development.

Around 500 million people across the world are presently infected with hookworm. Hookworm is an intestinal parasite most commonly found in developing countries where poverty and poor sanitation co-exist in tropical and subtropical climates.

Hookworm is a public health issue significantly affecting the long-term health of women and children. Control of hookworm infection through mass drug administration is problematic as individuals quickly become reinfected.

World-first live hookworm vaccine trial

A QIMR Berghofer researcher and infectious disease clinician, Dr Paul Chapman, is working towards bettering human health for millions of people living in parts of the world commonly affected by hookworm. He is currently leading the world’s first clinical trial for a live hookworm vaccine, in the hope of eradicating the parasite.

At the time of publication, 15 Queenslanders were taking part in the human trial of the live hookworm vaccine, which is underway in QIMR Berghofer’s clinical trial facility, Q-Pharm. The vaccine consists of microscopic hookworm larvae exposed to UV light, which, it is hoped, will trigger the immune system to respond.

After receiving two doses of the vaccine, participants are given a dose of normal hookworm larvae (not exposed to UV light), to test whether the immune response protects against further hookworm infections. The trial participants will then be monitored for a further 10 weeks to determine the effectiveness of the vaccine.

We’re optimistic that by exposing hookworm larvae to UV light they will be impaired, which will make it possible for the human immune system to recognise the infection and develop a lasting immune response,’ Dr Chapman said.

The clinical trial compares the response of people who receive the experimental vaccine, with people who receive a placebo vaccine made using tabasco sauce.

We use tabasco sauce because tabasco sauce held against the skin for an hour produces a similar prickling sensation as the hookworm larvae penetrating the skin.

‘This means our participants don’t know whether they are getting the vaccine or the placebo, which is important when you are doing a study like this,’ he said.

Dr Chapman, who is part of Professor James McCarthy’s Clinical Tropical Medicine Laboratory, said the next step would be to do a larger study in a developing country, possibly a Pacific Island nation, where hookworm is currently endemic.

‘The sickness caused by hookworm infection mainly affects pregnant and lactating women and school-aged children, who are at risk of low iron stores or are more likely to be seriously affected by iron loss.

‘Developing a vaccine that makes people immune to hookworm infection would potentially reduce child mortality, developmental outcomes and maternal health in many parts of the world,’ Dr Chapman said.

Hookworms: a new avenue for treating inflammation

Concurrently, QIMR Berghofer’s Dr Severine Navarro is unlocking the hidden potential that hookworms can offer to treat ongoing allergy and autoimmune diseases, predominantly in children.

‘We have noticed that, when infected populations remove the hookworm, they start to develop symptoms of allergy and irritable bowel syndrome,’ Dr Navarro said.

She explains that when a child’s immune system is still being formed, hookworms send signals that aid the development of the body’s immune system. We are missing those signals in developed, more affluent, societies—indicating that hookworms may in fact, in some ways, be our friend.

Dr Navarro is currently trialling a protein produced by hookworms that actually benefits the human immune system. The protein has shown signs of suppressing chronic allergies and inflammation, irritable bowel syndrome and asthma.

‘My research has shown that hookworms, in particular a specific protein that hookworms excrete, have a direct impact on the gut microbiome and can help the overall body’s immune system,’ Dr Navarro said.

‘The goal is not to re-introduce the hookworm but to determine what components of the hookworm are beneficial to humans, which can then be used as a preventive and therapeutic drug.

‘Our methods are making drug development intelligent—we’re looking at nature and the environment to influence our treatments

- Dr Severine Navarro

‘Our methods are making drug development intelligent—we’re looking at nature and the environment to influence our treatments, rather than using synthetic drugs,’ she said.

The protein acquired from hookworms could be a potential game changer for treating chronic illnesses where inflammation is involved. Dr Navarro is also investigating ways to package this protein, perhaps in an easy-to-swallow pill, for treating a range of other conditions.

Dr Navarro’s research could be the benchmark that establishes QIMR Berghofer as a safe facility for growing, testing and harvesting hookworms for use in a range of clinical trials aiming to solve allergy and autoimmune conditions that are prevalent in developed countries.
Predicting and preventing blindness from glaucoma

Glaucoma is an eye disease where vision is lost due to damage to the optic nerve. It affects approximately 300,000 Australians. QIMR Berghofer research offers hope for predictive screening, monitoring, and treatment initiatives—but we need your help. Will you take part in an exciting new study?

Glaucoma is the leading cause of irreversible blindness worldwide. Glaucoma is an age-related disease; a person’s chance of developing glaucoma significantly increases after the age of 50. Alarmingly, 1 in 2 sufferers do not know they have the disease. Loss of sight is usually gradual, with a considerable amount of peripheral vision being lost before the person is aware of any problem.

But there is hope: glaucoma blindness is preventable in most cases if diagnosed in the early stages.

The head of QIMR Berghofer’s Statistical Genetics Laboratory, Associate Professor Stuart MacGregor, is passionate about the translational nature of his research in preventing glaucoma and hopes it will lead to a predictive screening model that will benefit all Australians.

Recently, he and his team completed a study, revealing some major breakthroughs in genetics and a person’s risk of developing glaucoma. They have identified 40 new genetic markers that increase a person’s glaucoma risk, increasing the total number of identifiable genetic markers to 53.

‘The discovery of these previously unknown genetic markers for glaucoma will be important for improving our ability to test for and predict a person’s risk of the disease.

‘Glaucoma is one of the most strongly genetic human diseases and early diagnosis is vital.

What makes this research significant is we can predict the age a person is likely to be at risk,’ Associate Professor MacGregor said.

The predictive screening test would screen for both risk and age of developing glaucoma.

Associate Professor MacGregor and his team are increasingly hopeful that they have identified many of the genes that will allow doctors to predict both a person’s risk of developing glaucoma and when it may develop. This is hugely exciting because, if a person is aware of the predicted age when they may develop glaucoma, they can take preventative treatments in the early stages.

‘If we can identify who is most at risk of developing glaucoma at the earliest opportunity, we can make sure those individuals receive the preventative treatment they need to stop them from going blind as they age.

‘Early treatment is vital because, once a person experiences vision loss, it is impossible to reverse,’ Associate Professor MacGregor said.

Glaucoma is treatable with eye drops or surgery, depending on the amount of damage sustained by the optic nerve but, if left untreated, the damage is irreversible. Therefore, the discovery of these new genetic markers has significant implications for predictive screening and the prevention of glaucoma.

‘A major goal of our work in glaucoma gene discovery is to develop a glaucoma prediction model for the public, providing clinically meaningful risk assessments,’ Associate Professor MacGregor said.

He explains a potential prediction model could involve optometrists.

‘Due to a natural ageing process where the eye lens hardens, most people’s close vision declines between the ages of 45 and 55 (this hardening is not related to glaucoma). At this time, most people visit the optometrist to be fitted with reading glasses.

This could be when a person may need to undergo a screening test for glaucoma,’ Associate Professor MacGregor said.

Glaucoma is a condition that generally develops between the ages of 60 and 75 but about a quarter of all people diagnosed will start to experience the onset of glaucoma in their 50s. If Associate Professor MacGregor’s research is successful, it will give people with a high risk of developing glaucoma an early warning. This will allow them to take preventative measures, which could be as easy as providing a saliva sample to complete the predictive test.

The next phase of Associate Professor MacGregor’s research will involve recruitment, where he is seeking current sufferers and people with a family history of glaucoma to participate.

‘We are hoping a significant number of the 300,000 current sufferers come forward to participate in the study. This will enable us to further refine the genetic predictive test, making it even more accurate,’ Associate Professor MacGregor said.

Register your interest for participating in the glaucoma study by emailing Stuart.MacGregor@qimrberghofer.edu.au.

‘Early treatment is vital because, once a person experiences vision loss, it is impossible to reverse.’

-Associate Professor Stuart MacGregor
Professor Ramm hopes that these important medical advances will offer safe non-invasive testing options, resulting in one less procedure these little patients will need to endure.

‘Our research findings have shown this equipment is accurate for both detecting liver disease in children with CF, as well as diagnosing the stage of the liver disease.’

-Professor Grant Ramm

Preventing the spread of lung bacteria

Professor Scott Bell, honorary group leader of the Lung Bacteria Laboratory at QIMR Berghofer, has been spearheading a long-term collaboration, called the CF Air Team, to uncover how CF patients contract bacterial infections of the lungs and what can be done to prevent the spread of bacteria. Using a purpose-built ‘cough laboratory’ (built by our QUT colleagues), the team found that these infections may be spread between patients through cough aerosols. ‘Our findings reveal that a cough from a cystic fibrosis patient will emit fine droplets of infectious bacteria and viruses into the air, which can travel several metres and remain suspended in the air for up to 45 minutes,’ Professor Bell said.

The CF Air Team also reviewed 18 adult CF treatment centres around Australia and tracked the spread of bacterial infections among patients. The findings suggested when patients were accommodated in close proximity to each other it facilitated the spread of bacteria between patients. ‘Essentially, conventional hospital wards are allowing bacteria to be shared between cystic fibrosis patients and some of these bacteria are resistant to antibiotics. ‘We are now exploring ways to reduce the risk of bacteria spreading, specifically by investigating the effectiveness of wearing face masks, and the potential to enhance air ventilation in hospitals and irradiation of potentially infectious aerosols with UV light,’ he said.

The CF Air Team’s findings suggest that patients need to be adequately separated in treatment centres to avoid cross-infection. This finding is already having an impact in hospitals nationally and internationally.

One example is the design and construction of a new purpose-built CF ward at The Prince Charles Hospital, providing single room accommodation for all adults with cystic fibrosis, especially designed to minimise cross-infection between patients. The CF Air program won one of Australia’s leading science awards—the 2018 Australian Museum Eureka Prize in the category of Infectious Diseases Research.

A closer look at lung bacteria

Associate Professor David Reid, honorary group leader of the Lung Infection and Inflammation Laboratory at QIMR Berghofer, has also been investigating lung bacteria in CF patients, specifically how the bacteria survive.

Dr Reid discovered that CF patients’ lungs are full of iron, which bacteria use as a food source. Now, together with international collaborators, he is uncovering the many ways that bacteria acquire iron from the lungs to contribute to the development of different treatments.

Our research shows that, if we can interfere with the bacteria’s ability to access iron, we will be successful in killing the bacteria,’ Dr Reid said.

Dr Reid’s other findings include demonstrating that people with CF have abnormal immune cell function that affects their ability to combat infection and revealing that bacteria produce cyanide within the CF lung. This finding has prompted other researchers from around the world to work on developing methods to measure cyanide in the breath to monitor bacterial infections.

Dr Reid’s team possesses the only preclinical model of CF in Australia and they are using this model to identify the problems with iron handling in the CF lung. Dr Reid’s and Professor Ramm’s teams work closely together using the CF model to investigate the causes of liver disease in CF.

Dr Reid is also a senior clinician at The Prince Charles Hospital, which houses one of the largest adult CF centres in Australia. Informed by Professor Bell’s findings, he is working with architects and construction engineers to incorporate state-of-the-art ventilation systems in the centre to minimise airborne bacteria and mitigate any risks of cross-infection.

‘This is a landmark example of how basic research can transform clinical practice for the benefit of people with CF,’ Dr Reid said.

Liver disease in children with cystic fibrosis

Professor Grant Ramm (pictured), head of the Hepatic Fibrosis Laboratory at QIMR Berghofer, has spent considerable time researching the prevalence of liver disease in children with CF. Chronic liver disease is a significant complication experienced by children with cystic fibrosis. Around 10 to 15 per cent of children with CF will also develop severe liver abnormalities, which is the leading cause of non-respiratory death for these young patients.

Professor Ramm and his collaborators have recently discovered one of the potential mechanisms that can lead to severe liver disease. ‘In some children with CF, the thick mucous secretion in the bile ducts blocks the flow of bile from the liver. This causes the bile to back up in the liver resulting in liver damage, fibrosis and eventually cirrhosis,’ Professor Ramm said.

‘By understanding how scarring and liver disease occurs in these children with CF, we can now, for the first time, identify molecules, pathways and cells in the liver that we need to target in order to treat it,’ he said.

Professor Ramm has also investigated new methods for testing liver function, without the need for patients to undergo an intrusive liver biopsy procedure. One method involves a new piece of equipment that can measure the stiffness of the liver (which represents the degree of liver fibrosis) by using modified ultrasound technology. The prototype machine was purchased with funds kindly donated to QIMR Berghofer by philanthropic donors, Veronica and Joseph Butta.

‘Our research findings have shown this equipment is accurate for detecting liver disease in children with CF, as well as diagnosing the stage of the liver disease and the severity of the fibrosis,’ he said.
Take a walk down memory lane as we exhibit a highlights reel of newsletter content published by QIMR Berghofer over the past 28 years.

The first newsletter from the Queensland Institute of Medical Research (QIMR) was the Bancroft Bulletin, named after Queensland’s influential family of scientists, the Bancroft family. Joseph Bancroft discovered *Wucheria bancrofti* – a mosquito-borne parasitic roundworm; and his son, Thomas Bancroft, linked mosquitoes to the transmission of dengue fever in the early 1900s.

In edition 30, the Premier of Queensland at the time, Peter Beattie, was on hand to announce plans to develop the largest Comprehensive Cancer Centre in the Southern Hemisphere—an extension to the QIMR facility.

In edition 41, the lead article was a plea to the public for donations to keep trials of an experimental cancer therapy alive—known as ‘dentritic cell therapy’. Today, this field of cancer research is called immunotherapy.

In edition 60, the lead article discussed vaccines as a way to a better future in human health, specifically highlighting the work QIMR was undertaking in the eradication of malaria.

In edition 72 featured Professor Nick Martin and the longitudinal Q-Twin study that is contributing to the ongoing work in genetics. He stated at the time, ‘We want to develop new approaches to slow the ageing process’.

In edition 78, we publicised that a team of researchers had started the largest Australian study of asthma genetics, to find out more about the underlying causes of asthma.

In edition 87 looked at Angelina Jolie’s journey with breast cancer. She had a family history of cancer and decided to have genetic testing, which found she carried the BRCA1 gene fault.

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New hope for patients with blood cancer

Each year, more than 10,000 Australians are diagnosed with blood cancers, most of which are leukaemia and lymphoma. Bone marrow transplantation—more formally known as haematopoietic stem cell transplantation—can cure otherwise incurable blood cancers. However, around half of all bone marrow transplant patients develop the debilitating and potentially life-threatening graft-versus-host disease (GVHD) as a complication. QIMR Berghofer’s Dr Siok Tey, a clinician-scientist, is working on making bone marrow transplantation better and safer.

Imagine that you have been diagnosed with blood cancer. You are told that your blood cancer is high risk and you have less than a 10 per cent chance of surviving unless you have a bone marrow transplant. What would be going through your mind?

You would find that, to undergo a transplant, a donor with a perfect or near-perfect tissue-type match must be found. You would learn that genetics play a vital role in finding a matched donor—a sibling has a 1 in 4 chance of being a match or, failing that, an unrelated donor who is a good match may be found. But, even with a perfect donor, around half of all transplant patients will go on to develop graft-versus-host disease (GVHD).

GVHD is a complication of undergoing a bone marrow transplant. As the name suggests, it’s a condition that occurs when the introduced donor’s cells (graft) react unfavourably towards the patient’s own cells (host), starting a ‘war of cells’ within the body. The condition can be mild and easily treated with medications or it can be severe and life-threatening. Around 20 per cent of patients have chronic GVHD that interferes with day-to-day living such as: difficulties eating; difficulties breathing; severe dry eyes, causing pain and threatening eyesight; skin ulcers that will not heal; and joints that are stiff and immovable.

Dr Siok Tey is a research scientist at QIMR Berghofer and a clinical haematologist and bone marrow transplant physician at the Royal Brisbane and Women’s Hospital.

‘Bone marrow transplantation can be life-saving and patients can go on and live a fulfilling life. However, a proportion of patients develop troublesome GVHD that can be life-changing. It is frustrating that we have cured their blood cancers but, in the process, caused another disease which prevents them from living life to the full,’ Dr Tey said.

‘Bone marrow transplantation may not be perfect but it is often the only hope for a cure. Yet until recently, some patients do not even get a chance to undergo a transplant because we cannot find them a matched donor,’ she said.

Dr Tey recently completed a clinical trial where bone marrow transplantation was carried out using ‘half-matched’ donors. These patients had run out of chemotherapy options, but could not undergo a conventional transplant, because they did not have a fully matched donor. However, Dr Tey developed a method to genetically engineer the donor cells to make them safer, thereby enabling ‘half-matched’ transplants to proceed.

“We recently completed the first clinical trial in Australia using cells that have been gene-modified to make them safer in bone marrow transplantation,’ she said.

‘We know that immune cells, called T cells, cause GVHD. Unfortunately, you can’t just remove those cells from the donor’s graft, because they are important in fighting leukaemia and fighting infection. On the other hand, they can also “turn” against the patient’s tissues and cause GVHD.

‘To overcome this problem, we have inserted a safety gene into the T cells so that they are pre-programmed to be “delete-able” if they cause life-threatening GVHD,’ Dr Tey said.

This clinical trial has produced promising results and is paving the way for future GVHD treatments and other forms of cutting-edge gene-modified T cells to treat blood cancers.

‘Our exciting next step will be a phase I clinical study using regulatory T cells to treat GVHD. Regulatory T cells can dampen GVHD. It is very exciting because they have the potential to “reset” the immune system, leading to long-term improvement and, potentially, even curing GVHD.

‘This clinical trial will use a new technology platform called clinical grade cell sorting to purify regulatory T cells.

‘Additionally, we will use our expertise in gene engineering to develop a way to follow what happens to these regulatory T cells after they are injected into the patients. Understanding what happens to these cells will be a big step in advancing treatment,’ she said.

This project is still in development and Dr Tey hopes to open the clinical trial in the next 12 months.

‘This is an exciting project and we have clinicians and scientists in Australia and the United States of America collaborating on this effort. If successful, we will be one step closer to finding a cure for GVHD,’ Dr Tey said.
What do cancer and malaria have in common?

How are cancer and malaria linked? Dr Michelle Wykes knows the answer. Join us as we follow her career in science and discover how interrelated the body’s immune response is to viruses and diseases.

Today, Dr Michelle Wykes is an immunologist working on cancer but she hasn’t always worked in this field.

She started her scientific career at the Sir William Dunn School of Pathology within the University of Oxford, studying immunology. Dr Wykes returned to Australia to apply her knowledge to malaria, specifically how malaria infection affects the body’s immune system.

Dr Wykes’ malaria research focussed on an immune cell called a dendritic cell, which is central to the body’s immune responses. What started as a career trying to stop hundreds of thousands of people worldwide dying from malaria has progressed into research to develop a new treatment for cancer.

‘I describe the dendritic cell as the General of the immune army because it is the cell type that can actually sense if malaria is around. It senses its environment and has the ability to call the immune cells and say “go fight this disease”,’ Dr Wykes, who is head of the Molecular Immunology Laboratory at QIMR Berghofer, said.

‘We found the PD-L2 molecule, or protein, was important in the immune system’s response to malaria.

‘We started to look at dendritic cells and it became very clear that they send out some signals that tell immune cells to fight disease and other signals that say “stop fighting that disease”,’ she said.

Dr Wykes is now testing this protein’s ability to combat cancer cells.

‘The same cell type that kills malaria also kills cancer, so, if we understand how to wake up the cell types to kill malaria, we can wake up the cell types to kill cancer,’ she said.

Although now a cancer researcher, Dr Wykes is grateful for the time in her career researching malaria. ‘I feel fortunate to have studied and researched malaria. It provided me with an amazing foundation for understanding how the immune system functions.

‘My research has shown the body has the same immune response for both cancer and malaria so I could easily bring all of my findings over to the field of cancer research,’ she said.

The impact of her work is already being felt around the world with many researchers requesting Dr Wykes’ protein to test in their own work, particularly in infectious disease.

‘A lot of people want this protein and they want to see how it affects their models or whatever diseases they are studying,’ she said.

Dr Wykes and her team have now reached an exciting stage of the project, developing and testing drug treatments that activate these immune cells needed to kill cancer cells.

Dr Wykes is supported by an amazing team of researchers, Mr Deshapriya Karunarathne, Ms Rebecca Faleiro and Mr Ji Liu. They all work on testing different treatments to combat cancerous cells, primarily immunotherapy-based treatments.

Collectively, the team hopes they can find the best protein that will work for cancer treatment.

‘It is very early days but we are having really exciting results and it just shows you how every piece of basic research adds value,’ Dr Wykes said.

‘We’ve identified the molecules in the body that need to be activated to create the desired immune response. Now we are testing treatments that will achieve this response,’ she said.

Dr Wykes hopes to begin clinical trials treating patients in the next few years.
research and become an independent researcher. This is not the end of the story. Knowing that there are people like the team from the Children’s Hospital Foundation, who believe in young researchers like me, makes it all possible.

What is the one thing you hope to achieve in your scientific career or what is your hope for the future in your area of research?

I would love to design a drug or a product that prevents the development of allergy in children. My main motivation is to help families so children can just enjoy life and be children. Living in fear of going into anaphylactic shock or having an asthma attack is no way for a child to grow up and the side effects from long-term use of corticosteroid drugs are serious. Allergy and autoimmune diseases do not only affect the children but also their families—I feel terribly sorry for them and I want to help.

Gut health and the microbiome have emerged as a burgeoning area of interest. What does it mean to you to be working in this field of research?

As any scientist, I love a good puzzle and problem-solving. I am particularly amazed at the dynamic complexity that is the microbiome (because the microbiome is not only located in the gut!). When all is well, the trillions of bacteria, fungi and viruses live happily as our friends, allowing us to resist infection from certain pathogens and protecting us from developing metabolic, allergic or autoimmune diseases. I find it fascinating to understand how these organisms work together, interacting with the human body and immune cells to determine health and disease.

You are very passionate about nutrition and diet. What is the biggest misconception surrounding diet and nutrition?

I think the message on how nutrition affects our health needs to be louder. What we eat affects us from the early stages of life. It has become clear that diet during pregnancy and early childhood impacts cellular function and can severely influence the development of disease. As a result, we are currently working on understanding the mechanisms of transmission between mother and child, to design preventative strategies against allergy and autoimmune diseases.

What was the biggest obstacle you faced with your research and how did you overcome it?

The biggest hurdle in research these days is, of course, the fierce competition for funding and sustainability in the field. I cannot say that I have overcome it, as it is a constant struggle, but, for now, I keep my chin up and always give my best.

As a new Senior Research Fellow and Team Head at QIMR Berghofer, what do you like about working at QIMR Berghofer?

I feel very lucky to have the opportunity to join QIMR Berghofer as a Team Head. QIMR Berghofer is an internationally renowned institute, which is home to leaders producing world-class research—it’s very inspiring. The infrastructure and resources offered by the Institute are amazing and Brisbane is an absolutely fantastic hub for networking and developing new ideas.

When you have a couple of hours free, how do you pass the time?

I have two young girls (free time is not part of my vocabulary) but what I love above all is a good family adventure, whether it be discovering Brisbane or walking a trail.

How has your scientific career evolved over the years?

I started as a Marine Biologist at the Florida Institute of Technology but, after finding one too many banana spiders crawling on me while going out into the field collecting soil-samples in alligator-infested rivers, I made the change to molecular biology. Initially, I wanted to work in neuroscience but landed my first job in immunotoxicology at the University of Montana, looking at toxins and their effect on the immune system. It was here I discovered how essential the immune system is. That is when I decided to do my PhD in immunology—studying ways to suppress allergic asthma. I have been working on developing novel therapeutic strategies to prevent and treat chronic inflammatory diseases ever since. My particular area of interest is paediatric research, specifically preventing the development of allergy and inflammatory bowel disease by studying the role of the microbiome.

What is your career highlight to date?

My career highlight is when the Children’s Hospital Foundation noticed my work and decided to support my research program. They have been a blessing and a fantastic group of people to work with. I’m studying the role of the microbiome in the development of allergy, which is the first program to be supported by the Woolworths Centre for Childhood Nutrition Research. This amazing stepping stone has allowed me to expand my

Dr Severine Navarro
Head of Mucosal Immunology Group

Q&A
There’s a lot of concern among Australians about high out-of-pocket medical expenses.

QIMR Berghofer recently conducted a population-based study in Queensland of 452 people with cancer, allowing researchers access to their Medicare data through both the Medicare Benefits Scheme and Pharmaceutical Benefits Scheme.

All billings through these schemes were assessed over a two-year period. The participants had a confirmed diagnosis of either melanoma, breast, prostate, colorectal or lung cancer through the Queensland Cancer Registry.

Financial costs for going through cancer treatment can be significant, because the management of cancer is lengthy. It often requires multiple health professionals, many doctors’ visits, multiple tests and treatments (surgery, radiotherapy, immunotherapy, chemotherapy and medications) and ongoing monitoring after the initial treatment.

Our findings showed that doctors charge a very wide range of fees, with out-of-pocket costs ranging from zero dollars to tens of thousands of dollars. The key range of fees, with out-of-pocket costs ranging from

- the total median cost charged to patients for all services and medicines they received over a two-year period was $9800. However, three-quarters of patients were charged up to $20 300
- the median out-of-pocket costs incurred by people with cancer was $1800. However three-quarters of patients were in the red by $4900
- the median out-of-pocket costs were highest for breast cancer at $4200 and lowest for lung cancer at $1100
- the highest out-of-pocket costs paid by any patient was around $20 000 and the lowest was zero, and
- approximately 74 per cent of the study participants had private health insurance, compared with around 50 per cent of the Australian population. Therefore, the above out-of-pocket costs may be conservative, because some surgical procedures may have been partially covered by health insurance.

Extra costs are hardest felt by people with chronic diseases or multiple medical conditions, as well as those who earn lower incomes, are younger or live in rural areas.

Although low-income individuals are more often bulk-billed, some people delay seeing a doctor, skip appointments and avoid preventive care (e.g. dental check-ups), because they simply cannot afford these expenses.

It is unknown exactly how many Australians on low incomes would choose not to visit a specialist due to high costs but one international survey found 16 per cent of Australians failed to access healthcare in 2013 because the cost was prohibitive.

With the ongoing public discourse about private insurance and out-of-pocket costs, the even greater financial burden may lie with those in the public system who are struggling to make ends meet due to expenses like travelling for treatment and losing income from time off work to attend appointments.

Medical out-of-pocket costs continue to be a significant problem for both wealthier and poorer Australians but the sources of these burdens are different.

This is particularly relevant as we enter an era where millions of middle-aged Australians are at risk of being diagnosed with chronic disease.

I believe healthcare must remain within reach of all Australians.

Supporting medical research can take many forms, whether it be through giving regular donations, leaving a gift in your will or directly sponsoring a researcher or PhD student.

QIMR Berghofer researcher Daffodil Canson (right) knows all too well the difference this kind of support can make to a researcher’s career.

Ms Canson is the 2018 recipient of the Ailsa Zinns PhD Scholarship, a scholarship awarded to a promising female doctoral candidate and covers the three to four years of study and work required to obtain a doctorate. Competition for scholarships is intense, with only the most talented young researchers being selected.

‘This scholarship is particularly crucial as I’m in the early stages of my academic career,’ Ms Canson said.

‘It allows me to focus completely on my PhD, researching endometrial cancer.’

Ms Canson studied part-time for her Master’s degree in Biochemistry at the University of the Philippines in Manila, while also working as a research associate at the same university.

On completion of her Master’s degree, Ms Canson relocated to Brisbane to commence her PhD studies.

‘Getting a PhD degree through QIMR Berghofer will undoubtedly boost my chances of a successful career,’ she said.

‘It will add weight to my credentials when I apply for a post-graduate position or submit a research grant to pursue an independent project.’

Ms Canson recently had the opportunity to meet with Ailsa Zinns (left), her benefactor, at QIMR Berghofer. Ailsa is a long-time supporter of QIMR Berghofer and a passionate supporter of women in science.

‘Ailsa and I talked about some of the things that I’m planning to do for my project and where I am from. It was lovely to listen to Ailsa’s stories about her life experiences.’

Ailsa’s wonderfully far-sighted support is helping train the next generation of scientists. The benefits of this support will travel through the generations as these talented young researchers take us to a healthier future.
Dr Edward Derrick, an early Director of the Queensland State Health Department Laboratory of Microbiology and Pathology, had a vision for the future of health.

From humble beginnings in 1945, the Queensland Institute of Medical Research, now QIMR Berghofer, is recognised as a world-leading medical research institute with a rich history of scientific discoveries and translational research. The Institute has also made a significant contribution to enhancing the reputation of Queensland-based research.

On a daily basis, approximately 900 scientists, support staff and students conduct world-class research to develop new diagnostics and better treatments and prevention strategies, specifically in the areas of cancer, infectious diseases, mental health and chronic disorders.

A significant portion of vital research programs in progress at the Institute are funded by donations received from donors like Helen and Robert Francis, who have been regular contributors since 2002.

For Helen and Rob, the experience of caring for their daughter, who required treatment at the Mater and Royal Children’s Hospitals in her younger years, brought home the importance of medical research and its potential to have a positive impact on many lives.

‘I think QIMR Berghofer is a charity that everyone can relate to because, whatever you’re researching, chances are it has touched somebody at some time,’ Helen said.

A number of Helen and Robert’s family members have also suffered from chronic disorders like diabetes and asthma. They are particularly encouraged by the recent progress made into asthma research at the Institute.

‘The Institute has a huge team of scientists that are so focussed and believe in the research they are doing. We are so pleased to donate to a Queensland-based institute that continues to make such globally recognised medical breakthroughs,’ Helen said.

‘We don’t want to lose our scientists overseas. We want to keep them here,’ she said.

Helen appreciates that 100 per cent of donations go directly towards supporting the Institute’s research.

‘It’s really important to us that the money we give goes to the research,’ she said.

Helen said making a commitment to a weekly donation has become second nature and is just something they work into their financial routine.

‘It doesn’t have to be a huge amount of money. If it saves even one life, it is worth every cent.’

Sign up for weekly or monthly regular giving at: https://support.qimrberghofer.edu.au/regular-giving.

What your donation means to QIMR Berghofer

$100  A day’s worth of testing to see whether a new drug kills malaria parasites.

$200  A G rex container for culturing immune cells for immunotherapy treatment.

$330  Purchases one antibody for flow cytometry cell analysis.

$100  Collection of blood samples to assist in the manufacture of T cell therapy in an immunotherapy trial.

$250  Grows blood cells from a person with Alzheimer’s disease to help understand if their immune system is changed.

$100  Collection of online mental health assessment, DNA sample and genetic analysis of a participant in a depression genetics study.

$1000  Funds a PhD scholarship for a bright young mind (...who knows what they will discover?)

$100  Identify over 100 microbiome bacteria from 10 infants to help understand the link between nutrition and the development of allergic diseases.

$200  Chest x-ray on a participant in an asthma genetics trial.

A G rex container for culturing immune cells for immunotherapy treatment.

Identify over 100 microbiome bacteria from 10 infants to help understand the link between nutrition and the development of allergic diseases.

Grows blood cells from a person with Alzheimer’s disease to help understand if their immune system is changed.

A day’s worth of testing to see whether a new drug kills malaria parasites.

Purchases one antibody for flow cytometry cell analysis.

Funds a PhD scholarship for a bright young mind (...who knows what they will discover?)

You can help support The Future of Health by donating online at qimrberghofer.edu.au or call us on 1800 993 000.
Walking on
Sunshine Gala Dinner
After 15 years of fundraising for melanoma research, Walking on Sunshine Foundation founder, Anne Stanton, celebrated the end of an era hosting her last gala dinner on 4 August 2018. Poet Rupert McCall paid tribute to Anne with a stirring rendition of The True Sense of Courage. The dinner, along with a Midwinter Meet event, raised a sensational $37,700 for melanoma research at QIMR Berghofer. Thank you to Anne, Jo and the Walking on Sunshine Foundation for your incredible dedication and support over the past 15 years—you have raised in excess of $320,000 for QIMR Berghofer.

GPT Golf Day
QIMR Berghofer was delighted to be the charity partner for the annual GPT Group Golf Day once again. Under bright sunny skies, some of the Institute’s melanoma researchers were on hand to demonstrate the effectiveness of sunscreen using a special UV camera. This year, the event raised over $28,000, bringing the total amount raised over 15 years to $350,000. Thank you to the organisers Bob Rice, Elvis Soiza, Kyle Symonds, the GPT Group and all the participating organisations for a great day on the green.

Dentons law firm enters The Sunday Mail Bridge to Brisbane
The team from Dentons law firm braved the rain on 26 August 2018 to raise funds for QIMR Berghofer, completing The Sunday Mail Bridge to Brisbane. They rose early to take part in the 5 km and 10 km annual Brisbane event and successfully raised $10,000 for the Dentons’ Honours Scholarships. This is the second year the scholarships will be awarded, assisting some very deserving QIMR Berghofer early-career researchers. Thank you to Dentons law firm, who matched the amount raised by their staff. Congratulations to the team.

Capalaba Bowls Cancer Charity Day
The Capalaba Bowls Club put in a huge effort for their annual Cancer Charity Day in June. The Club invited the local community for a game of barefoot bowls, a vintage car show and a barbecue lunch, with profits from the cake stall, meat and seafood tray raffles all donated to breast and prostate cancer research. QIMR Berghofer was delighted to receive a cheque for $6,800. Thank you Capalaba Ladies and Men’s Bowling Club and Capalaba Sports Club for your ongoing support.

Worms and Germs visits local school
When you are six years old, a rhinovirus may sound a little scary. This need not be the case according to QIMR Berghofer’s Medical Illustrator, Madeleine Kersting Flynn, creator of Worms and Germs—a delightful show that introduces children in preschool and prep to some basic medical facts in a fun and engaging puppet presentation.

When Madeleine couldn’t find a suitable book about medicine to share with her six-year-old son, she decided to do something about it by creating a show especially for children.

“I thought it would be great to do a puppet show for children to engage them at a level they would understand,” Madeleine said.

“The lessons we teach in Worms and Germs are pretty basic like practising good hygiene and the different everyday worms and germs,” she said.

Last year, Madeleine debuted Worms and Germs at her son’s daycare centre. It was a big hit with children, educators and parents alike. The show introduces children to the rhinovirus, influenza and ‘Wormi’ the threadworm.

Madeleine recently presented Worms and Germs to some very enthusiastic prep students at Holy Cross Primary School.

Madeleine has adapted the script and props to appeal to the prep students.

“This year, we have expanded the subject matter for the prep students and added an extra germ, E. coli. We also now have a puppet booth and our puppets are a little more sophisticated,’ she said.

According to Madeleine, Worms and Germs is a great avenue to pique children’s wonder and curiosity in science and medicine at an early age.

“One of the best questions I had was from a child who asked me how big worms and germs are. I was able to explain how scientists use a microscope to look at them because they are really, really small,” she said.

Madeleine hopes her Worms and Germs audience will grow in time but, for now, she is focussing the storylines for children under the age of seven.

Eventually, I would like to see Worms and Germs on the stage or screen. I’ve got a million storylines in my head for that!' Madeleine said.
OUR DOORS ARE OPEN TO YOU!

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2 Ecological community of microorganisms
3 The mosquito-borne infection Dr Michelle Wykes researched
4 Virus from the Worms and Germs show
5 Eye nerve affected by glaucoma

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