

scope

Immunity and disease

Our immune system is one of nature's most magnificent and yet complex inventions. It is constantly on alert, utilising its intricate network of organs, cells and proteins to protect us from the billions of bacteria and viruses that we are exposed to every day.

The true power of our immune system comes from its ability to "remember" invading germs that it has fought in the past and is therefore able to strike more quickly if they attack again. When this happens, the body is said to have immunity.

Not surprisingly, the consequences of a poorly operating immune system can be severe. Individuals with immune systems that are less active than normal are highly susceptible to diseases such as cancer, while those with overactive immune systems are at risk of developing autoimmune diseases such as arthritis or multiple sclerosis.

By unlocking the secrets to controlling immune responses, scientists at the Malaghan Institute of Medical Research hope to develop more effective and natural therapies for treating disease.

"Scientists at the Malaghan Institute are deeply committed to finding immune-based solutions to treat disease,"

Prof Graham Le Gros, Director.



Immunity against disease.



research saves lives

Immunity – the battle within



*The parasitic worm
Nippostrongylus brasiliensis.*

In order to exploit our immune system to treat disease, it is important to understand how the different cells and proteins work together to generate an immune response.

The Enemy

Think of your body as an isolated fortress, constantly under attack from hostile foreign armies of viruses, bacteria and parasites. These germs want to invade your body to use its resources for their own purpose, potentially harming you in the process. The term “foreign” is often used by scientists to describe invading germs or other substances not normally found in your body. However, in addition to the enemy being anything that is not us, such as germs, it can also be things that are no longer us, as happens in cancer.

Germs and cancer have substances on their outer surfaces that are not normally found in the human body. These foreign substances, called **antigens**, raise an alarm that causes the immune system to react.

The immune system is much better at recognising and attacking germs than cancer because cancer cells originate from within the body and are often not seen as foreign. This is thought to be why cancers are often able to grow, despite the presence of a healthy, working immune system. So instead of thinking of cancer cells as an invading army, they could be considered as more like traitors operating from within.

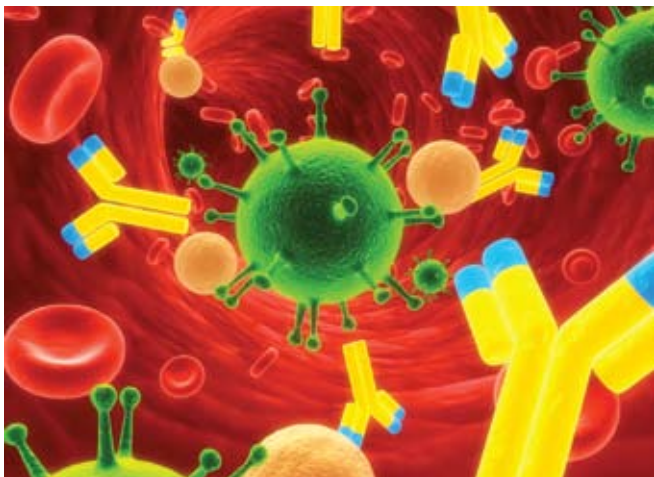
The Defense Force

The response to antigens is a highly coordinated process that uses the many types of cells of the immune system to defend, attack, control and provide long-term security against future invasion. Immune cells are white blood cells that are produced in large quantities in the bone marrow. There are a wide variety of immune cell types, the most important of which are the **CD4 T helper cells**.

The General and the Assassins

The CD4 T helper cell acts as a General, directing the other immune cells in the tasks they have to perform. The primary role of CD4 T helper cells is to trigger the activation of **B cells** and **killer T cells**. The command centres for this information transfer are the **lymph nodes** and **spleen**.

In response to specific commands from CD4 T helper cells, **B cells** release special proteins called **antibodies** that act like smart bombs, specifically targeting a particular intruder and marking it for destruction.



Immunology in action. Viruses (green), killer T cells (orange) and antibodies (yellow) in the blood.

The assassins of the immune system are the **CD8 killer T cells** and **natural killer T (NKT) cells**. Upon instruction from CD4 T helper cells, these killer cells will seek out and attack cells of the body infected with viruses or cancer cells. When these killer cells come into contact with foreign or cancerous cells, they give off substances that destroy them.

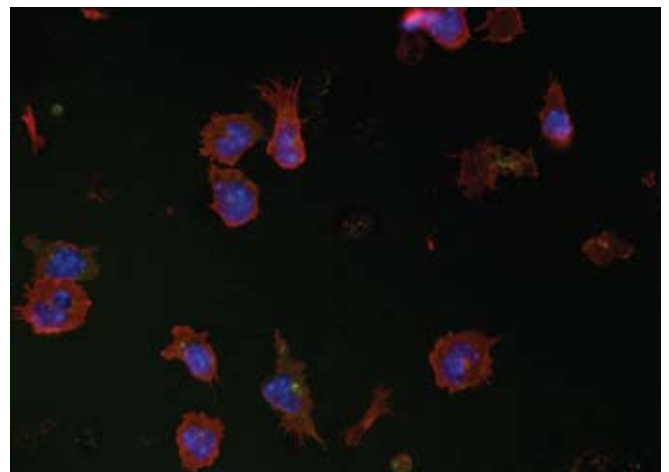
Another important role of the General is to stimulate the activity of **regulatory T cells**. These cells act as “brakes” to help keep the immune system in check. Autoimmune diseases such as multiple sclerosis can arise when these cells do not work correctly.

Sometimes the General can get it wrong and mistakenly direct immune responses against harmless substances such as pollen or certain foods, resulting in the diseases asthma and allergy. At the Malaghan Institute we have research programmes dedicated to understanding how and why this happens so that we can apply this information to the development of effective therapies for the treatment of these diseases.

The Aides

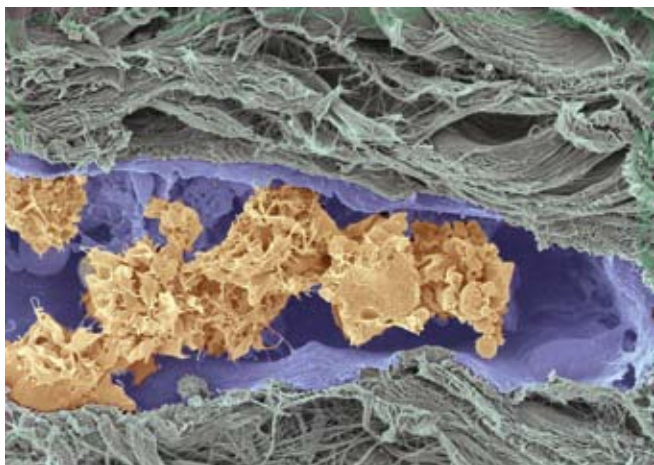
T cells need help to recognise and respond to germs, so like a General in his war room, the CD4 T helper cell must rely on his aides to provide him with the who, what, and where of potential threats.

The most powerful aides are a rare group of immune cells called **dendritic cells**, which patrol the body like sentinels, alerting the immune system to germs and potential threats. If the dendritic cell comes into contact with a foreign invader or cancer cell, it captures the potential threat and travels to the nearest lymph node command centre to present its captive to the CD4 T helper cell. The CD4 T helper cell will then process this information and decide on the appropriate course of action.



Microscopic image of dendritic cells (kindly provided by Nina Dickgreber)

Dendritic cells form the basis of cancer vaccines being used at the Malaghan Institute to treat patients with the aggressive brain tumour glioblastoma multiforme. The dendritic cell vaccines are generated from a patient's own dendritic cells and tumour tissue and are designed to stimulate the patient's killer T cells to seek out and destroy their cancer. Cancer immunotherapy is emerging as one of the most promising alternative approaches to cancer treatment and has the advantage of minimal side effects to the individuals being treated.



Cancer fighting immune cells.

The Enlisted Followers

Other key contributors to the immune response are **neutrophils, macrophages, basophils, mast cells** and **eosinophils**, which travel throughout the body in pursuit of invading germs and either devour any foreign invaders they come into contact with, or release substances that kill them.

Conclusion

This is just a glimpse of our immune system and the intricate ways in which its parts interact. Immunity is a fascinating topic that still holds many secrets, which Malaghan Institute scientists are working hard to unravel.

Upcoming Events



Open Day – Sunday 9 August

We are pleased to announce that the Malaghan Institute will be holding an Open Day for all interested members of the public, on Sunday the 9th of August from 11.00am – 3.00pm. This is an ideal opportunity to learn more about your immune system and speak with Malaghan Institute immunologists.

We will have tours running at regular intervals throughout the session and our state-of-the-art laboratories will be open for viewing. If you are interested in coming along, please register your interest with Vicky Hale on 04 499 6914 x 821 or vhale@malaghan.org.nz. Don't miss out on this great opportunity to see science in action.

Golf Tournaments

The Friends of the Malaghan Institute will be holding their annual charity golf tournaments on the following days:

- **Auckland** – The Grange Golf Club, Friday 30th October
- **Hawkes Bay** – Hastings Golf Club, Friday 30th October
- **Wellington** – Manor Park Golf Club, Friday 13th November

For more details, please contact Tanya Fulcher on 04 499 6914 x 811 or tfulcher@malaghan.org.nz

Recognition of the Malaghan Institute's quality health research

The Malaghan Institute's pioneering allergy, asthma and cancer research programmes were recognised last month with the award of over \$4 million of highly contested Health Research Council of New Zealand (HRC) funding. This is an incredibly significant achievement for the Institute and is a direct testament to the quality of the research being undertaken by our scientists.

Up-and-coming Malaghan Institute scientist Dr Elizabeth Forbes was the recipient of a prestigious HRC Emerging Researcher First Grant to develop a novel experimental model to investigate new strategies for the treatment and prevention of food allergy.

Allergy was also the focus of two other Malaghan Institute research projects to have received HRC

funding. The first of these, headed by Institute Director Prof Graham Le Gros, will explore the role of powerful chemical substances called cytokines that are released by cells of the immune system, in driving allergic airway diseases such as asthma. Complimenting this project is Prof Franca Ronchese's HRC funded allergy research, which will address the role of dendritic cells in stimulating allergic immune responses.

With evidence indicating an increasing prevalence of food allergy and asthma in much of the Western world, they are now considered very significant public health problems, particularly in children. The Malaghan Institute's multilayered approach to targeting these diseases holds the promise of improved quality of life for affected individuals.

Prof Ronchese and Dr Ian Hermans also received HRC funding to further the Malaghan Institute's world-class cancer immunotherapy research programme. The outcome of this research will be an improved understanding of the cancer fighting CD8 killer T cells and more effective strategies for using vaccines to stimulate anti-tumour immune responses.

HRC funding of innovative research programmes such as those being undertaken at the Malaghan Institute are vital to ensure the continuing success of health research in New Zealand.



*Prof Graham Le Gros, Dr Elizabeth Forbes,
Prof Franca Ronchese and Dr Ian Hermans.*

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What's been happening...



Flow Cytometry Suite Manager, Kylie Price, is shown some of the latest software at the NZFCG Conference

NZFCG Conference – 22/23 April

The Malaghan Institute was proud to host the first New Zealand Flow Cytometry Group Conference which was attended by over 35 research scientists and clinicians from across the country. The goal of the meeting was for people to advance their knowledge, skills and understanding of the most critical cell analysis technology, flow cytometry.



The attendees mingling after the World day of Immunology lecture

World Day of Immunology – 29th April

The Malaghan Institute and the Australasian Society for Immunology jointly hosted a free public lecture by Victoria University of Wellington's Dr Anne La Flamme. Over 60 people attended the event and

learnt about the daily battle that our immune system undertakes to keep us healthy. Afterwards, there was the opportunity to talk to Malaghan Institute scientists and also Dr La Flamme herself.

NZASI Conference – 4/5 June

Another annual conference on the Malaghan Institute calendar is the New Zealand branch of the Australasian Society for Immunology meeting. This year the keynote speaker for the meeting was renowned immunologist Dr Ethan Shevach from the National Institutes of Health, MD, USA, who presented his cutting-edge research on immune regulation and autoimmunity. Over 100 Scientists attended the conference to develop collaborative and integrative immune-based research strategies that can be used to more effectively treat diseases such as cancer and tuberculosis.

Taupo Friends Cocktail Function – 8 June

On Monday the 8th of June, 40 residents of Taupo attended an informal information evening at the Tui Oaks Hotel in Taupo. The aim of the event was to gather support for the instigation of a new Friends group in Taupo. A great evening was had by all and we now have a dozen people who will make a wonderful committee and who are already planning a golf tournament for later in the year!

NZ Fieldays – 10-13 June

For the first time, the Malaghan Institute of Medical Research had a stand at the New Zealand Agricultural Fieldays in Mystery Creek, Hamilton. Though not the usual type of stand people were used to at the Expo, we nonetheless had a good response with lots of people stopping to find out more about the work of the Institute.

Grants (March – June 09)

Thank you very much to the following organisations for their support:

Cuesports Foundation

Keith Seagar Research Fund