



UNIVERSITY  
of  
**OTAGO**  
Te Whare Wānanga o Ōtago  
NEW ZEALAND

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# University of Otago, Christchurch **Newsletter**

BIOENGINEERING SPECIAL

## Dean's welcome



Medical technology is one of the most exciting and rapidly evolving areas of health care.

It is at every stage of patient care – from computer systems which record patient notes from general practice to hospital, to the latest MRI scanners and medical implants.

New Zealand, and particularly Christchurch, is gaining an international reputation as a breeding ground for medical technology innovation and excellence.

Our Centre for Bioengineering is involved in many of the most promising medical technology research and developments. Last year the Centre was part of three major awards by the Ministry of Business, Innovation and Enterprise aimed at growing our country's medical technology sector. These awards totalled more than \$18 million to be invested over the next six years in Christchurch. The main projects for developing new technologies on our Christchurch health campus are

medical imaging, and tissue engineering or replacing or repairing damaged tissue and bone with that grown from patient's own cells. The potential, and benefits for patients, is huge.

This autumn edition of our newsletter focuses on some major bioengineering projects happening at our campus. A key part of much of this work is collaboration with others – significantly, the Canterbury District Health Board, Canterbury and Auckland Universities, and private companies in the Canterbury medical technology sector.

I hope you enjoy this newsletter, which also features articles on latest research into the areas of breast cancer and heart disease, as well as details on a long-standing connection one of our Professors has with Nepal.

Regards,  
**Peter Joyce**

## Freemasons researcher focuses on predicting future heart attacks

The inaugural Freemasons Carrell-Espiner Postdoctoral Fellow is working to identify markers in the blood for predicting people at risk of a future heart attack.

Over half of all heart disease-related deaths occur in people with no previous symptoms or warning signs.

Dr Moritz Lassé is analysing blood samples from hundreds of Christchurch volunteers, looking for common patterns of circulating proteins. By comparing blood samples from those who subsequently experienced a heart attack with those who remained heart healthy, Dr Lassé aims to find patterns of proteins which may indicate a heart attack is imminent within the next few years. This is particularly important in seemingly healthy individuals who would be classed as low risk of heart disease by current screening methods.

Dr Lassé is working with the Christchurch Heart Institute's geneticists Professor Vicky Cameron and Dr Anna Pilbrow. The pair has long focused on genetic differences to pinpoint why some people have heart attacks despite appearing at low risk of heart disease. Professor Cameron says genetic differences may be expressed as varying levels of circulating proteins in the blood, which is why Dr Lassé's expertise in protein profiling complements their work so well.

The Christchurch Heart Institute is a partner in funding the postdoctoral fellowship, along with the Freemasons.



Dr Moritz Lassé

# Bioengineering

## Transforming orthopaedic surgery at Christchurch's medical technology hub

Replacing a patient's bone or cartilage with material grown from their own cells is the future of orthopaedic surgery. This is the exciting field of regenerative medicine, and at its forefront is the Christchurch Regenerative Medicine and Tissue Engineering (CReaTE) Group.

The 20-strong group of Christchurch-based orthopaedic surgeons, bioengineers and cell biologists is producing arguably some of the biggest breakthroughs in this rapidly developing field. They are part of the University of Otago, Christchurch's Centre for Bioengineering, and the city's medical technology hub.

**“Replacing a patient's bone or cartilage with material grown from their own cells is the future of orthopaedic surgery. This is the exciting field of regenerative medicine.”**

The Government and elite health research organisations have granted CReaTE in excess of \$4 million to progress their work. CReaTE group is also a leader of the regenerative medicine theme within the newly established Government-funded Medical Technology Centre of Research Excellence.

Group leader, Dr Tim Woodfield, says its aim is to transform the way orthopaedic surgery is done internationally within 10 to 15 years.

The group is expert in combining 3D printing and biology. They are now applying this expertise to help private companies develop the next generation of 3D printed titanium with a Ministry of Business, Innovation and Employment (MBIE) grant. Dr Woodfield says the next step towards



Dr Tim Woodfield with a 3D printer.

radically changing orthopaedic surgery is to 3D print porous implants and layer them with the patient's own cells or smarter biomaterials for better integration and a more functional tissue.

Another area of work is 3D printing degradable 'scaffolds' onto which cells, or small tissue units, can be printed or assembled, replacing bone and cartilage. Dr Woodfield says combining a patient's own cells with biodegradable scaffolds in this way offers the opportunity to provide significant advantages over current surgical interventions used to repair or regenerate damaged tissues following trauma or disease.

## Bioengineering students have big futures

The MARS project involves students and researchers from a diverse range of disciplines, such as computing, mathematics, physics, molecular biology, and engineering.

Many PhD students work on the project, and all have gone on to further supported study or jobs within the biotechnology sector.

The latest members of the team are recent PhD graduates, computing expert Dr Neils de Ruiter and mathematician Dr Chris Bateman. Dr de Ruiter uses his computing expertise to translate data produced by the scanner into images radiologists can use. Dr Bateman's work involves developing novel algorithms for information provided by the scanner to identify the exact content of, for example, water, lipid or calcium, in human tissue.

MARS project leader Professor Anthony Butler says opportunities are growing for people wanting to undertake a PhD in bioengineering.

“Christchurch is a hub for excellence in medical technology and undertaking a PhD at the University of Otago, Christchurch, provides access to this dynamic and rapidly expanding scene.”

## Staff

### New head of Psychological Medicine

Professor Richard Porter has become the head of the Christchurch campus' Department of Psychological Medicine. Professor Porter is a psychiatrist whose primary research interest is mood disorders, such as depression and bipolar disorder.

Professor Porter is also a consultant psychiatrist for the Canterbury District Health Board, specialising in the psychiatric care of adults with intellectual disability and resistant mood disorders.



# Bioengineering

## Life-saving collaboration between medicine and engineering

A world-first project marrying engineers with intensive care specialists is saving lives and dollars.

University of Otago, Christchurch (UOC) health researchers and University of Canterbury engineers have developed a computer model which charts patients' specific medical status. This allows clinicians to give patients the most appropriate, personalised care. The project is a culmination of more than a decade of collaboration between the Universities, along with Canterbury District Health Board ICU staff.

**“Getting people the best care at the best time means fewer deaths, less time spent in hospital and significant savings.”**

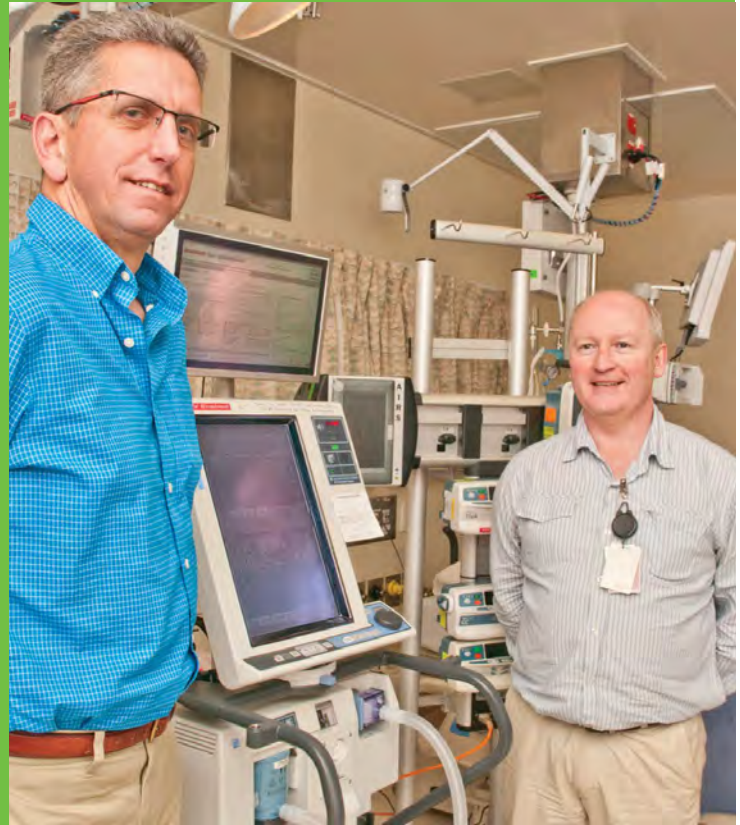
ICU specialist and UOC Professor Geoff Shaw says three critical factors determine a patient's requirements in ICU: blood sugar, ventilation and heart rate. The team has developed a model for each condition. So far they have implemented the blood sugar model in Christchurch's ICU and achieved significant results.

Canterbury University engineer Distinguished Professor Geoff Chase says research shows up to 30 fewer people might die in ICU per year in comparison to previous years when this treatment was not available. Getting people the best care at the best time means fewer deaths, less time spent in hospital and significant savings.

The team's blood sugar model is now being used in a Hungarian ICU.

Professor Chase says, to his knowledge, there is nowhere else in the world where engineering students regularly work on an ICU ward.

With the support of a Health Research Council grant, the team are now setting up a mechanical ventilation study in Christchurch's ICU.



Professor Geoff Chase, left, and Professor Geoff Shaw with monitoring equipment in the ICU.

## MARS project working on human-sized scanner



Professor Anthony Butler

The world's first human colour scanner will be housed at the University of Otago, Christchurch (UOC), and should be ready for clinical trials within five years.

Professor Anthony Butler heads a team from the University of Otago, Christchurch, and the University of Canterbury, who are developing the world's first full spectral colour x-ray scanner. Unlike current technology, the MARS scanner provides 3D information about the molecular make-up of the body.

The MARS project team won a \$12 million Ministry of Business and Enterprise grant to build the first human-sized scanner over six years. The current machine is only large enough to contain tissue samples.

Scanner trials so far have shown it is extremely successful in measuring molecular components of tissue and the presence of drugs in tissue samples. For example, it can determine not only the presence of cardiac plaque but whether it is likely to break off or clot and cause a fatal heart attack or stroke.

Professor Butler says “the MARS scanner is an excellent example of collaboration to achieve an amazing outcome. We've got the medical and bioengineering expertise of the University of Otago, Christchurch, combined with University of Canterbury's physics input. There is also the support of the Government in the form of its multi-million dollar grant.”

# Christchurch is a breast cancer research hub

A team of specialist cancer researchers have joined forces to focus on the impact of obesity on breast cancer.

The researchers all work for the University of Otago, Christchurch's Mackenzie Cancer Research Group. Associate Professor Gabi Dachs, Dr Margaret Currie and Dr Logan Walker have previously investigated various aspects of cancer but decided to team up to focus on these significant health issues.

Dr Margaret Currie says obesity is a growing social problem which affects people's cancer risk, treatment and survival outcomes. Breast cancer is also a common and significant disease for New Zealand women. Mackenzie Cancer Research Group head, oncologist Professor Bridget Robinson is a breast cancer clinician and researcher.

Each researcher will investigate different aspects of obesity and breast cancer:

Associate Professor Dachs is looking at molecular factors associated with obesity in cancer, particularly how fat cells communicate with cancer cells and negatively affect them.

Dr Margaret Currie is putting fat and breast cancer cells together to see how the fat cells make tumours more resistant to treatment. She suspects the fat cells provide 'an extra energy hit' to cancer cells by providing lipids, or fats, in addition to glucose.

Geneticist Dr Logan Walker will investigate whether the obesity-related gene responsible for the amylase enzyme in saliva (AMY1) contributes to breast cancer development. He will also explore the role of key genes that behave differently in breast tumours from obese women.

Three new Bachelor of Biomedical Science, Honours students, will work with the senior researchers on their projects.



From left, Associate Professor Gabi Dachs, Dr Margaret Currie and Dr Logan Walker.

## Breast cancer and obesity: the facts

- Breast cancer patients who were obese before or after diagnosis are less likely to survive than patients with normal BMI.
- Risk of dying from breast cancer increases by a third for every increment of 5kg/m<sup>2</sup> in BMI.
- About 30% of New Zealanders are overweight and an additional 40% are obese.
- Death from breast cancer in Māori is double that of non-Māori.
- Breast cancer is the most commonly diagnosed cancer in NZ women and the second most common cause of cancer death.

## Christchurch Professor's long-standing relationship with Nepal



Professor Murdoch in Nepal (picture supplied by Lynley Cook)

Leaving Nepal after the devastating earthquakes was one of the hardest things Professor David Murdoch has done.

"It was gut-wrenching. My connection with Nepal is deeply personal and a large part of me wanted to stay behind, but I hope I can do more good by being in New Zealand through the activities of the Himalayan Trust."

The world-renowned infectious disease specialist was in Kathmandu to work and teach at Patan Hospital when the magnitude 7.8 earthquake hit. For more than two decades, Professor Murdoch has worked and conducted research studies in Nepal, including providing evidence to establish a national pneumonia vaccination for local children. His connection with the country

began as a young doctor when he and his wife Lynley Cook spent two years working in the Khunde Hospital, established by Sir Edmund Hillary. His association with Sir Edmund's Nepalese organisation, the Himalayan Trust, continues today.

Professor Murdoch says the Nepalese are coping in the face of a massive disaster that would challenge even far richer countries. But they will need a lot of help. In the short term, donations will ensure supplies of fresh water, shelter and food to help stem the flow of potentially deadly infectious disease such as cholera.

Some charities collecting donations are the Himalayan Trust, Red Cross, Oxfam and Save the Children.

# Healthier Future Appeal

## Be part of Christchurch's healthier future

See how to foster some of the best and  
brightest students and researchers.

[otago.ac.nz/christchurch/about/appeal](http://otago.ac.nz/christchurch/about/appeal)