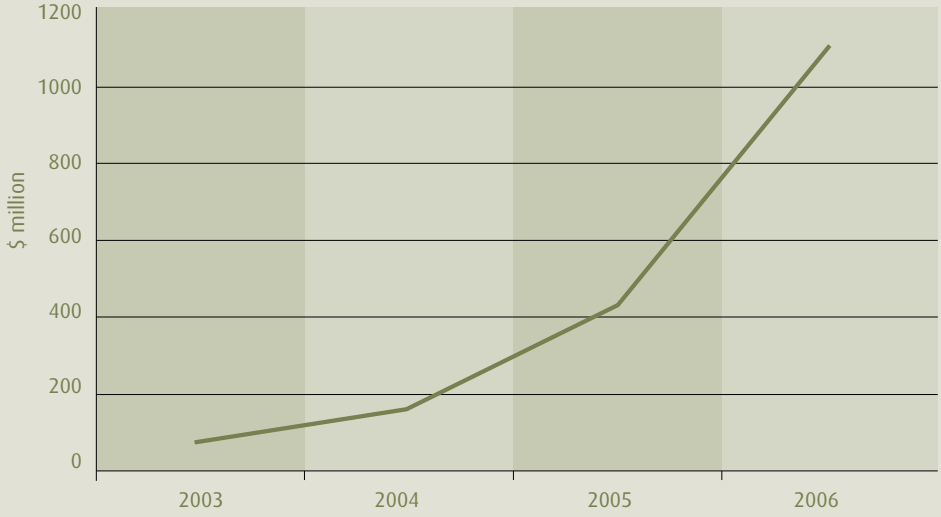
University research commercialisation

Paying dividends for New Zealand

New Zealand Vice-Chancellors' Committee

UCONZ
University Commercialisation Offices of New Zealand

MARKET CAPITALISATION OF UNIVERSITY START-UP COMPANIES



Year	$m
2003	76
2004	159
2005	431
2006	1100

University research commercialisation:

Paying dividends for New Zealand

The year 2008 marks the 20th anniversary of the establishment of New Zealand's first university commercialisation company, the University of Auckland's UniServices. In the intervening 20 years the other seven universities have all established commercialisation entities to capitalise on the fast-growing research outputs of the universities. Today their combined activities have grown to a business worth $350 million a year.

In 2005 the eight universities set up UCONZ – University Commercialisation Offices of New Zealand – to bring together the commercialisation offices of all the country's universities and to establish closer links with government and commercial research partners.

A leading accounting firm has recently collated survey responses from UCONZ members regarding their commercialisation activities. This revealed a total income in the four years 2003–2006 of $1.2 billion dollars, with income now at $350 million a year. The study yielded other notable findings.

Between 2003 and 2006, 736 new invention disclosures were received by university commercialisation offices, 303 new patents were applied for and 97 patents were granted, and 156 licences were issued.

Revenues from technology licensing have increased from just under $4 million in 2003, with 97 active licenses, to over $10 million in 2006, with 210 active licences, generating a total of $29 million.

Total technology sales paid for in equity by licensee companies in the same period produced a further $32 million of revenue.

Revenue from contract research carried out at universities has increased from $201 million in 2003 to $275 million in 2006, or nearly a billion dollars over four years.

Consultancy activities over the same period have brought in a further $65 million of revenue.

Between 2003 and 2006, over $155 million of capital has been raised for start-ups.

In the same period, 29 new start-ups were formed, bringing the number operating as of 2006 to 44.

The number of full-time staff employed by these start-ups has grown from 198 to 363.

An earlier study showed that per dollar invested, New Zealand universities produced more than twice as many new companies than the United States average, and more than 50 percent more than Canada. In addition, New Zealand universities produced patent applications at a rate on a par with US performance, and 30 percent more efficiently than Canada.

The commercialisation activities carried out by the universities are wide-ranging. This brochure details some of the exciting opportunities being pursued by UCONZ members. Information on how the universities can help business can be obtained from any of the universities whose contact details are listed on page 11.

Power without wires

A new process developed by University of Auckland researchers has produced a safe, clean, reliable way of transmitting an electric current without the need for wires.

Researchers in the Power Electronics Group at the University of Auckland have developed a new process of transferring electrical power without physical contact. The low-maintenance system allows electric motors and lights to be powered and batteries to be charged very safely.

While Inductive Power Transfer (IPT) is not in itself a new technology, having been around for more than 100 years, a way of powering several electrical loads on a single track had never been found. Building on research undertaken at the university in the late 1970s, a team led by Professor John Boys and Dr Andrew Green made the vital breakthrough in the early 1990s.

Shopping trolleys recharging via coils embedded in a power mat.

The first prototype was a self-propelled trolley driven by an electric motor. This system was the start of a successful research and commercial programme that now includes six licensees in New Zealand and overseas. Royalties from overseas licensees of millions of dollars per year have effectively funded the growth of local research, and provided the basis for local start-ups using new applications of the same technology.

The IPT system uses magnetic fields to transfer power from transmitter to receiver instead of cables or brushes. There are no rubbing parts to wear out or connecting cables to break.
The system has many advantages:

- Immunity to dirt, dust, water, ice and chemicals
- Minimal cabling and risk of cable breakage
- Low maintenance and quiet, safe performance
- Adaptability to low and high-speed applications
- Multi-functionality, handling both power and data transfer.

Both the transmitter and the receiver can be sealed from all external influences, so the system can be partially buried or submerged. The elimination of cable connections between track and pickup means that broken exposed

wires are a thing of the past. The high frequency used (10kHz to 40kHz) will not cause electrocution in the unlikely event of contact with an exposed live wire or terminal.

Applications include motor drives for belt systems for use in clean rooms and automotive assembly plants, automated guided vehicles, battery-charging systems for buses, and pedestrian and vehicle guidance lighting systems. Power ranges vary from a few watts to many kilowatts. Now 75 percent of the world's integrated circuits and most of the world's flat screen monitors depend upon this technology.

In New Zealand one licensee uses IPT-powered road studs glued to the road to provide a highly visible light path. New developments will allow the colour of the lit studs to be changed remotely to signal lane changes or hazards.

Other recent developments have included more efficient pickups, wide bandwidth digital signal transmission, and a battery charging system suitable for cars and light commercial vehicles. This latest development will allow electric vehicles to be charged automatically without being plugged in.

With increasing interest in electric vehicles, hybrid and full electric, UniServices' current priority is IPT battery charging. This builds on the work done with Wampfler and a more recent licensee, Cabco Ltd, who use IPT charging for entertainment systems for their KidKart supermarket trolleys.

A low-cost battery charging system, comprising a domestic-size power supply and matching under-car pickup, is being developed and discussions are being held with several car manufacturers.

MITOQ /ANTIPODEAN PHARMACEUTICALS INC

Established with platform technology developed at the University of Otago by Professor Robin Smith and former colleague Dr Michael Murphy, Antipodean Pharmaceuticals Inc has taken a new drug, MitoQ, into Phase II clinical trials in New Zealand, targeting a key mechanism underlying Parkinson's disease. In 2005 the company, in which Otago Innovation is a shareholder, raised US$15 million for further research and US Food and Drug Administration trials. Phase III trials will target the product's use in combating hepatic disease, and potential dermatological applications.

Making Lab Testing Easy

Khipu Systems

Quick and accurate laboratory testing that will help farmers improve pasture yield and efficiency.

Laboratory testing is easier as a result of the application of the innovative software produced by Khipu Systems, a joint venture between the University of Waikato's WaikatoLink and Hamilton-based Hill Laboratories. The unique software modelling system draws on the expertise of the machine learning team at the University of Waikato, and Hill's industry expertise. The software radically speeds up and improves the accuracy of soil and plant sampling, and allows laboratories to produce results quickly and accurately for large numbers of test samples. One of its many uses is to help farmers to better calculate fertiliser needs by accurately establishing the nitrogen and carbon content of soil.

The software reduces the time taken for soil sampling from several days to a matter of minutes, by scanning samples using near-infrared spectroscopy to produce "spectral signatures", replacing time-consuming laboratory chemical analysis. The software combines the "signatures" with known reference values to create sophisticated mathematical calibration models, which can be used to predict the samples' composition with great accuracy.

The software tools fully automate data acquisition, integration, and pre-processing, and the generation and optimisation of mathematical models.

The software has been in routine use at Hill Laboratories in Hamilton for three years and has been sold to Europe's largest soil and plant testing laboratory, Blgg of the Netherlands. Other leading international companies are evaluating the product portfolio. After these early successes Khipu is advancing rapidly along the development and commercialization curve.

This software has potential for application to manufacturing and process control in many industries, from oil refining to feed manufacture. The original research team at Waikato has secured further funding to develop machine learning software based on gas chromatography.

Khipu Systems illustrates how research commercialisation from universities can be driven by working with industry. Khipu's success follows that of other WaikatoLink hi-tech spin-outs, such as rapidly growing biotechnology company ZyGEM, which has launched its DNA extraction products on the international market.

Magritek

Hi-tech solutions for hi-tech industries

Many New Zealanders will be familiar with the work of the MacDiarmid Institute for Advanced Materials and Nanotechnology based at Victoria University of Wellington. Magritek was set up in 2004 by the institute's then director, Professor Paul Callaghan, and other top research scientists from Massey University and Victoria, to convert some of the ideas produced by the institute into commercial realities.

Magritek is involved in the design and construction of innovative Nuclear Magnetic Resonance (NMR) and Magnetic Resonance Imaging (MRI) systems, with a focus on industrial applications outside the research laboratory. Combining the latest advances in NMR techniques, compact high-speed electronics, and powerful software, Magritek provides robust, compact high performance NMR and MRI systems suited to use in demanding industrial environments.

NMR is a powerful sensing technology, with application in chemistry, biology, medicine, and more recently industrial process control. The devices have been used for environmental research in Antarctica, non-invasive humidity measurements, and determining the molecular structure and dynamics of polymers and food on a molecular level. In addition, these devices have been integrated with cutting-edge hand-held NMR technology. The latest Magritek products can be powered by batteries, and they generate the necessary magnetic fields using either permanent magnets or Earth's magnetic field. A new potential application of these devices is non-invasive automated quality control in production lines.

NMR/MRI is one of the most successful technologies to emerge in the 20th century. In the field of medicine the use of MRI has grown explosively in the last 20 years and an MRI Scanner is now an essential element of any modern medical facility. Magritek believes that while the industrial market has been slow to develop, it nevertheless has enormous potential.

Magritek sells a range of NMR/MRI systems ranging from a complete earth's field NMR/MRI teaching system to completely portable battery powered NMR spectrometers.

ANZODE INC

This silver-zinc battery lasts four times longer than existing products. Spun out from research by Dr Simon Hall and Dr Michael Liu at Massey University, Anzode Inc is attracting strong interest from the US Government, a major US consumer electronics firm, and the world's largest manufacturer of electronic components for cell phones and laptops.

Whisper Tech Limited

Cutting household costs through efficient energy generation

Christchurch-based Whisper Tech Limited is the owner and developer of the WhisperGen microCHP system. MicroCHP stands for Combined Heat and Power and the WhisperGen, is a small domestic appliance which simultaneously generates heat and electricity.

In 1989 Don Clucas embarked on a PhD based around the development of a commercially viable Stirling engine at the Engineering School of Canterbury University. In 1994 when his studies were completed Dr Clucas and the university transferred all of their interests in the technology to Whisper Tech Limited which, with external funding, continued work on the prototype, developing a commercial product suitable for mass manufacture.

The WhisperGen blends perfectly into the household environment.

The WhisperGen is a highly efficient energy generator which offers the user cost savings and the potential for significant carbon gas reductions. It is used in homes in Europe, where it replaces a domestic boiler. Fired by natural gas, it produces all of the hot water that the home's boiler would normally make for heating and domestic hot water, and at the same time generates electricity which can either be used in the home or sold back to the electricity grid. Its life, service, and noise levels are similar to a boiler, and its highly efficient use of fuel will reduce a typical homeowner's energy costs by 20–30 percent. WhisperGen's efficiency offers significant carbon reductions compared with the central generation of electricity; in a typical British home it can reduce CO_2 emissions by about a tonne per annum.

Whisper Tech has this year entered into a joint venture with a major European industrial and manufacturing conglomerate; this will be the vehicle for the manufacture and distribution of the WhisperGen system throughout Europe. It expects to commence manufacturing in Spain in late 2008. Market interest in the product is significant, and the production of more than 200,000 units over the next five years is planned.

Eco-n™ Nitrification Inhibitor Technology

Helping New Zealand stay clean and green

Eco-n™ treated paddocks on the Lincoln University Dairy Farm. The equipment in the foreground measures the effects of eco-n™ in reducing nitrate leaching losses from the soil.

Eco-n™ is a product that reduces the environmental impacts of dairy farming and increases farms' productivity and sustainability. The technology was developed by Lincoln University and Ravensdown Fertiliser Co-operative Ltd. It was launched in 2004, and in 2008 sales will approach $10 million.

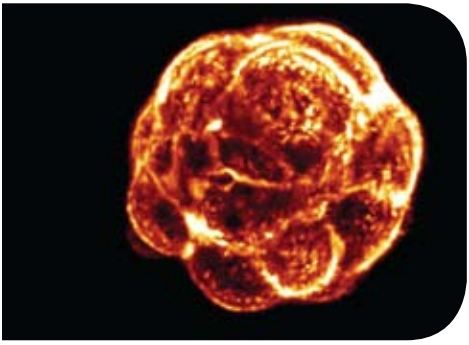
The invention originated in a research programme funded by the Foundation for Research, Science and Technology and conducted at Lincoln University. It was discovered that treating soil with a nitrification inhibitor could reduce nitrate leaching losses from pastoral agriculture by up to 60 percent, reduce nitrous oxide emissions by up to 70 percent, and increase pasture production by up to 15 percent. Ravensdown has co-invested heavily in the science as well as the commercialisation of eco-n™.

Nitrate leaching from agriculture reduces water quality, and nitrous oxide emissions from agricultural land account for about 17 percent of New Zealand's greenhouse gas inventory and about 33 percent of its agricultural greenhouse gas emissions. Reductions in nitrate leaching are also needed to reduce pollution of groundwater, rivers and lakes. The development of eco-n™ is an important contribution to the continuing efforts to preserve the environment.

Current research indicates that if most of New Zealand's dairy farmers used eco-n™ nitrification inhibitor technology then emissions of nitrous oxide from dairy farming could be reduced almost to the 1990 levels required under the Kyoto Protocol.

KODE Biotech Limited

Developed by Professor Steve Henry of the Auckland University of Technology, KODE™ constructs have a large range of potential diagnostic and therapeutic applications, including diagnostic controls, immune modulation, antigen enhancing/masking, diagnostic analytical systems, cell labelling and imaging, vaccine and drug delivery, cell culture improvement, immune therapy and fertility enhancement. KODE™ represents an advance in the control of membrane surface characteristics.



Embryo labelled with a KODE™ construct

A commercial example of KODE™ technology is CSL Securacell™, a product for making blood supply and blood transfusion processes safer. Launched to the Australian market, Securacell™ represents the first multi-purpose quality control system for immunohaematology laboratories. Similar products are about to be released in the EU and the US, pending regulatory approval.

Professor Henry founded KODE Biotech Limited in 1996 to develop innovative technologies based on the KODE™ platform and is also the Director of AUT's Biotechnology Research Institute. Unlike the other enterprises described in this brochure, KODE™ is not a "spin-out" but a "spin-in", having started as a stand-alone company before partnering with AUT. KODE Biotech and AUT's Biotechnology Research Institute share expertise, equipment, facilities and staff. In this mutually beneficial relationship, AUT offers KODE Biotech infrastructure support while the university's PhD students have the opportunity to apply their academic skills in a commercial environment.

While KODE Biotech retains ownership of the intellectual property generated in the company, a contractual relationship with AUT allows the benefits of commercialisation to be shared. KODE™ technology is now going global and is being licensed to market leaders, spin-out ventures and major academic institutions/ organisations.

These are just a few examples of the way UCONZ helps transform the research flowing from the eight New Zealand universities into commercial reality. Many are still at the developmental stage, but all have the potential to make a major contribution to New Zealand's economic transformation. For details of the ways university commercial entities can assist, please contact the nearest UCONZ office.

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