

Auckland March 2010 NOW



Growing our future

New Zealand's largest longitudinal study underway

Jumping power

Auckland's breakthrough Inductive Power Transfer fuels electric car technology

Going east

The University's China strategy



**THE UNIVERSITY
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NEW ZEALAND

Te Whare Wānanga o Tāmaki Makaurau



Power Performance

A tourist with a heart condition steps into an electric vehicle for a trip around the bubbling mud pools and geysers in Rotorua. It's a small world - his new pacemaker is powered by the same technology as the vehicle he's travelling in.

The University of Auckland's Power Electronics Group are world leaders in the development of Inductive Power Transfer (IPT), which transmits electrical power without using wires. Their pioneering technology uses magnetic fields to transfer power instead of cables or brushes.

Back in 1986 the group, led by electrical engineer Professor John Boys (pictured above right), ignored the doubters in the scientific world and made power jump across air from one object to another by intersecting two magnetic fields.

"Everyone said that it was impossible," says John. "But we thought we had the technology to do it. There was also a lot of knowledge in our group at the time about driving motors and power electronics."

Two years later Japan's Daifuku, materials handling specialists, gave IPT a big boost when they bought the first licence to use the technology in their assembly plants. They saw the versatility of IPT and soon installed it in semi-conductor factories that make computer chips and flat panel displays.

"These factories have to be particularly clean - no dirt or dust or sliding contact," says John. Daifuku developed a unique monorail system using IPT to move up to 3.5-square-metre liquid crystal sheets of glass around the factory. Now similar systems are in 70 percent of "clean rooms" around the world.

As the understanding of IPT has grown, so has its application. Today it is powering artificial hearts, being used for lighting in

theatres and road tunnels, and may soon charge up internal lighting systems on passenger aircraft.

"We even had an inquiry from NASA last year about using IPT for transferring power between stationary spacecraft."

But for John and his team the holy grail of IPT is applying it to electric vehicles - they imagine a future where petrol stations are redundant and electric cars recharge on the move.

The group, co-led by Associate Professor Grant Covic (pictured above left), has the technology to transmit more than 10 kilowatts of power from a charging pad embedded in the road to a receiving component underneath an electric vehicle.

This is now being developed to make cars that can charge up as they drive around cities and out on the highway.

"If drivers can charge up while on the move it will take away their anxiety about needing to plug in," says Grant. "They will use a smaller battery, the car will be more efficient, and we think we can power the embedded road pads from wind and solar energy so they will be clean and green too."

www.youtube.com/researchworkswonders

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Food for Life

We know that poor diet can lead to health problems including obesity, diabetes and even cancer. But now scientists are finding it's not just your diet but also what your mother ate - particularly during pregnancy - that matters.

This is the focus of epigenetics research at The University of Auckland's Liggins Institute.

"Epigenetics is a genetic switching mechanism that we didn't previously know existed," says Liggins Director Professor Wayne Cutfield. "There's a traditional view that our genes hard-wire us. But this is not necessarily the case. During the very early stages of life the developing baby gets a sense of its external environment through nutritional signals received from its mother and programmes the function of key genes in expectation of a certain nutrition regimen after birth. Depending on the 'fit' between the expected and actual nutritional environment, the growing baby is then set on a course to health or disease later in life."

Epigenetics has implications for all age groups but at the Liggins the focus is on research for a healthy start to life. Four years ago former director and leading epigenetics specialist, Professor Sir Peter Gluckman, spearheaded the development of an international consortium of researchers and global food companies to apply the new science to the nutrition of mothers and their babies.

Liggins researchers are now developing diagnostic tools to determine epigenetic profiles of newborns and, based on those, establish nutritional alternatives (for example, tailored infant formulae).

"Our early information suggests that in the future we might be able to identify children with not just different growth and metabolic profiles but also learning and behavioural needs,"

says Steve Hodgkinson, Liggins Business and Innovation Manager. "Then rather than giving them a one-size-fits-all infant formula we'll have worked out which nutritional strategy is best for them."

Ground-breaking Liggins research has shown that offspring of female rats that are under-nourished during pregnancy are much more susceptible to obesity, over eating, high blood pressure and heart disease. These impacts are often not seen until the offspring are themselves mature.

"Translating these observations we can see a possible reason for the burgeoning levels of type 2 diabetes in developing nations," says Steve. "Thirty years ago these people were typically engaged in labour-intensive occupations and nutrition was marginal. Now the children, whose mothers were undernourished during pregnancy, are often living in more affluent communities where food is cheap and plentiful. As a consequence they're much more susceptible to diabetes, obesity and metabolic disorders because of the way their genetic switches were set before they were born."

"This will be an important issue with 200 million type-2 diabetics projected in South-east Asia in the next decade. In New Zealand alone there are at least 110,000 adults with type 2 diabetes and this is rapidly rising with the increased rate of obesity in all age groups."

www.liggins@auckland.ac.nz

Photo: Scan of five-month-old female fetus in womb.



Embracing China

The University of Auckland has been building bridges with China for nearly two decades, so when the headwaters of the mighty Yellow, Yangtze and Mekong rivers needed urgent environmental protection Auckland was ready to help.

“The Three Rivers project is one of several that Auckland researchers are contributing to in western China,” says Associate Professor Christopher Tremewan, the University’s Pro Vice-Chancellor (International).

Along with Tsinghua University in Beijing and Qinghai University on the Tibetan plateau, the University’s research capability is being used by the Chinese Government on major infrastructure projects in highland ecology (including river and grasslands management), high-altitude medicine research and magnesium development.

“These projects will open up long-term opportunities for New Zealand business,” says Chris who leads the University’s China strategy. The collaboration also shows how far the University has reached into China since establishing the New Zealand Asia Institute on campus in 1995.

“We knew back then that if we wanted New Zealand to be up with the game internationally we had to build links with the world’s largest growth economy.”

Today 15 years of hard work are reaping rewards. As a result of the first China-New Zealand Commercialisation Forum organised by the University at Tsinghua Science Park in 2008, contracts have been developed for drilling the world’s deepest hole in the earth’s crust at Qingdao (near the Olympic yachting venue) for geothermal exploration and earthquake prediction.

The University’s Induction Power Transfer (IPT) technology is also being trialled for electrifying Shanghai’s public transport system.

The New Zealand Centre at Peking University, launched by The University of Auckland, is now in its fourth year and provides a venue for NZ-China policy development. Prime Minister John Key has been a guest speaker and this year the Centre will host high-level seminars on environmental policy and climate change, and look at the Free Trade Agreement.

Back home, the University has become a gateway for contacts with China. These include Lu YongXiang, President of the Chinese Academy of Sciences (CAS) and Vice-President of the National People’s Congress, who was awarded an honorary doctorate. A Confucius Institute (one of 300 world-wide) has been established on campus and is run in partnership with Shanghai’s Fudan University. It fosters understanding of Chinese language and culture in New Zealand schools, businesses and the community. Top Chinese PhD students are also enrolling at Auckland, with 40 expected this year, many in disciplines like biomedicine and bioengineering.

“China is crucial to New Zealand’s future,” concludes Chris. “Our strategy of technology commercialisation, building business links, recruiting top research students and working on globally important issues will open up opportunities and provide New Zealand with a huge network for the future - both back into China and globally.”

www.ci.ac.nz

Photo: Chinese PhD candidate Xilai Li, director of the Grassland Institute at



Our children's future

Even a casual observer of New Zealand society will be aware that we are failing our children. Of the 24 wealthiest OECD countries, New Zealand has the highest rate of child deaths due to accidents and injuries, the second to lowest immunisation rates and a greater proportion of our children growing up in relative poverty compared to the other countries.

Although we have spent billions of dollars over the last few decades trying to change this, we are not seeing any measurable difference and inequalities are worsening.

A new study led by The University of Auckland aims to refocus ineffective strategies into spending that reaps benefits for all our children.

Growing Up in New Zealand is following some 7,000 children born in 2009, not only to identify problematic outcomes in our newest generation, but also to understand "what works" for our current population.

The potential savings are huge: international experience shows that for every dollar spent on this research, eight could be saved through effective prevention and intervention - and that's just in the health sector.

"Top of our agenda is to make sure we're reflecting the diversity of New Zealand's current births in this study," says Research Director Dr Susan Morton. "That's the best way to ensure that when policies are made they're actually going to address the issues that affect all our families."

Growing Up in New Zealand was launched in 2008, with all pregnant women invited to enrol from across Auckland, Counties-Manukau and Waikato. The births in these areas reflect the diversity of New Zealand families having babies at

the moment, including first-time and subsequent mothers, single or partnered women and those living in the country, small towns and cities.

Of equal importance, this is the first longitudinal study to reflect the ethnic diversity of New Zealand's current births with Māori, Pacific and Asian babies included in appropriate numbers. It is also leading the way in international studies by starting 12 weeks before the baby is born and continuing until he/she turns 21.

Another first is inviting fathers and/or partners to take part. "We interview both Mum and Dad and collect information about who they are and what the family is like before the child is born," says Susan. "We ask what their hopes are for their child and their intentions for things like breastfeeding, early childhood education and returning to work."

The collective voice of *Growing Up's* mothers and fathers will be known soon. "Our intention is to report back later this year on the first findings from the antenatal interviews," says Susan. "And we plan to keep releasing findings throughout the life of the study. These results will help us develop public policy that truly makes New Zealand a better place for all our children to live."

www.growingup.co.nz

www.youtube.com/researchworkswonders

Photo: Susan Morton with three babies enrolled in the *Growing Up* study. From left: 15-month-old Kanoa MacFie, 9 ½-month-old Lucy Ward and 5 ½-month-old Mei an Peacock



360°

When 19-year-old Architecture student Paul Lelieveld left his hometown of Hamilton to study at The University of Auckland, he had no idea he could end up in Reykjavik, Beijing or Dublin.

Last year Paul was among 197 Auckland students who went on a 360° Auckland Abroad student exchange. "I wanted to see some of the buildings and architecture I was studying rather than just look at them on a PowerPoint," says Paul, who completed the second year of his Bachelor of Architectural Studies at Kingston University in London.

He had plenty of choices - The University of Auckland has exchange agreements with 90 universities in 24 countries. They include Universitas 21, a network of leading research-intensive universities of which Auckland is the only New Zealand member.

As well as giving him valuable credits, the exchange enabled Paul to see, first-hand, architectural monuments such as St Paul's Cathedral and the Tate Modern. He also went on a field trip to Switzerland to study the work of modern architects there. "Overall," he says, "it was great to get a different point of view and work with different tutors."

Now back at Auckland for his third year, Paul says the exchange has "reinvented" his interest in architecture and given him a new respect for his subject.

"International exchanges give our students a chance to spread their wings and encounter the world," says Associate Professor Chris Tremewan, Pro Vice-Chancellor (International). "Students bring back scholarly maturity and focus, not to mention cultural awareness and a great boost to their CVs."