IRL solutions

SPRING 2011

Social science

R&D collaboration set to revolutionise treatment of autism

INSIDE:

INDUSTRIAL RESEARCH LIMITED
Te Tauihu Pūtaiao

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www.irl.cri.nz ISSN 1179-6073 (print) ISSN 1179-8165 (online)

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Fast forward

One of the great things about this country is its ability to rise to the challenges put before it. The recent earthquakes in Christchurch have challenged not only the people of Canterbury but the New Zealand economy as a whole.

Despite this, the local business community is showing great resilience, with some firms even looking to develop new, innovative products for export markets. One such company is Christchurch-based start-up i-ORA, which is collaborating with IRL research engineer Marcus King to develop a medical robotics platform that assists autistic children to learn basic social skills. Already the company has stimulated interest in the world's biggest market for medical devices—the United States (see story page 8).

The global market for medical robotics is predicted to grow significantly in the coming years and it is just one area of advanced manufacturing that will provide opportunities for New Zealand firms willing to invest in R&D.

It has been widely recognised that if, as a nation, we are to enjoy the living standards to which we aspire, the New Zealand economy needs to grow faster than it has in the past few decades. Companies like i-ORA exemplify the approach required if our advanced manufacturing sector is to play its part.

Advanced manufacturing is the sector of the economy with the most potential for growth. A significant proportion of the world's most successful economies have well-developed advanced manufacturing sectors and if New Zealand wants to achieve the sustained economic growth enjoyed by nations like South Korea, Taiwan and the Nordic countries, we need to take a strategic, long-term approach to its development.

The question is, how best to do this for New Zealand? It should be stressed that one size does not fit all, but there are several policy framework themes that are common to most of the aforementioned countries. They all have a strong emphasis on science and engineering in their respective education systems, national visions for science, engineering and innovation and governments that work closely with industry to achieve national goals—one of the most important being the international competitiveness of firms. Government-funded R&D organisations work closely together, with a clear understanding of their respective roles.

I have previously called for increased public and private sector investment in R&D. While this is important in the long term, it is clear that current fiscal constraints will limit the country's ability to do this in the short and medium terms. This means it is important that we focus our efforts sharply on areas where New Zealand firms can find niches in global markets that will enable them to earn sustained and significant export revenues in the coming decades.

International market intelligence firm Frost & Sullivan recently released a list of the top 50 technologies it predicts will be ubiquitous in 2020. These reflect recognised trends such as the move towards smart technologies that self-monitor performance to enable a better usage of resources and greater operational efficiency.

It is encouraging to note that many of the areas of R&D focus currently undertaken at IRL are included in this list. Digital, micro and nano-manufacturing, and the development of smart sensors, lightweight composites and wireless power transmission are just some of the areas in which IRL is actively engaged, and that are predicted to lead technology development globally.

Another theme observed by market watchers is the increasing globalisation of technology development and the need to take a global, rather than regional, perspective. To ensure products and services are ready for the international market, it is vital that international partnerships are developed. A good example of this, detailing IRL's collaboration with the Titanium Industry Development Association of New Zealand and Germany's Fraunhofer Institute for Manufacturing Technology and Advanced Materials, can be found on page 4.

Another example can be found in the story "Sound research shows its worth" on page 5 in which the research by IRL's Dr Mark Poletti into assisted reverberation, which resulted in a lucrative licensing agreement with US-based Meyer Sound, has led to further work in the emerging field of high-fidelity 3D sound.

While it is clear that New Zealand's advanced manufacturing sector has the potential to contribute significantly to growing this country's economy, it is also clear that the Government, the private sector and R&D providers need a common vision of how we can make this a reality. IRL is ready to play its part.

Shaun Coffey
Chief Executive
Industrial Research Ltd

The global market for medical robotics is predicted to grow significantly in the coming years and it is just one area of advanced manufacturing that will provide opportunities for New Zealand firms willing to invest in R&D.

COMMERCIAL REVENUE ON THE RISE

Growth in commercial revenue has put IRL in a positive position and given it a solid platform from which to serve the future needs of industry.

For the financial year ending 30 June 2011 total revenue was $63 million, with operating profit at $143,000, while net profit before tax (NPBT) was $773,000.

Chief Executive Shaun Coffey says the financial result augurs well for IRL and the advanced manufacturing and associated sectors it serves.

"In the past year, IRL's Industry Engagement team, in association with various science teams, has made a concerted effort to demonstrate the benefits of investing in R&D to firms across the country.

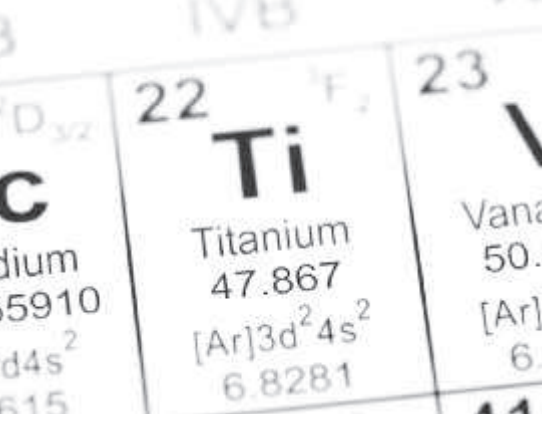
"This growth in commercial revenue shows that industry has confidence in IRL to deliver R&D solutions that will enable improved productivity and profitability," he says.

GlycoSyn, IRL's active pharmaceutical ingredient manufacturing business unit, was a particularly good performer, achieving strong sales growth.

IRL management has set increased commercial revenue targets for the current financial year.

"I am confident that, given our performance in the past few years and growing recognition of the role IRL can play in assisting the advanced manufacturing sector to realise its potential, these targets will be met," Coffey says.

Above: Professor Bernd Kieback. The demand for titanium is growing in global markets.



Proving their metal

IRL's materials experts are helping to forge a new industry for New Zealand based on the wonder metal, titanium.

IRL has a distinguished history in the development and application of next-generation materials for New Zealand industries. Among the products to come out of its advanced materials research are high-strength, corrosion-resistant advanced ceramics for the aluminium foundry industry, energy-efficient cement products for geothermal wells, and nanostructured membrane materials to separate and capture high-value hydrogen gas at high temperature.

Now, IRL's materials researchers are exploring titanium, applying the knowledge they have gained in other materials to understand how it behaves and how it can be manipulated to produce materials that are useful for the manufacturing industry.

The research will support the fledgling titanium manufacturing industry in New Zealand, which includes Titanox Developments Ltd, a Tauranga company that developed a cost-effective way of producing titanium alloy powders in 2006.

Subsequently in 2010 a new organisation, the Titanium Industry Development Association (TiDA), was set up to promote industrial uses of the materials in new products, including research into applications for these alloy powders.

In June TiDA hosted Germany-based titanium powder metallurgy expert Professor Bernd Kieback, Director of the Fraunhofer Institute of Manufacturing Technology and Advanced Materials, and Director of the Institute of Materials Science, Technical University of Dresden.

He visited IRL and several other New Zealand research and education institutes and signed a Memorandum of Understanding between the Fraunhofer Institute and TiDA with a view to project collaboration, strengthening ties between New Zealand's emerging titanium sector and the institute, jointly developing new and more efficient titanium production techniques for the growing global market and establishing a programme of student exchanges.

Titanium has many advantages as an industrial material. It has the greatest strength-to-weight ratio of any metal, meaning that products made with it weigh little but are very strong. Another advantage is that it is exceptionally durable and resistant to corrosion.

Unlike some other high-performance metals, titanium ore is widely available. In its most common form—rutile or TiO2—it is routinely mined and traded as a common commodity material for the international paint pigment industry. Globally, the demand for titanium is growing rapidly, with aerospace, marine and industrial applications using significant quantities.

Dr Ian Brown, who manages IRL's Materials and Energy team, says the project is using IRL's considerable experience in a variety of novel materials for the eventual benefit of the rapidly developing titanium industry in New Zealand.

"We are transferring our knowledge of processing advanced ceramics to titanium. We want to understand how titanium behaves and how it reacts when combined with other materials.

"The ultimate aim is to produce new metal structures that make the most of titanium's special qualities and have the potential to develop new, high-value-added products in areas such as the biomedical and advanced engineering sectors."

Dr Mark Poletti's research into assisted reverberation has been a commercial success.

SOUND RESEARCH SHOWS ITS WORTH

A world-class acoustics system based on IRL research has reached a million-dollar milestone.

Royalties from technology arising from research undertaken by IRL acoustics researcher Dr Mark Poletti have passed the $1 million mark.

Building on his research into an assisted reverberation system, the technology was licensed to a small US company, Level Control Systems, that was later acquired by Meyer Sound.

The system, marketed as the Meyer Sound Constellation acoustic system, ensures perfect acoustics independent of venue design, so is sought after for performance spaces that need to accommodate a variety of uses.

As a result, Constellation is used in venues in the Americas, the Middle East, Asia and Europe, and also in Cirque du Soleil productions. It has received rave reviews from artists and audio experts alike.

Using Constellation microphones and loudspeakers, combined with the Variable Room Acoustics System (VRAS) technology developed by Dr Poletti, Constellation extends the acoustics of a space to allow optimal acoustical performance.

Dr Poletti was recently involved in upgrading Constellation's software to incorporate design improvements.

Constellation won the Sound System Technology category at the 2011 Musikmesse International Press Awards—referred to as the Grammys of the musical instrument and professional audio sector.

"We are very happy that we've reached the million-dollar royalties milestone, which is significant in terms of the sales it would have taken to reach that point," Dr Poletti says.

"Since Meyer took over VRAS, the system's profile has also grown significantly, so we are now looking forward to a similarly significant increase in sales as a result."

Below: Meyer Sound's Constellation system ensures concert-goers around the world can enjoy perfect acoustics.

IRL IP manager Neville Queree says the milestone is a major achievement for IRL as well as Meyer, which has grown sales of Constellation despite the US recession.

Meyer Sound recently broadened its market for Constellation from multi-purpose auditoria, schools and houses of worship to high-end recording studios, such as the Tamalpais Research Institute studios owned by Grateful Dead's Bob Weir.

Other developments to emerge from Dr Poletti's acoustics research include a recently completed demonstration prototype of a loudspeaker-based binaural sound system, which reproduces high-fidelity 3D sound using as few as two speakers.

The technology, which recently featured on Radio New Zealand, uses innovative audio digital signal processing to stop sound from the wrong speaker reaching the wrong ear.

IRL Solutions was a finalist in the Magazine Publishers' Association Annual Awards in 2011 for Best Cover Design in the Custom and Membership Publishing category.

The recognition was for the cover of the Summer 2011 edition, highlighting IRL's research for Resene Paints on a sustainable paint.

The cover photograph was crafted by IRL engineer and photographer Alan Wright.

Left to right: Steve Robinson, Director AquaMax Devco; Janina Bruggemann, final-year engineering student, University of Applied Sciences, South Westfalia, Germany; Monica Palmer, Project Manager, AquaMax Devco; Paul Mather, Director Technology Development and Transfer, Centre for Smart Product, WelTec Connect.

SMART MOVE

The co-location of WelTec's high-tech product and skills development hub at IRL employs international best practice to bolster New Zealand industry.

WelTec has relocated its Centre for Smart Product to IRL's Lower Hutt site, in a move set to benefit the high-value manufacturing sector and the development of the high-tech skills underpinning it.

"The relocation brings WelTec's product development centre alongside IRL's engineering workshops to create an applied engineering powerhouse that will develop new products for industry, and build the skilled workforce to use them," says Paul Mather, Director Technology Development and Transfer, Centre for Smart Product, WelTec Connect.

The move builds on WelTec's already strong relationship with IRL and companies such as HTS-110, Mesynthes and Im-Able, with which it has helped to develop new export products. That link goes in both directions, with IRL and staff from some of these companies also delivering lectures to WelTec engineering students.

Engineering contractor Andrew Rodger, AquaMax Devco (a WelTec-supported start-up technology company specialising in ultra-high-pressure, low-volume waterjetting), and international and local engineering students working on projects with industry comprise the initial group co-locating with IRL.

Mather says the presence on site of a ready pool of young, bright, enthusiastic students can only enhance innovation.

"The centre offers an integrated service that helps high-tech manufacturers to develop new products and build their staff," he says.

In addition, with both IRL and WelTec being accredited research providers in the Government's Technology Transfer Voucher scheme, the co-location will offer a "one-stop shop for manufacturing companies".

IRL General Manager Shared Services George McIrvine says the relationship is of great benefit to IRL, WelTec and New Zealand industry, and provides students with linkages to industry throughout the country.

"WelTec students support IRL but also get the opportunity to work with innovative, high-growth New Zealand companies in the high-value manufacturing sector."

This model of cooperation between educational and research providers and industry can be seen overseas at highly successful research organisations such as Taiwan's Industrial Technology Research Institute, with which IRL also has strong links, he says.

Pure genius

A specialist, portable, supercritical chromatography plant designed for onsite pilot-scale production is now available to help fast-track the production of highly pure ingredients in New Zealand's functional food, biopharmaceutical and cosmeceutical industries.

The new facility—the first of its kind in the Southern Hemisphere—has been designed by IRL scientists and engineers to meet the growing need for new high-value, high-purity natural products.

"The chromatograph is a concept born out of an industry pull—a client who required a facility to capture their high-value lipid product opportunity," says Industry Engagement senior account manager Tom Nicolle.

"Whilst IRL's portable supercritical unit, SuperEx, enables companies to produce sample runs of products, a crucial part of the high-value manufacturing process, this new facility further refines the crude extract and separates it into individual and highly concentrated components."

The unit operates in a manner similar to the industry standard—preparative HPLC—except that instead of an organic solvent it uses a supercritical fluid. The technology is more environmentally benign as the supercritical fluid is recyclable, whereas in preparative HPLC the organic solvent normally goes to waste.

Like SuperEx, a pilot plant developed by IRL that uses carbon dioxide and other gases at high pressure to extract valuable compounds from natural materials, the pilot-scale chromatography unit is available for companies to hire and use within an environment that is already registered as compliant with the relevant food processing, pharmaceutical and cosmetics regulations.

HIGH-VALUE HELP

The first participant in IRL's Scientist for a Day programme says the experience was valuable and he'll be back for more.

From left: Dr Ralf Schwörer (IRL), Lucie and Paul Gray (Aqua Sinka), Carl Bigley and Dr Neil Milestone (IRL).

IRL's first successful participant in the Scientist for a Day (SFAD) programme, Paul Gray, spent a day at IRL with the Cement Science team of Dr Neil Milestone, Carl Bigley and Bill Owers, who are developing methods for manufacturing a novel, high-density cementing system.

Gray has been involved in recreational fishing for most of his life and spent more than a decade creating and running a commercial catch-and-release fishery in the UK.

Back in New Zealand, he founded his company Tapu Bay Ltd (now Aqua Sinka Ltd) in 2007 with the aim of creating an environmentally friendly alternative to lead fishing line sinkers, which are constantly adding to pollution concerns in our oceans.

Gray patented an alternative fishing line sinker made from a mix of ironsand, cement and selected non-toxic chemicals and required help with the next step into the production stage.

He was delighted to have the opportunity to be at IRL for the day and said that the team not only had a wealth of knowledge to impart, but were also excellent hosts.

"I'm sure my time spent at IRL will help me a lot in developing my new product. It has raised some more questions I need to work on, but should result in a well researched product.

"After my day at IRL I would be very likely to ask for your help again in the future—the benefits far outweigh the costs."

Gray intends to carry out more testing and involve IRL in the analysis and assessment process.

IRL is currently collaborating with Auckland University of Technology (AUT) to help another SFAD participant, Computer Recycling Ltd, on a project to investigate ways to improve on the handling and sorting of e-waste: recyclable products ranging from computer terminals to keyboards and printers.

IRL's General Manager Industry Engagement Gavin Mitchell says that the collaboration with AUT is an exciting opportunity and an excellent example of how two research organisations can work together for the benefit of industry.

Vouching for R&D

IRL's regional seminars help businesses access funding to support technology development.

Thanks to IRL's ongoing regional seminars, more and more small and medium-sized enterprises (SMEs) around the country have been finding out how they can leverage support for innovation and R&D to increase the export potential and international competitiveness of their companies.

One of the aims of the workshops, which have been held in Timaru, Tauranga, Dunedin and Gisborne to date, is to help businesses access funding to support technology development.

"Many competent but smaller New Zealand firms have little experience with research and minimal information about where to start when it comes to what funding is available," says IRL's General Manager Industry Engagement Gavin Mitchell.

"What we have found during our workshops so far is that once SMEs become more aware of available funding, they are encouraged to find out more about how R&D support and capability can add value to their products."

The lowering of the Technology Transfer Voucher threshold for companies, from $100k to $30k, further supports a long-term approach when it comes to encouraging the uptake of R&D, says Mitchell.

"We are in this for the long haul. We would like to reach SMEs throughout the country through our seminars and significantly boost not only understanding of the benefits of R&D to New Zealand industry, but also knowledge of the specific support services and funding that have been made available to them."

ABOVE: i-ORA creative director Murray Grossmith and IRL human movement scientist Dr Kimberlee Jordan.

Social science

With the help of IRL's world-leading assistive technology research, a Christchurch software company is developing an innovative robot platform designed to assist children with autistic spectrum disorder.

At the start of 2011, Christchurch software company i-ORA set itself a challenge: to explore the therapeutic potential of using technology to help children with autism spectrum disorder (ASD).

i-ORA develops software and interfaces for medical, health and safety and educational applications for both national and international clients and scientific collaborations.

"Our initial aim was to develop a platform, similar to iTunes, where parents and educators could review and download applications that not only were fun to engage with, but also had proven beneficial effects," Murray Grossmith, creative director of the project, says.

"This platform is now an interface for caregivers to track children's progress and provides us with invaluable data about how effectively the software is working."

However, as the project developed, i-ORA discovered a potentially innovative route to engaging children with ASD.

Autism is a developmental disability, impairing brain function and impacting on development in the areas of social interaction and communication skills. Both children and adults experience difficulties in verbal and non-verbal communication, social interactions and play activities.

"When someone first mentioned robots I thought they were joking," says Grossmith.

"But preliminary research indicates that using an anthromorphic interface may be the key to bridging the gaps in human relationships."

The robot in question is called iZac, and can often be seen around the i-ORA offices in Christchurch.

iZac is no toy—he's a fully functioning robot with facial and voice recognition software (so he knows who you are), camera (so he can see you), infra-red and ultrasonic detectors (augmenting himself to the room), and he even tells you when he's feeling tired and goes and plugs himself into his base station.

"The really clever stuff is combining this hardware with the software we're developing," says i-ORA Chief Executive Jeremy Cadillac.

"Then, unlike a PC or iPad, you have a device that will actually come up to you and ask you how you're feeling today. This type of predictable social engagement is a key factor in our research into ASD."

Recently i-ORA presented iZac at Autism One, one of the major annual conferences for autism in the United States. There, they engaged with more than 5000 people over four days, many of them parents dealing with ASD.

"It's vital that we provide people with applications and resources that they need, but we also need to get the science right," Grossmith says.

To achieve this, i-ORA partnered with IRI's Marcus King, New Zealand's premier inventor of assistive technology and winner of the Cooper Medal for his leading work in rehabilitation science.

"New technology gives us huge potential for doing things that we couldn't think of before, especially for people with disabilities," King says.

"Kids love playing with cute robots, and using this to help them engage with friends and become part of society is an exciting area of science."

Applications created by King as part of this work teach basic social skills such as awareness of others' emotions.

"Our applications encourage group interaction with the robot and taking turns in order to continue to play and develop human interactional skills."

i-ORA plans to have a fully functional product to market within the next 12 months.

ABOVE: iZac—potential to help children with autism learn social skills.

"Preliminary research indicates that using an anthromorphic interface may be the key to bridging the gaps in human relationships."

Tranquillity bass

IRL research into composite materials is helping the building industry to find an affordable way of insulating inner-city dwellings against noise pollution.

ABOVE: Dr Emilio Calius is collaborating with BRANZ and Fletcher Building to develop novel noise insulation solutions.

The trend towards inner-city living in New Zealand cities has brought life to our urban areas, but those who reside in the central city can be in conflict with those who enjoy the nightlife. Apartment dwellers complain about the noise, and the people who run the cafes, restaurants, bars and nightclubs resent having their businesses curtailed.

IRL, in collaboration with the building research organisation BRANZ and Fletcher Building, is applying novel technology that could help reduce the problem.

Wayne Sharman, strategic business development manager for BRANZ, says it is an issue that will only increase in importance.

"Urban intensification, where more people opt for apartment-style living, is inevitable in New Zealand. Conventional low-frequency sound insulation is heavy, bulky and expensive, so BRANZ is looking for a breakthrough solution to this problem."

IRL's Dr Emilio Calius, science leader for the project, says the issue is with frequencies below 1kHz. "Anyone who's had to put up with a party going on next door probably knows how annoying this can be. It's the thump, thump produced by the bass beat from certain music systems and it is an irritatingly penetrating noise," he says.

"It is also the sound spectrum that is most difficult and expensive to exclude with conventional construction."

Currently, good low-frequency sound isolation means very thick walls and ceilings. While structurally strong, it eats into living space in apartment-style dwellings and is too costly for single-unit detached and semi-detached housing. So the IRL researchers are working to produce isolation systems that are thin and affordable.

This research is based on new discoveries about the physics of wave propagation in meta-materials—complex composite materials that can be engineered to have special characteristics such as cloaking acoustic or electromagnetic waves.

Dr Calius says the aim is to use this knowledge to develop high-performance construction materials that are lightweight and thin, yet can prevent the low-frequency noise getting through.

"We can do this by creating acoustic band gaps using internal structures that resonate at a certain frequency and work to block wave propagation from the unwanted noise source," he says.

Dr KL Chan, who is managing the programme for IRL, says there could be other applications for the technology.

"While we are concentrating at the moment on low-frequency noise insulation in buildings, we can see other applications in this approach to noise reduction in household appliances, aircraft and boats."

IRL's Dr Kit Wong (left) and Patrick Lim are developing a mobile robotic platform to help the horticulture industry increase on-farm productivity.

Farming the future

An IRL-developed robot brings intelligent machines that boost horticultural efficiency a step closer to reality.

IRL has developed a mobile robotic platform as the basis for intelligent machines aimed at increasing on-farm efficiency and reducing wastage in the horticulture industry.

IRL robotics research team leader Patrick Lim says the platform has been designed specifically to move around the outdoor farm environment on its own, not just negotiating the uneven ground surface but also sensing the position of the crop.

"To allow it to navigate without human intervention, we have equipped it with machine intelligence that allows it to map its environment and discriminate between different plant types.

"It uses an array of sensors to get a picture of the territory it is working in so that it can move around safely and not damage or destroy the growing plants.

"This intelligence is vital if the robot is to be useful in tasks such as weed eradication and harvesting of crops," he says.

The team has been trialling the robot platform around IRL Auckland and out in the field. The preliminary results have been very encouraging, with the platform achieving its intended design objectives.

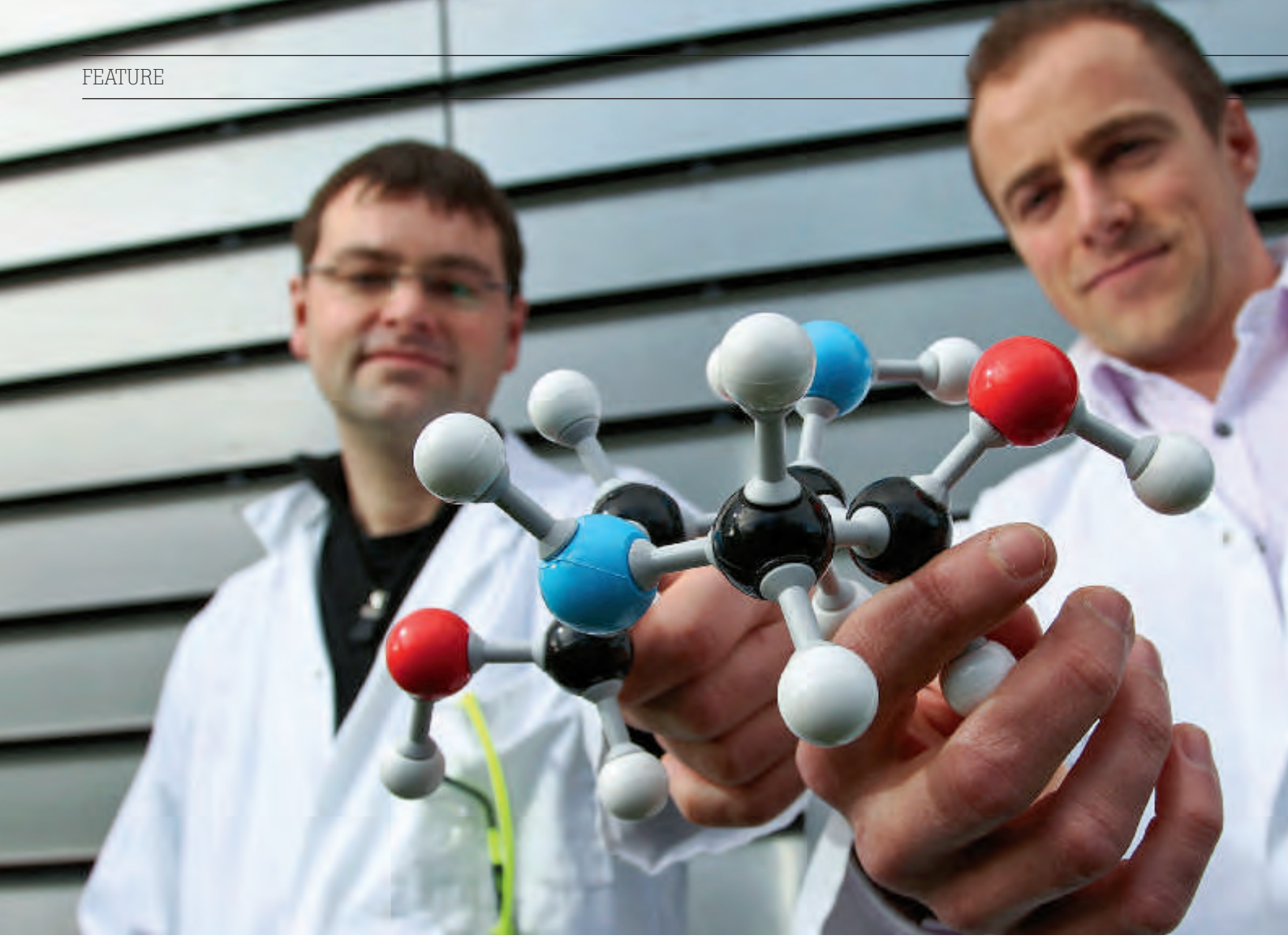
The next stage in this project will be to produce a multi-purpose manipulator—a tool that will be mounted on the robotic platform to perform the wide variety of jobs involved in horticulture.

Lim says this will mean increasing the intelligence of the robot and expanding its range of sensors.

"If this approach is to be successful in mechanising and automating all the stages of horticulture, the robot needs to be able to make its own decisions on issues such as the best route to take in the field, the quality of the crop and which plants are ready for harvesting—important if it is to be able to harvest a crop selectively—and how best to pick the crop so that there is no damage or wastage."

The platform's development was achieved thanks to the Ministry of Science and Innovation's Capability Fund, and with strong support from industry, in particular Auckland produce company Fresh Direct, which has guided the research direction and provided technical expertise.

The platform has been designed specifically to move around the outdoor farm environment on its own, not just negotiating the uneven ground surface but also sensing the position of the crop.



A SHARPER REACTION

GlycoSyn offers an improvement on an essential drug development process.

"We plan to offer aminohydroxylation as a service to our pharmaceutical industry clients, and make the new reagents available for purchase on a kilogram scale as well."

ABOVE: Drs Andreas Luxenburger (left) and Lawrence Harris have developed a novel process for aminohydroxylation that will be valuable for the pharmaceutical industry.

In 1975, Nobel Prize winner Professor K Barry Sharpless developed an osmium-catalysed reaction that in one step converts cheap hydrocarbons called alkenes into vicinal amino alcohols, important products in organic chemical synthesis. Later, he found a way to make the reaction "asymmetric", meaning its products were chiral (i.e. left- or right-handed) and hence of great interest for the synthesis of new pharmaceuticals.

Unfortunately, despite being widely used in research and with a number of improvements reported, this reaction—known as aminohydroxylation—still has some serious limitations: irreproducibility, the requirement for use of an unstable oxidising reagent and added base, and the formation of undesired by-products. This has limited the general applicability of the methodology by the pharmaceutical manufacturing industry.

GlycoSyn, IRL's pharmaceutical development and scale-up arm, offers for sale several high-value, biologically active research materials that include the vicinal amino alcohol functionality, especially allosamidin, an enzyme inhibitor that may have implications for the treatment of asthma. GlycoSyn's synthesis of allosamidin utilised the best known Sharpless aminohydroxylation technology, but variable yields, approaching zero when the reaction was attempted at increased scale, were a major problem.

The breakthrough came when Drs Simon Mee, Andreas Luxenburger and Lawrence Harris from IRL designed novel reagents that turned the Sharpless aminohydroxylation reaction into a reliable process that could be operated at scale without loss of yield or the need to add an additional substance as a base.

They were just as good in the asymmetric version of the reaction, where there was no loss of regio- and stereo-selectivity, says Dr Richard Furneaux, head of IRL's world-renowned Carbohydrate Chemistry group.

"A further advantage is that the reaction conditions are compatible with base-sensitive functional groups, so that there is greater flexibility

in the choice of protecting groups used during synthesis."

These alkyl benzoyloxycarbamate reagents are crystalline, stable and easy to prepare on a kilogram scale.

"GlycoSyn is excited at the potential of this new discovery," GlycoSyn General Manager Dr Paul Benjes says.

"We plan to offer aminohydroxylation as a service to our pharmaceutical industry clients, and make the new reagents available for purchase on a kilogram scale as well.

"A provisional patent application has been filed, and we are willing to consider licensing arrangements that might assist greater uptake of the technology worldwide."

To find out more about the technology, purchasing the reagents, hiring the service or licensing the technology, contact GlycoSyn account manager Dr Tony Davidson.

IRL staff profile

DR LAWRENCE HARRIS

Chemistry is both a hobby and a job for Dr Lawrence Harris, a Welshman who loves the challenge of making compounds no-one has made before.

Lawrence is proud to be Welsh, although he shyly admits to having been born in England. His family is from the valleys in South Wales and he became fluent at a Welsh-speaking school. "My parents don't speak the language, but my grandparents do—it's quite common to have skipped a generation," he says.

"My doctorate (DPhil) was from Oxford University. I was undecided whether to follow it with an academic post-doc or move into industry, but I had also had a dream to live in New Zealand after visiting in 2005. I found out about the job at IRL through a friend who was already working here, so I applied, was lucky enough to get it, and started in June 2009.

"Chemistry is really a hobby as well as a job for me. I like the challenge of making a compound that has never been made before and thinking mechanistically about all the details of a reaction scheme and rationalising everything. I really enjoy what I do.

"The team at IRL is a leading carbohydrate research group on the world stage and has an excellent reputation. This is my first job out of university, and I'm still learning a lot, so it's great to learn from experts in various areas of organic chemistry."

Lawrence's recent projects have included the development of a new methodology for an amino hydroxylation reaction that was a problematic step in the synthesis of allosamidin, a complex molecule made up of three sugars (see story at left). This work was recently published as a feature article in the Journal of Organic Chemistry (see reference below) and is the basis of two provisional patent applications.

He is also working on the synthesis of an ORPTase (orotate phosphoribosyltransferase) enzyme inhibitor target that is part of the group's ongoing collaboration with the Albert Einstein College of Medicine in New York. "It's been a big collaborative effort to get this far, and several others have spent time on it. The synthesis is 22 steps long, but I've focussed on the last 12.

"I like working here—it's a relaxed atmosphere, everyone is keen to help, and the labs have everything you need. There is a very good social network here too, which has been really important to me, coming from overseas. I love living in New Zealand—the lifestyle is brilliant and there are so many beautiful places, all in one country.

"I enjoy the skiing and hiking here. I like rugby too, but there have been a few inevitable clashes over the All Blacks. I watched Wales play them in June 2010, but unfortunately we lost. It would have been the first win in 57 years, so I guess we're still waiting for that day."

Reference: L. Harris, S.P.H. Mee, R.H. Furneaux, G.J. Gainsford and A. Luxenburger, Alkyl 4-Chlorobenzoyloxycarbamates as Highly Effective Nitrogen Source Reagents for the Base-Free, Intermolecular Aminohydroxylation Reaction, J. Org. Chem., 76 (2011) 358-372.

Spark Dental's smart mirror pointer enables better hygiene and interfaces with electronic patient record management systems.

High-tech hygiene

IRL and Spark Dental have developed a tool that is both a mirror and a computer input device.

"The dentist doesn't need to take the mirror out of the patient's mouth. If they see a problem or potential problem they can note it on the patient's dental chart immediately."

IRL research engineer Paul Harris has a long-standing research partnership with Spark Dental Technology—a company specialising in software and new technology for the dental profession. IRL, with its strong engineering skills, is able to refine Spark's first prototype hardware to work with software developed by Spark. Together Spark and IRL are able to provide new tools for dentists to give better service to their patients.

It was while working on dentistry tools with Spark that the topic of a new product overcoming hygiene issues arose.

"During examinations, the dentists use instruments that have undergone sterilisation and they wear gloves," Spark Managing Director Paul Weatherly says. "Increasingly, patient records and X-rays are computerised, but to access the data the dentist needs to use the computer mouse or keyboard—and that immediately raises hygiene problems."

Working together, Spark and IRL have developed a dental mirror that the dentist uses during examinations and, with some clever electronics, also acts as a computer input device. Dental records and charting software are controlled by gesturing.

"The dentist doesn't need to take the mirror out of the patient's mouth. If they see a problem or potential problem they can note it on the patient's dental chart immediately. They can review previous treatment records for a specific tooth or pull up previous X-rays or intra-oral images on screen," Weatherly says.

The mirror pointer, as it is known, is also capable of communicating bi-directionally so it could, for example, be used to alert the dentist to a patient arriving in reception.

The mirror pointer has other advantages. It is plastic rather than steel so is very light, with a good balance and feel. The mirror is made as part of a cover, which can be thrown away if it becomes scratched or damaged. Full sterility management is attainable via the mirror and its cover while the electronics are protected and do not need to be sterilised.

The tool is currently being trialled by some dentists and demonstrated to others. Spark is also approaching global supply companies since it believes this is a tool that will have global appeal.

Harris says it is a good example of how having close links with businesses can make all the difference when introducing new high-tech products that provide new economic opportunities for New Zealand companies and the economy as a whole. "Spark and IRL, working together, have rapidly developed a product that meets a real need."

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Sound research shows its worth

Dr Mark Poletti's research into 3D, high-fidelity sound builds on the commercial success of his work in assisted reverberation systems. By using a mannequin with microphones placed inside the head, he can accurately record 3D sound that can be reproduced using loudspeaker arrays (see story page 5).