The MacDiarmid Institute
Annual Report

2016

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Introduction

Out of the lab

Into the marketplace

Into the community

Into the metrics

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Director's report

Professor Thomas Nann
Director

When the MacDiarmid Institute was first conceived, it was with a vision of science excellence; a vision that would bring together the best researchers in materials science in order to create research of a standard and excellence beyond what could be achieved by these researchers alone.

I don't know whether even Sir Paul Callaghan foresaw that the MacDiarmid Institute would one day out-compete most of New Zealand's universities and other research organisations, as it has in the 'Nature Index 2016', by taking the fourth place in New Zealand's Top 10 research institutions. But I know he'd be delighted. Research excellence is part of our mandate and 'punching above our weight' is something the MacDiarmid Institute has done for many years.

In 2016 we grew our international dimension with new MOUs and other collaborations. The fact that we are a sought-after international partner is high endorsement of our science.

Materials science naturally leads itself to high-tech spin-outs and so we map the journey from the lab to the marketplace—'Bridging the Gap'. We show how MacDiarmid affiliated start-ups are making their way from the lab into the real world of intellectual property, tech incubators, and the world of investors and how the MacDiarmid Institute is supporting them along this journey.

It's no easy task keeping students interested in the physical sciences, yet a prosperous New Zealand needs students keen to continue in these subjects through to university. As you'll see we've expanded our public engagement into new and exciting areas, another aspect of our work of which Sir Paul Callaghan would, I know, be extremely proud.

0.2
Chair's report

Dr Ray Thomson
Chair

2016 has seen the new leadership team settle into their roles. I have been pleased to see the way the wider MacDiarmid Institute has supported them in this. The New Zealand materials science community is small, but the Institute delivers scale, making our researchers internationally competitive. I am encouraged by the efforts of our Director, Thomas Nann, to encourage and foster research areas which draw on the strengths of our investigators. And I am pleased to see so many of our investigators receiving scientific awards at the highest level, in particular Marsdens and the Endeavour Round, PreSeed Accelerator Fund and many more (see 'Funding successes' on page 85).

Outside my pure Chair governance role my main interest and focus has been on the commercialisation and industry engagement area, supporting Deputy Director Justin Hodgkiss. We continue to make good progress with several new ventures entering the tech incubator programme and with many others in the pipeline. Further down the track, Cather Simpson's Engender Technologies (using lasers to sort bovine sperm by sex) is on the verge of significant international success. The introduction of the Interface programme, which began late 2016 and will be launched in May 2017, will see our investigators directly tackle industry problems, and is an encouraging new initiative.

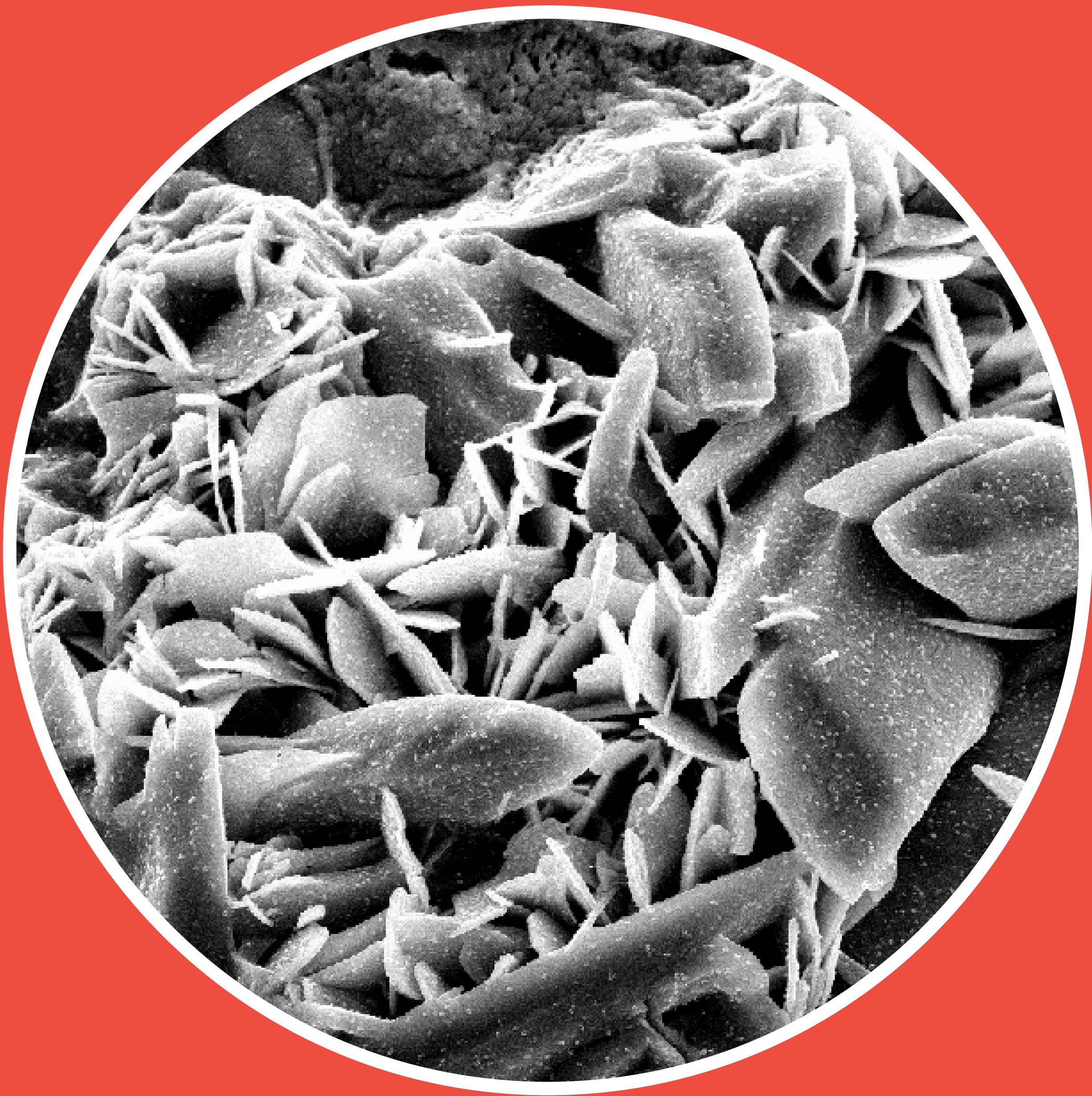
In the public engagement area our Deputy Director Nicola Gaston is overseeing the continuing strong work that MacDiarmid has been leading as we encourage younger students to get more interested in science, which is just so important in this rapidly changing technological age.

The MacDiarmid Institute for Advanced Materials and Nanotechnology is a national network of New Zealand's top materials scientists. Materials science underpins high-tech manufacturing. The Institute enables materials scientists to collaborate between disciplines and across institutions. By spinning out new companies and working closely with industry, the Institute drives a high-tech economy, creating new intellectual property, jobs and wealth.

The MacDiarmid Institute
for Advanced Materials and Nanotechnology

1. Out of the lab.

1. Out of the lab.



We have eight new Investigators—you'll meet them on the following pages. We also highlight researchers who are performing at levels impressive for some so young. And most importantly, we celebrate our Emeritus Investigators who have shaped and guided the Institute through excellent science and mentoring and by transferring skills and knowledge to new generations of MacDiarmid Investigators.

We celebrate this year—the people of the MacDiarmid Institute.

Anyone will tell you the heart of a workplace is its people. Here at the MacDiarmid, an 'institute' without walls, we are defined solely by our people—each a top researcher in the field of materials science and nanotechnology.

We cannot say that the MacDiarmid Institute exists as it did when it was set up by Sir Paul Callaghan in 2002. Nor would he want us to. As the people have changed over the years, so has the Institute.

What hasn't changed is the fundamental culture that Sir Paul dreamed of and brought to life 14 years ago. A culture of collaboration, of blue sky research, of working together to create so much more than a small research community could do on its own. A science culture which partners with and feeds ideas and new technology into industry so that all New Zealanders benefit from growth. In March an international panel of scientists endorsed the MacDiarmid Institute as belonging among the premier league of international materials institutions.

And in December, the Nature Index for Australia and New Zealand ranked the MacDiarmid Institute alongside all universities as number four of the top 10 research institutions in New Zealand (after the universities of Otago, Auckland and Victoria).

The following pages give you a sample of just some of the science stories that wouldn't have happened without the collaboration between researchers and students that the MacDiarmid Institute makes possible. Again—for 2016, this is the 'MacDiarmid difference.'

Materials to combat our changing climate.

1.1

Reinventing catalysts, one atom at a time

Our planet is struggling on many fronts. Populations are booming, freshwater supplies are polluted and deforestation is widespread. We're burning more fuel and using more energy than at any other point in history, and poor air quality is heralding a global health crisis. But, across the world, scientists are taking on these global challenges, and materials science lies at the heart of some of their most innovative solutions. In particular, a class of materials called catalysts have come to the fore in recent years; not because they're new, but because materials scientists are completely reinventing them, one atom at a time.

The role of a catalyst is to speed up a chemical reaction. It does this by providing an alternative, easier route for atoms to bind to one other in a controlled way. But catalysts themselves aren't changed by that reaction, and only a tiny quantity of catalyst is needed to kick-start each reaction. Because of this, catalysts are used in countless industrial applications, and are the basis of most of the manufactured products we rely on.

But as Einstein's famous quote tells us, we can't solve problems by using the same thinking we used when we created them. That's where MacDiarmid researchers come in. They're designing a whole host of low-cost, high-efficiency catalysts that could answer some of the biggest questions we're facing, and they may just signal the start of a more sustainable age.

Cleaning up

New Zealand's water quality was once the envy of the world, but the agricultural intensification of more recent decades threatens to change that. The overuse of fertilisers, and increased quantities of animal waste, have resulted in more nitrate entering our waterways than ever before. Nitrate pollution in drinking water can be hazardous to human health, and because it promotes algal growth, nitrate can also starve a lake or river of oxygen, leading to a loss of biodiversity and, ultimately, death of the ecosystem.

Current denitrification processes are slow and energy-intensive, but Associate Investigator Dr Anna Garden from the University of Otago is designing new nanocatalysts that could solve this problem. "Catalytic denitrification is a particularly promising method because, in principle, it could convert nitrate into harmless nitrogen, quickly and without generating dangerous by-products," she explained. Nanoparticles work well as catalysts because they have a high surface to volume ratio—they're comprised of so few atoms that most of them are on their surface. This makes them uniquely reactive, and much less material is needed to produce the same reaction. But, with a virtually infinite number of compositions available, it is a challenge for lab scientists to find the ideal catalytic nanoparticle for any given application.

Computer craft

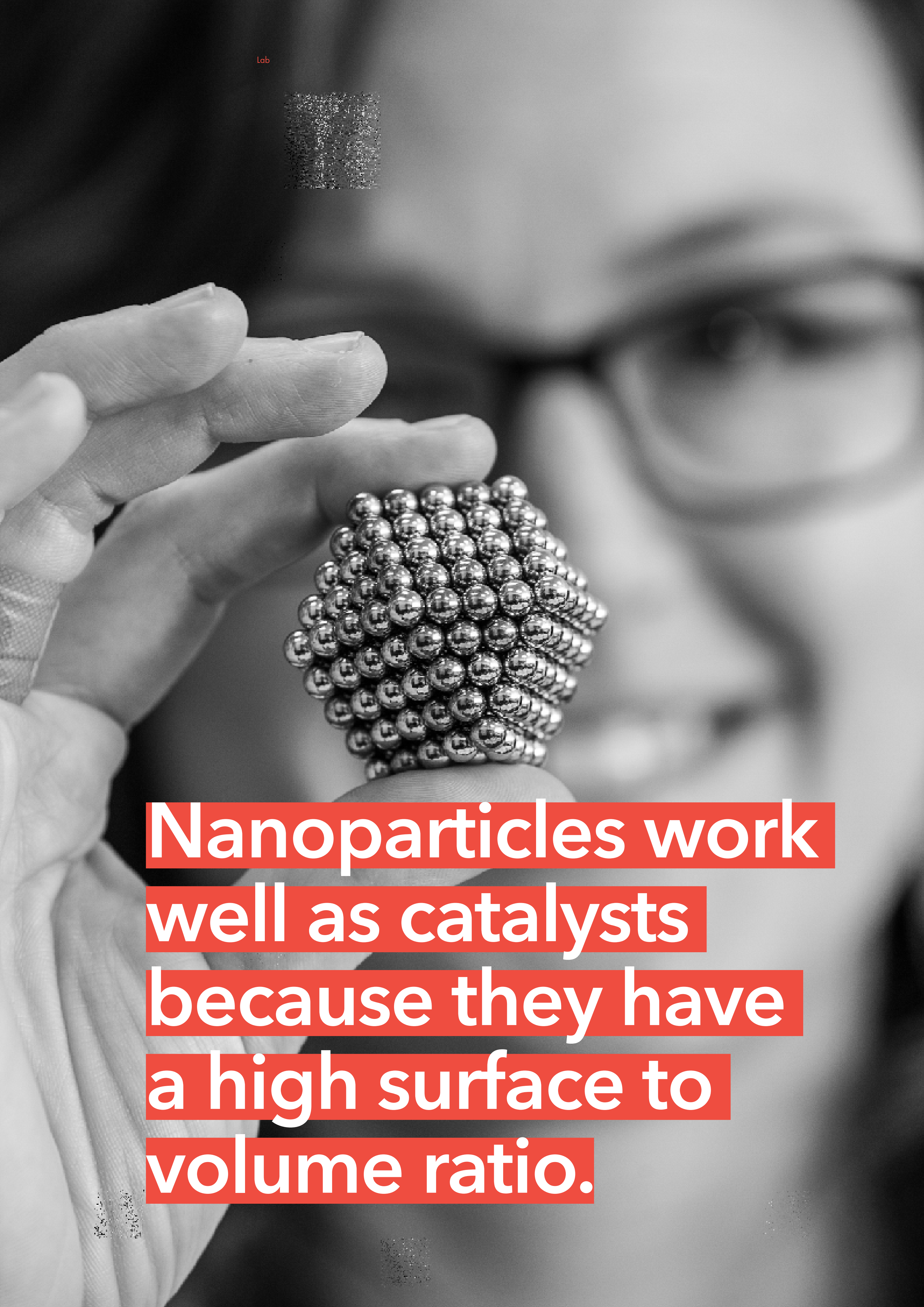
So Dr Garden uses advanced computational techniques to screen thousands of candidate materials, in order to identify those that display the highest catalytic activity. Collaborating with Professor Egill Skúlason from the University of Iceland, she is investigating the rate and products of this catalytic denitrification on the nanoscale, in order to design more efficient catalysts for cleaner water. In 2016 Dr Garden won a Marsden FastStart grant to work on nanotechnology to clean up waterways. Dr Garden's goal is clear, "Ultimately, we're trying to discover new catalysts that will help us move toward a more sustainable future."

Principal Investigator and Massey University Professor Shane Telfer is also interested in cleaning up the environment, but his work focuses on air pollution. Working with his colleagues at Massey University, Professor Telfer has developed three dimensional metal-organic frameworks (or MOFs) that can soak up carbon dioxide (CO_2) from the smoke stacks of coal-fired power plants.

Sustainable vehicles

Because MOFs act like molecular sponges, they can also be used to store gases. Vehicles powered by methane or hydrogen have been recognised as a more sustainable option than fossil fuels. And using MOFs like those being produced by Professor Telfer could reduce the pressures needed to safely store the gaseous fuels on-board, making these vehicles even more practical.

Dr Anna Garden



Nanoparticles work well as catalysts because they have a high surface to volume ratio.

Fueling the future

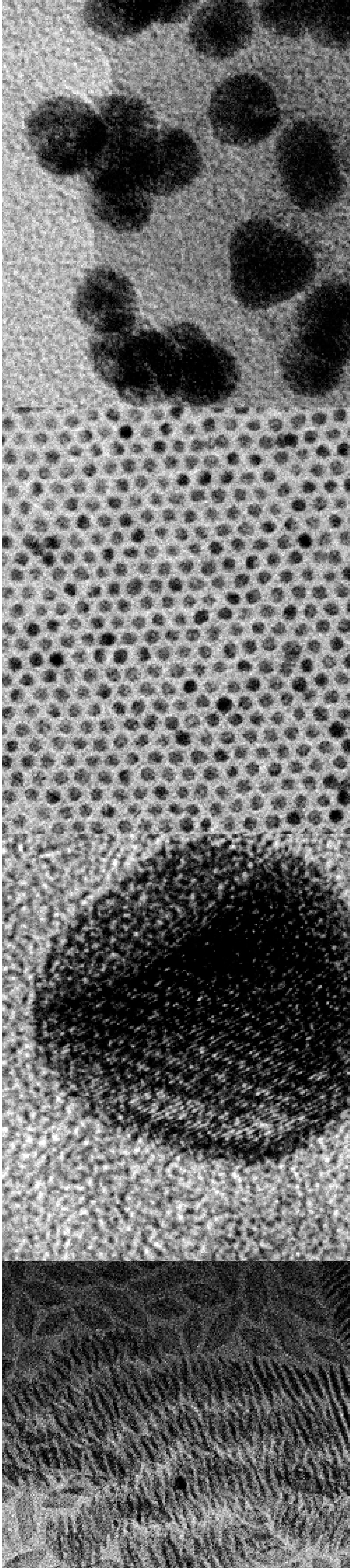
Sustainable fuel is the focus of other MacDiarmid Institute researchers too, including Principal Investigator Associate Professor Geoff Waterhouse (University of Auckland), Principal Investigator Professor Thomas Nann (Victoria University of Wellington), Associate Investigator Dr Vladimir Golovko (University of Canterbury), and Principal Investigator Professor Sally Brooker (University of Otago), and they've taken inspiration from the sun. Photocatalysts are compounds that use the sun's energy to accelerate a reaction. We've all heard of photosynthesis, where in the presence of sunlight the light sensitive molecules chlorophyll helps plants produce their own food. The most famous photocatalyst in industry is titanium dioxide, used in everything from sunscreens to self-cleaning glass.

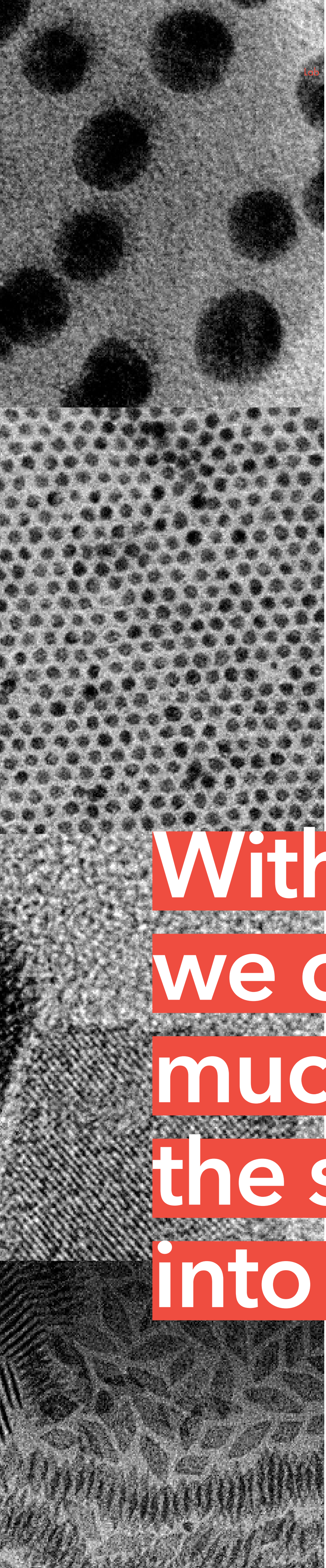
Photocatalysis is incredibly common in nature—light sensitive molecules allow us to see, changing their shape in the retina when light hits them, and provide our skin cells with a way to make Vitamin D, a vital ingredient in bone development. These reactions are incredibly efficient, as Dr Vladimir Golovko explains, "Nature had millions of years to perfect natural catalysts. They work with atomic precision to make very specific biological products. Unfortunately, human civilisation has only had decades to play with catalysts, so most of them are poorly defined. We want to change that."

So MacDiarmid scientists are developing a new breed of catalysts that will make it easier to produce cleaner fuels. "In order to replace fossil fuels, we need to offer a practical alternative for vehicles; one which makes the most of renewable energy sources," said Professor Nann. "With photocatalysts we can, in principle, convert 30% of the sun's energy into fuel."

Turning CO_2 into methane

With other teams focused on carbon dioxide (CO_2) capture, Professor Nann, Associate Professor Waterhouse and Dr Golovko are investigating how low-cost photocatalysts could be used to turn this greenhouse gas into methane. This would not only remove CO_2 from the atmosphere, but the resulting gas could be added directly into the natural gas grid, providing power to homes without needing to alter the infrastructure. Further down the line, these researchers also want to use photocatalysts to extract hydrogen gas from water.





Inspired by nature

This is a question that's also keeping University of Otago's Professor Sally Brooker busy. She is looking into photo- and electro-catalysts to develop a bioinspired approach to hydrogen production. Existing industrial catalysts used for this reaction tend to be based on rare metals like platinum, and are inefficient. But nature has a better solution—an enzyme called hydrogenase that relies on iron and/or nickel.

"Control of the metal centre is everywhere in naure—haemoglobin, the active iron-containing protein in red blood cells, for example. Without the precise environment that surrounds its iron core, you'd just get rust," explains Professor Brooker. "The same is true for catalysts—controlling the environment that the metal ions are in is absolutely critical to their performance, so that is our current focus." Their work on hydrogen production is in its infancy, but early results from their international collaborations are extremely promising, and look likely to have an impact on the hydrogen economy.

With photocatalysts we can convert much more of the sun's energy into fuel.

Professor Thomas Nann

Plastic fantastic

Amongst all of the materials that we rely on in our modern world, arguably none have become more ubiquitous than plastics. Used in everything from banknotes and lunchboxes, to car parts and sewage pipes, their highly-tuneable properties have made them the go-to option for a range of industries. But the bulk of today's plastics are made from petrochemicals, which makes them increasingly unsustainable. In addition, because many of them don't biodegrade, their disposal poses a major environmental hazard. So, alongside her hydrogen work, Professor Sally Brooker and her team are investigating a catalyst-based approach to producing compostable bioplastics. Their source material is corn, which contains large quantities of a compound called lactide. With the aid of a suitable catalyst, single molecules of lactide building blocks join to form a long chain, to produce polylactide, a biodegradable plastic that can be used in a host of products.

"We've had a lot of success so far—our international collaborators have shown that our catalyst is hyper-active, which means it is very good at turning lactide into polylactide," says Professor Brooker. "But we still have questions to answer." With competing catalysts already on the market, her aim is to improve their catalyst even further. She's also looking further ahead, towards biodegradable co-polymers, made from two or more compounds. "This will be a much bigger challenge, but if we get it right, industry will certainly stand up and take notice."

Power up

Another key challenge for tomorrow's changing energy landscape will be to match reliable energy generation with storage. Professor Maan Alkaisi from the University of Canterbury thinks that solar power will play a huge role in this. Photovoltaic panels installed on buildings across New Zealand may be the best option for converting sunlight into electricity, but they're not all that efficient. Professor Alkaisi has designed a nanopatterned surface that improves the efficiency of commercial solar panels, by making it less reflective, and better at absorbing light. Its low cost and scalability means that it could also lead to a new generation of transparent photovoltaics, integrated directly into buildings. And for energy storage, Professor Alkaisi and other MacDiarmid researchers, including Professor Thomas Nann and Dr Vladimir Golovko, are involved in designing a system that combines a battery with a photocatalyst. In 2016, this team of MacDiarmid researchers from the University of Canterbury and Victoria University of Wellington, won an MBIE Smart Ideas grant for this work. "This work is only just beginning, but by bringing together the skills of scientists from multiple disciplines, we feel optimistic and excited for its future."

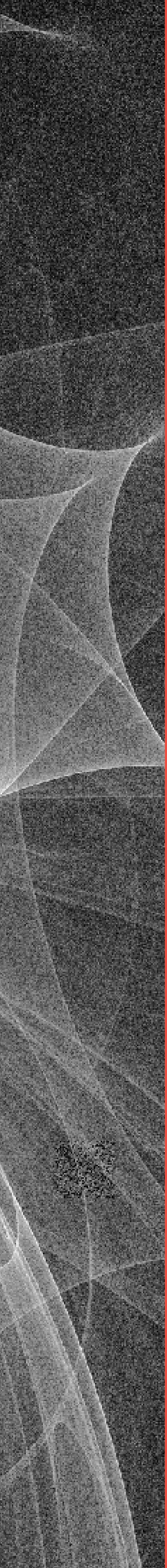
The state of our planet will require more than one answer to the question of energy security and climate remediation. But with solutions like these being spearheaded by MacDiarmid researchers, the future looks a little brighter.

If we get it right, industry will certainly stand up and take notice.

Professor Sally Brooker

Professor Thomas Nann, Professor Sally Brooker, Associate Professor Geoff Waterhouse, Dr Vladimir Golovko, Dr Anna Garden, Professor Shane Telfer and Professor Maan Alkaisi

A revolution in computing—driven by a new breed of materials



1.2
Tomorrow's computers

When the first powerful computers began to appear during World War II, they were viewed solely as military tools. No-one could have predicted that within 40 years, computers would become so compact that you could fit one onto a desk. Fast-forward to today, and around 90% of New Zealanders now own a smartphone; a computer that could outperform all of those early machines combined, despite weighing less than 200 grams.

We can thank the rapid development of low-cost microelectronics for our ability to shrink computers without compromising on their performance. But there could be a new revolution coming to computing, and it is MacDiarmid Institute researchers who are leading the charge.

Quantum leap

No matter how sophisticated they may be, most of today's computers rely on the same basic mechanism—electrical circuits, each containing millions of tiny switches called transistors that flick between on and off. Though seemingly simple, this binary system allows us to store and process complex data as strings of ones and zeros, or 'bits'.

And now quantum computers could extend our vocabulary even further.

Quantum computers rely on quantum bits (nicknamed 'qubits') that can have three possible states—on, off, or both simultaneously. This weird effect, called superposition, exists only at incredibly low temperatures—fractions of a degree above absolute zero—but it could increase our computing power exponentially. Making qubits is a huge challenge, though. Even in silicon, the most widely-used element in electronics, impurities can ruin a stable quantum bit. So MacDiarmid Principal Investigators Dr Andreas Markwitz (GNS Science) and Dr Grant Williams (Victoria University of Wellington) are working with MacDiarmid students, Prasanth Gupta and Konrad Suschke, along with a team from the University of Melbourne to develop a brand new way to produce silicon qubits.

This work involves building a world-first—a compact, pure Silicon-28 ion source, which can be used to implant quantum computing 'islands' into standard silicon wafers. This approach could provide a reliable, scalable way to produce qubits that are stable enough for use in a wide range of applications.

"For certain problems, such as molecular simulations and drug design, quantum computing might well be a total game-changer," said Dr Markwitz, who received a 2016 MBIE Smart Ideas grant for this work. "If this work is successful it would lead to new computer chips that would be much faster for certain kinds of problems, and would give New Zealand a significant share of the global electronics market."

Superconductors

Silicon qubits aren't the only contender for computing's 'next big thing'. In fact, another MacDiarmid Principal Investigator, Associate Professor Ben Ruck, from Victoria University of Wellington is looking instead towards superconducting logic. One of the challenges of conventional silicon circuits is that as they're pushed harder, they dissipate increasing amounts of energy, as heat. That's why computers employ fans—it helps to cool the circuits down. Scale that effect up to something the size of an internet server farm, and you're facing an ever-growing energy bill.

Dr Andreas Markwitz

This work if successful would give New Zealand a significant share of the global electronics market.

Associate Professor Ben Ruck, Dr Simon Granville, Dr Franck Natali, Professor Joe Trodahl

A new breed of materials

Associate Professor Ruck's research aims to replace the conventional silicon transistors with superconducting circuits. These have zero electrical resistance, so they don't dissipate heat at all, making them many times more efficient than today's computer chips. Superconducting circuits could also promise greater processing power, thanks to the design of their components. Although, like qubits, these circuits need low temperatures to operate, this is not quantum computing. It's more like conventional computing that's being done with a new breed of materials.

Associate Professor Ruck is collaborating with a number of the MacDiarmid researchers on this work, including Principal Investigators and Victoria University of Wellington researchers Dr Franck Natali, Emeritus Professor Joe Trodahl and Associate Investigator Dr Simon Granville. And he's quietly confident about the future: "Silicon chips are fast approaching their physical and economic limits, so there's reasonably little doubt that superconducting computing will become a reality," said Associate Professor Ruck. "It won't be in your desktop computer, but it will be invaluable to those sprawling data centres that we all rely on."

Electric dreams

Tomorrow's computers won't just get faster, though. They'll get smarter too. Unlike conventional computers, the human brain is a master of complex tasks like pattern recognition. It's this skill that allows us to learn from experience—we continuously recognise and characterise objects and actions, and can recall them when needed. Part of this ability comes from the way our brain is constructed—as a network of neurons connected by synapses. For MacDiarmid Principal Investigator Professor Simon Brown from the University of Canterbury, this provided inspiration for a new approach to computing.

Dr Grant Williams, Dr Andreas Markwitz, Professor Simon Brown, Dr Simon Granville, Professor Joe Trodahl, Dr Franck Natali, Associate Professor Ben Ruck and Dr Natalie Plank

Beyond ones and zeros

Called neuromorphic computing, it uses tiny circuits to mimic the operation of the human brain. “We are deliberately trying to replicate the structure of the brain, so there are no ones and zeros here,” explains Professor Brown, who received a 2016 MBIE Smart Ideas grant for this work. “Instead, data forms a physical pathway across the complex series of connections present in the chip, similar to how memories are formed in the brain.”

Alongside Victoria University of Wellington Principal Investigator Dr Natalie Plank and Postdoc Fellow Dr Saurabh Bose, Professor Brown’s eventual aim is to set up a commercial company to fabricate these chips. While neuromorphic devices aren’t going to replace all types of computing, they could have a huge impact on image recognition—perhaps offering a route to real-time, low power consumption data processing, on a chip small enough to fit into your smartphone.

Low power data processing on a chip small enough to fit into your phone.

1.3
Every atom counts

Look around you. If you can see it with your naked eye, it is part of the macroscopic world. This world includes everything from the food you eat and the car you drive, to the furniture you sit on or the building you are in. Humans have long been masters of manipulating materials at this scale, and that's partly because the laws of physics behave themselves at this dimension—you can trust that a metal will behave identically whether you use it to make a nail, or to hold up a skyscraper.

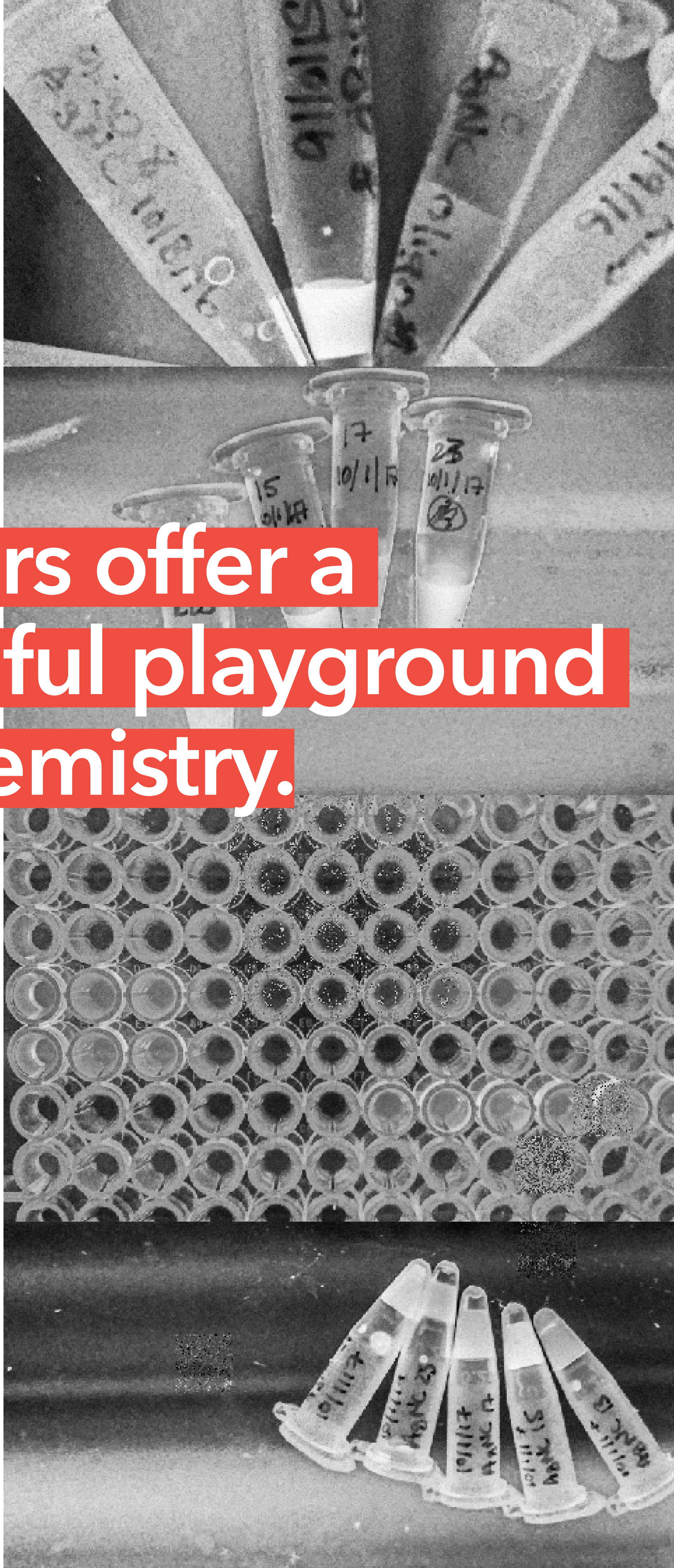
But that's not the case when things get very small. As first discovered in the 1980s by researchers working with materials like silicon and carbon, if a material gets small enough, its properties can change dramatically. This discovery kick-started the nanotechnology revolution, which allowed us to design new materials with seemingly 'impossible' properties. That, in turn, has given us a dizzying array of devices and products that we rely on, including efficient medicines and longer-lasting batteries.

But even now, 30 years later, nanotechnology continues to throw up surprises. Recent discoveries have proved that when atoms are arranged into precise groups called clusters, the addition or removal of a single atom can entirely change the cluster's behaviour. For example, a cluster of seven atoms of gold is magnetic, while a cluster of six is not.

Atomic ingredients

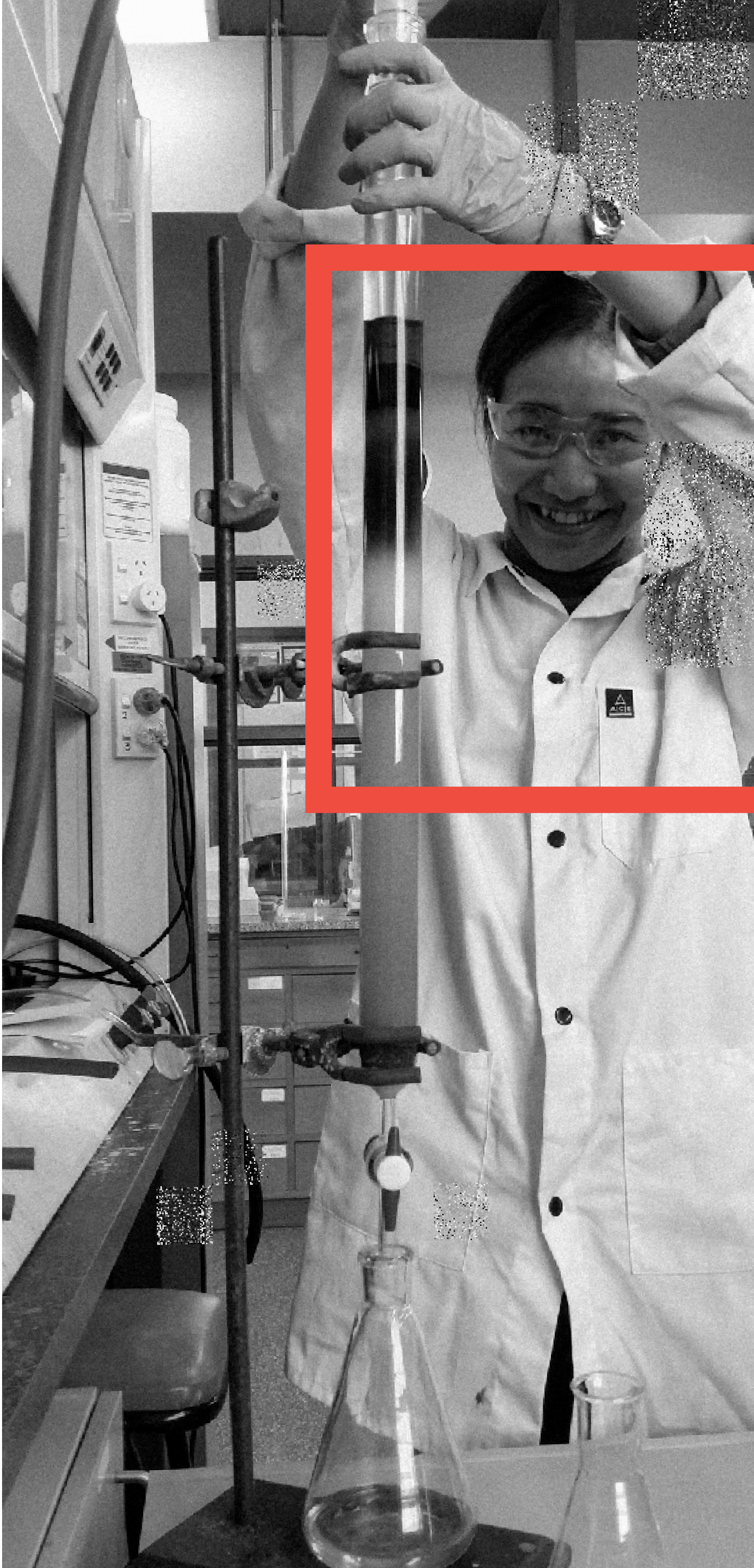
This ability to tune a material's properties, atom-by-atom, has captured the imagination of some of the MacDiarmid Institute's researchers, including Director and Principal Investigator Professor Thomas Nann. Working with colleagues at Victoria University of Wellington, Professor Nann has been using some of these tiny clusters as catalysts for renewable energy, and as markers for disease detection. "Because their behaviour is directly linked to their atomically-precise structure, clusters offer huge potential for producing materials with unique, desirable properties," said Professor Nann. "And we've only just begun to scratch the surface."

Professor Nann and his team rely on biological matrices—DNA or peptides—to stabilise these metal clusters, and this approach has proved to be the key to their early successes. But it comes with a surprising technical challenge. Their clusters are so small that they are impossible to see with current analytic techniques. "We can gather size and some chemical information from mass spectroscopy," explained Professor Nann, "but analytics-wise, that's where it stops. A large proportion of our work is dedicated to understanding exactly what we've got!"



Clusters offer a beautiful playground for chemistry.

Dr Vladimir Golovko



Collaboration is key

While these clusters are difficult to see, their properties are easy to test. And for that, cross-discipline collaboration is a must. Alongside his colleague Dr Renee Goreham, Professor Nann is collaborating closely with Dr Darren Day from the School of Biological Sciences at Victoria University of Wellington to investigate how clusters could be used in biomedical imaging.

New, non-toxic, biosensors

Many medical procedures such as MRI rely on a chemical contrast agent. The problem is that most of these traditional contrast agents are very toxic. But clusters are not; clusters rely on a scaffold of biological molecules, and are already therefore partially biocompatible and non-toxic. They can also be made soluble in water.

And perhaps most importantly of all, they can be designed to have several specific properties at once, potentially making them useful as a multi-modal contrast agent, or as a biosensor.

"Our research in this area is at the earliest of stages," said Professor Nann, "but we've already had some exciting results, and we're looking forward to taking them further!"

A chemical playground

Where Professor Nann and his team use biological molecules to stabilise these clusters, Associate Investigator Dr Vladimir Golovko from the University of Canterbury is using a chemical approach. His research focuses on the controlled synthesis of metal clusters for biotesting, sensing and catalysis.

According to Dr Vladimir Golovko, "Clusters offer a beautiful playground for chemistry. Playing with single atoms gives us the opportunity to design novel materials with precisely-defined properties."

Catalysts play a vital role in the modern world. Take the catalytic converter, found in the exhaust pipe of every modern car, as an example. As exhaust gas flows through it, particles of platinum act as a catalyst to convert highly-toxic pollutants into less-damaging ones. It's a system that's been ubiquitous in the automotive industry since the 1970s, but the catalyst itself is not well understood. It works, but it's not all that efficient, and it's extremely expensive. Clusters could offer a way to vastly reduce the quantity of precious metal required to catalyse a reaction—moving to just a few atoms instead of thousands would reduce the cost, and might also lead to superior performance. "There is fantastic synergy between our work, and that of Principal Investigators Dr Jonathan Halpert at Victoria University of Wellington, and Associate Professor Nicola Gaston from the University of Auckland," said Dr Golovko "This feedback loop of prediction, synthesis and testing has gotten us to a stage where our results, especially on gold catalysis, look extremely promising."

Develop the theory

Few areas of materials chemistry blend theory and experiment more productively than clusters. And when it comes to understanding why clusters behave as they do, MacDiarmid Deputy Director, Associate Professor Nicola Gaston, is leading the way. She is interested in understanding the relationship between size and the development of particular materials properties in clusters.

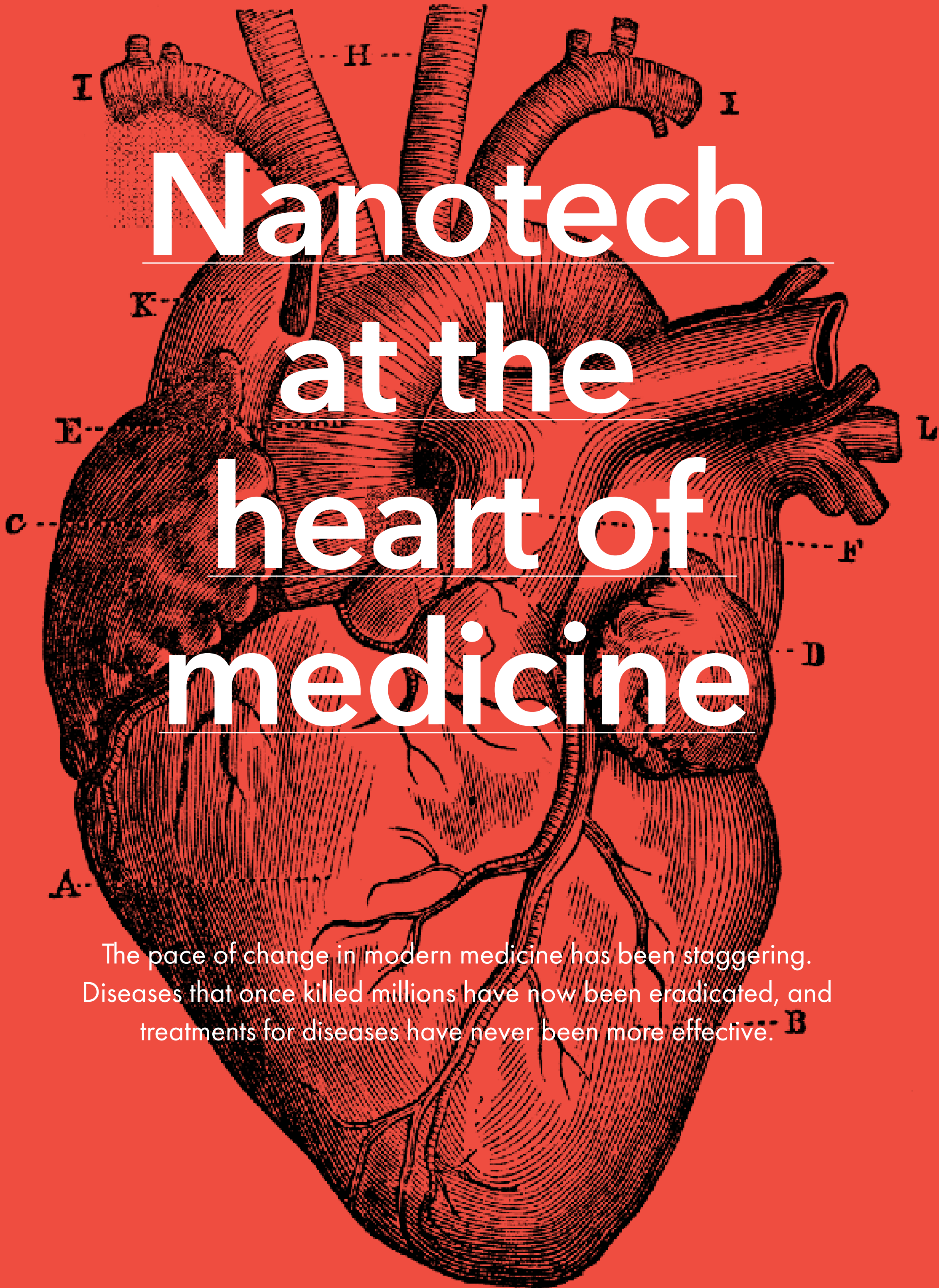
"Historically, in materials science, experiments have come first," said Associate Professor Gaston. "But that's no longer the case, especially for clusters. Our ultimate goal is to develop an overarching theoretical framework for the targeted design of these building blocks. The challenge with developing such a theory is related to their size. Clusters may be very small when compared to macroscopic materials, but they are very large compared to a single atom. Most existing computational techniques aren't designed to bridge this gap, which has led Associate Professor Gaston and her team to investigate a 'hybrid methodology', which will allow them to achieve accurate results but for a wide range of cluster size and species.

The MacDiarmid Institute umbrella connects these researchers from different disciplines and gives them the opportunity to work together. "The nature of the research means that we're collaborating with other MacDiarmid people looking at the same question, but from a different angle," explained Associate Professor Gaston. "Being part of the MacDiarmid team gives us the opportunity to meet up and find out what others in New Zealand are working on in regard to clusters. And working at this intersection, between physics and chemistry, is incredibly exciting."

Associate Professor Nicola Gaston

Working on a problem from different angles, across disciplines, under the MacDiarmid umbrella.

Professor Thomas Nann, Associate Professor Nicola Gaston,
Dr Jonathan Halpert, Dr Vladimir Golovko



Nanotech at the heart of medicine

The pace of change in modern medicine has been staggering. Diseases that once killed millions have now been eradicated, and treatments for diseases have never been more effective.

1.4 Nanotech at the heart of medicine

The pace of change in modern medicine has been staggering. Diseases that once killed millions have now been eradicated, and treatments for diseases have never been more effective. The 21st century comes with its own challenges, though–a higher life expectancy brings an increased burden of age-related diseases. Global populations are growing, but so too is the number of premature deaths caused by cardiovascular diseases and substance abuse. Into this fray, doctors and medical researchers must go, but they're not alone. Device manufacturers, engineers and materials scientists are working to develop smaller, smarter, cheaper and more reliable technologies, to answer some of the biggest questions facing future medicine.

Improved diagnoses

According to the World Health Organisation, the number of new cancer cases is expected to rise by about 70% in the next two decades. So, there's a growing need for new and improved diagnosis techniques and treatments. MacDiarmid researcher and postdoctoral fellow at Victoria University of Wellington, Dr Renee Goreham, is investigating a class of materials that could make cancer easier to detect, and it starts with an MRI (magnetic resonance imaging) machine.

MRI is one of our main diagnostic tools. It uses magnetism and radio waves to build up a picture of a person's internal organs, allowing radiographers to locate any signs of cancer. It relies on a contrast agent, injected into the body, to improve visibility, and this is where nanotechnology can help.

"The problem with the MRI contrast agents currently in use is that they have a low resolution, which limits the minimum size of cancerous cells they can identify," explained Dr Goreham. "They're also toxic, so can cause serious side-effects to patients." Dr Goreham's solution, now funded by a National Science Challenge Seed grant, was to develop a contrast agent made from nanoclusters of silver atoms. This non-toxic nanomaterial is predicted to be responsive to magnetic fields, and it also fluoresces. Together, these properties make it possible to analyse cancerous cells with multiple complementary techniques, increasing the likelihood of an earlier diagnosis.

In addition, Dr Goreham is exploring the use of exosomes–tiny particles, continuously produced by most cells in our bodies. Once thought to be trash carriers for cells, they're now known to be a vital communication tool, and one that researchers could make use of. "We think that exosomes could be used to further increase the effectiveness of our nanocluster contrast agent," she said. "But looking further ahead, they could also be used to carry molecules across the blood-brain barrier–a kind of biocamouflage drug delivery. If we can do this, it could give us a new route to diagnosing and treating a range of diseases."

Bioelectronic devices

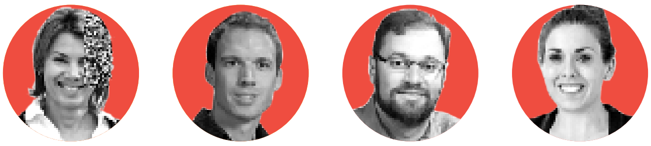
Improving diagnoses is also the focus of Principal Investigator Professor Jadranka Travas-Sejdic from the University of Auckland. But rather than looking at imaging techniques, she is developing a new class of biosensors made from novel polymers that can conduct electricity. Her focus is on the development of hand-held, in-field detection systems for fast, direct electrical sensing of biological molecules.

Looking further ahead, they could also be used to carry molecules across the blood-brain barrier. If we can do this, it could give us a new route to diagnosing and treating a range of diseases.

Dr Renee Goreham

It might sound like science-fiction, but it's coming.

Professor Jadranka Travas-Sejdic



Professor Jadranka Travas-Sejdic, Associate Professor Justin Hodgkiss, Dr Jonathan Halpert and Dr Renee Goreham

"We're using these sensors for DNA diagnostics, which is an important tool in identifying infectious diseases, genetic mutations, or inherited metabolic disorders," said Professor Travas-Sejdic. "The current technology is costly and time-consuming, and we want to change that." In collaboration with Professor David Williams, the group is currently working on producing these sensors using high-throughput printing technologies. And the next stage is to test the printed devices with complex body fluids.

Professor Travas-Sejdic and her team are funded by a 2016 Marsden grant to look further ahead too—toward stretchable and self-healing electronics for use in health monitoring. They are collaborating with microbiologists at Harvard Medical School to understand how such electronic patches could be used in, for example, repairing cardiac tissue function. "It might sound like science-fiction, but it's coming," she explained. "Patches that could interface directly with organs would allow us to monitor the health of vulnerable patients, or even stimulate biological tissue directly. It is an emerging new approach to healthcare."

Nano-sensing

For our Deputy Director, Associate Professor Justin Hodgkiss from Victoria University of Wellington, nanomaterials can also make our roads and communities safer. Funded by an MBIE grant, he is developing ultrasensitive analytical devices for real-time detection of the drug methamphetamine; one for use in roadside tests, and the other for mapping substance contamination in buildings.

The devices use precisely-designed DNA aptamers, also known as synthetic antibodies, to rapidly recognise methamphetamine molecules from small, easy-to-take samples. "The existing saliva test for methamphetamine detection is expensive, slow and prone to showing false positives," explained Associate Professor Hodgkiss. "And in order to identify the production of the drug within our housing stock, samples currently need to be collected and analysed off-site. Our new devices use nanotechnology to tackle these issues, reducing the cost of tests, and making them faster and more reliable." Medicine has long been a collaborative pursuit. But these projects, and others like them, demonstrate the growing role that materials science will play in its future. No sci-fi nanobots needed.

1.5
Materials stars

New Investigators

Penny Brothers

New MacDiarmid Principal Investigator and University of Auckland Chemist, Professor Penny Brothers, is building novel molecules as building blocks for light-absorbing components of solar cells and magnetic materials.

Anna Garden

New MacDiarmid Associate Investigator and University of Otago Chemist and winner of a 2016 Marsden grant, Dr Anna Garden, is using computers to design nanomaterials for environmental remediation.

Jonathan Halpert

Senior Lecturer in Chemistry at Victoria University of Wellington, Rutherford Discovery Fellow and now new MacDiarmid Principal Investigator, Dr Jonathan Halpert, is investigating new nanomaterials for use in next generation solar cells, LEDs and other optoelectronic applications.

Jenny Malmströtm

New MacDiarmid Associate Investigator and University of Auckland Chemical Engineer, Dr Jenny Malmström, was awarded a 2016 Rutherford Discovery Fellowship and Marsden Fast-Start to develop artificial tissue surfaces to enable a deeper understanding of stem cell regulation.

Carla Meledandri

Joint winner of the KiwiNet 2016 Emerging Innovator Award, University of Otago Chemist and new MacDiarmid Principal Investigator, Dr Carla Meledandri, is taking nanotech into the world of dentistry.

Franck Natali

New MacDiarmid Principal Investigator and Victoria University of Wellington physicist, Dr Franck Natali, is creating new memory storage devices for tomorrow's computers.

Geoff Waterhouse

New MacDiarmid Principal Investigator and University of Auckland Chemist, Associate Professor Geoff Waterhouse, is developing nanomaterials that catalyse the transformation of light energy into chemical fuels.

Catherine Whitby

New MacDiarmid Associate Investigator and Massey University Chemist, Dr Catherine Whitby, is using nanotechnology to understand and improve the properties of emulsions in food and cosmetics.

Rising stars

Baptiste Auguie

2016 Rutherford Discovery Fellow, Victoria University of Wellington Physicist and MacDiarmid alumnus, Dr Baptiste Auguie, is putting a new twist on light-matter interactions with his research programme on chirality at the nanoscale.

Renee Goreham

Postdoctoral Fellow in Professor Nann's group with strong links to the MacDiarmid Institute, Dr Goreham won a 2016 NSC seed grant to explore the physical properties of silver clusters for medical applications.

Ben Mallet

2016 Rutherford Postdoctoral Fellow, University of Auckland Physicist and MacDiarmid alumnus, Dr Ben Mallett, is seeking to understand the love-hate relationship between magnetism, superconductivity and charge order.

Nicholas Monahan

2016 Rutherford Postdoctoral Fellow, Chemist and MacDairmid alumnus, Dr Nicholas Monahan, returned to Victoria University of Wellington to shed light on how next generation solar cells generate electricity.

At my stage the question is—how can I enrich the work of others?

Professor Jeff Tallon

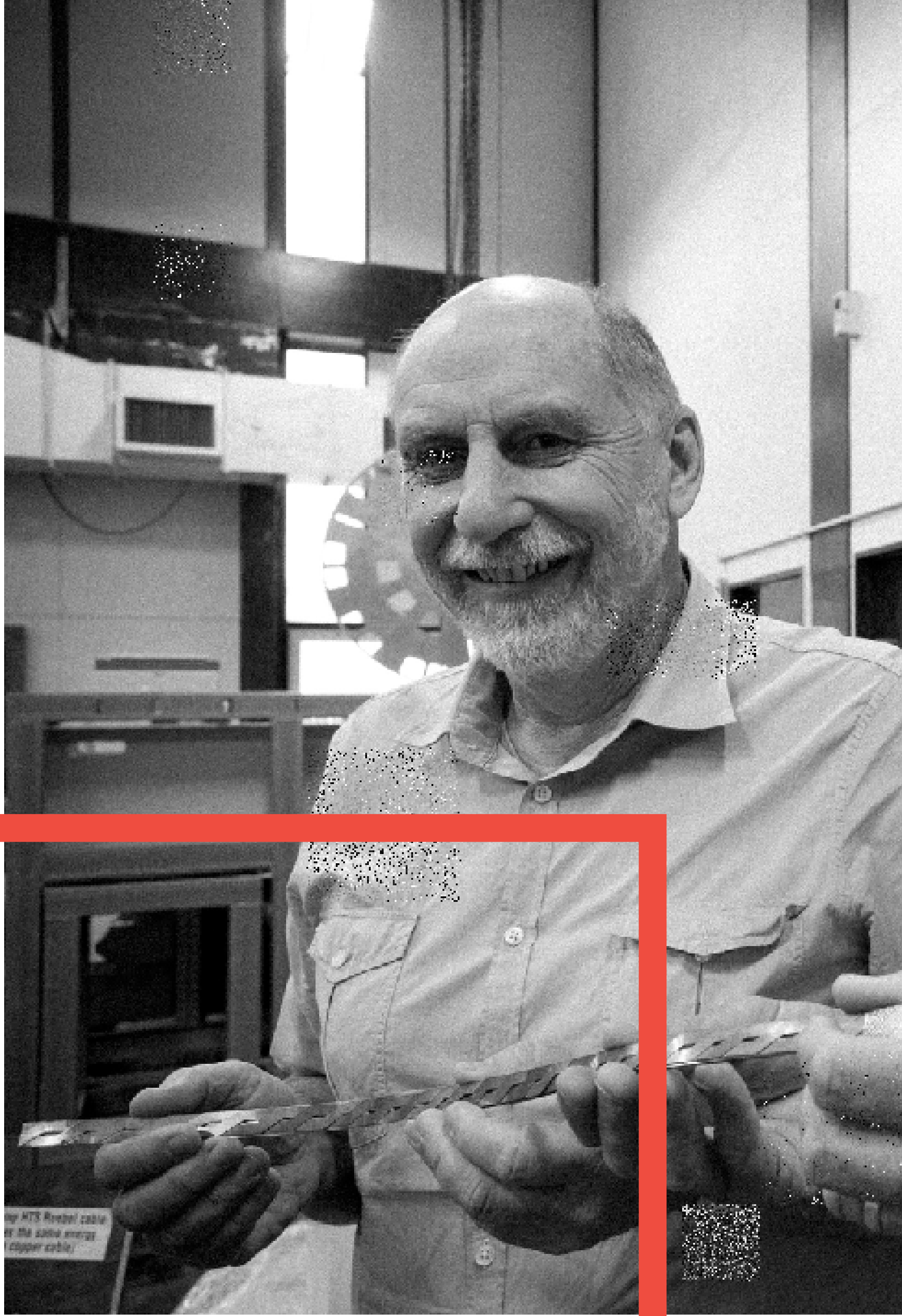
1.6
Emeritus Investigators

When it comes to science there's often a focus on the 'new'; the most current, the latest (research, funds, etc). It can be easy to forget how success is built on the ongoing support of others. Few of the achievements of the MacDiarmid would be possible without the people who worked for years to grow and nurture the Institute. Many of them now stand as Emeritus Investigators (EI), guiding and mentoring those who are newer to the MacDiarmid.

Professor Jeff Tallon, Professor of Physics at Victoria University of Wellington, based at the Robinson Research Institute sees the role of an EI as one of piloting new MacDiarmid Investigators in their research. "Over a period of time you acquire a pretty good grasp of the breadth and range of issues and also the ability to bring disparate ideas and research together. You can be a bit of a glue within the Institute. So I've done quite a bit of that in recent years—linking up people I never would have before—chemistry, materials, nanotechnology, together with my research field of superconductors."

Professor Tallon has been with MacDiarmid right from its inception and wrote part of the original bid with Sir Paul Callaghan. He says he has seen the difference the MacDiarmid made over time. "The MacDiarmid breaks boundaries between institutions and disciplines. It has enabled many disparate groups and research topics to somehow come together over the years. This didn't happen immediately; for the first six years everyone continued to do what they used to do. But research slowly cross-pollinated. It's very rich now. It's a broad-based dynamic, based not just on research, but reaching out to the public and schools. Both AMN7 and AMN8 were were terrific illustrations of this—there is terrific new stuff going on. Longevity gives this strength. It would be a big step backwards to lose the dynamic that's been built up."

He says he had a mentoring role right from the beginning but that this cemented in over time. "At my stage the question is not how the MacDiarmid can be useful to me but the other way around—what contribution can I make to enriching the work of others? I've had my time of benefit. It's really important now that I work to make a richer environment for others, put students from different themes together with senior researchers in other themes. We as EIs have a responsibility to stretch the horizons of the younger researchers, especially students and postdocs."



Professor Jeff Tallon

You can be a bit of a glue within the Institute.

For MacDiarmid Associate Investigator and Robinson Research Institute scientist Dr Shen Chong, having Professor Tallon as a mentor has been critical. "The sheer knowledge and experience Jeff brings to my work is invaluable. He gives advice on my research and how to apply for funding and how to run things in general. And because of his wider links he puts me in touch with people I need to collaborate with, through the MacDiarmid." Dr Chong, who won a 2016 Marsden grant for nanostructuring in iron-based wires for ultra-high current density, said that it is great having Professor Tallon active within the Institute's research theme 'Tomorrow's Electronic Devices'. "Jeff is still keen to give ideas and encourage the rest of us within the theme."

Emeritus Investigator Professor Simon Hall has similar views to Jeff Tallon's. Simon offered to move to EI status in 2015 after changes to his role at Massey University. He still attends MacDiarmid Energy theme meetings, sharing his ideas and thoughts about commercialisation of energy technology. "Part of staying on as an EI has got to be about contributing back. I definitely see myself having a role within the broader Institute in terms of mentoring younger researchers."

Four MacDiarmid Emeritus Investigators are in senior executive leadership positions within New Zealand universities; Professor Richard Blaikie is Deputy Vice-Chancellor at the University of Otago, Professor Jim Metson is Deputy Vice-Chancellor at the University of Auckland, Professor Kate McGrath is Vice-Provost Research at Victoria University of Wellington and Professor Simon Hall is Deputy Pro Vice-Chancellor of the College of Sciences at Massey University. Professors Blaikie and McGrath are both former directors of the MacDiarmid Institute.

Dr Shen Chong

The sheer knowledge and experience Jeff brings to my work is invaluable.

2. Into the marketplace.

2. Into the marketplace.

The MacDiarmid Institute advances science with an endgame—real-world applications—from solar technology to medical diagnostics. Our materials science and nanotech lends itself naturally to hi-tech spin-outs. We support and grow commercial nous and capability amongst our scientists to enable them to deliver these high-value business opportunities to the New Zealand hi-tech economic sector.

Bridging the gap; translating science into commerce

It's not an easy journey from the lab to the marketplace. But as Sir Paul Callaghan identified, a thriving hi-tech economy needs top scientists in the workplace. Hi-tech companies rely on the expertise of key researchers to grow the specialist technical knowledge, ideas and capacity needed for a successful spin-out venture. It is absolutely critical that scientists can build bridges from academia to industry, taking with them the essential science knowledge and skills New Zealand needs for a high technology economy. The MacDiarmid Institute set about making this happen.

2.1 Bridging the gap—translating science into commerce

Dr Carla Meledandri

MacDiarmid Principal Investigator Dr Carla Meledandri runs a busy chemistry lab at the University of Otago, specialising in nanoscale materials. Back in 2011 she and her collaborator, Dr Don Schwass from the Faculty of Dentistry, had an inkling her research could lend itself to potential commercial applications using nanosilver for dentistry. They could certainly see the need—over 40% of New Zealand children have at least one filling by age five. But developing ideas for the market didn't fit within her already full workload of research and teaching, and entrepreneurship was a skillset she had yet to acquire.

Tech Transfer Office Award

Dr Meledandri says her first break came from a university Technology Transfer Office (TTO) award. "We had all these ideas and no resources. So winning an Otago Innovation Proof of Concept Award of $50,000 paid for a Research Assistant and really helped us get started developing a series of products."

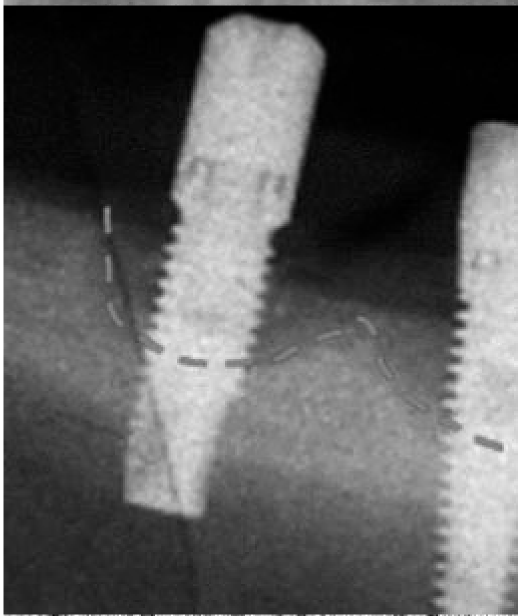
Global market survey

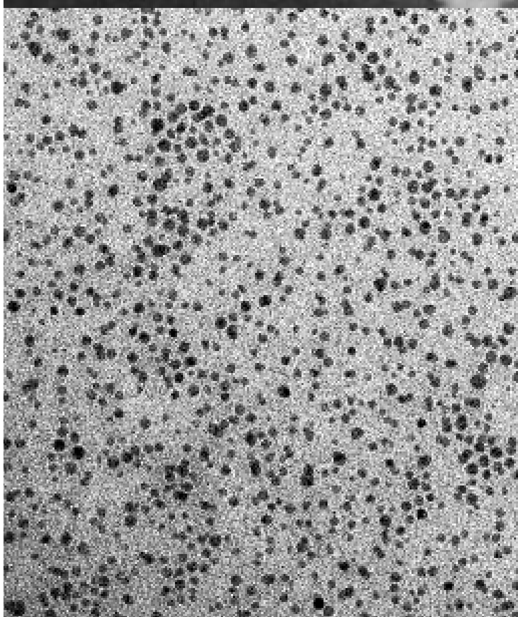
Drs Meledandri and Schwass embarked on a world tour visiting dental companies and discussing their technologies. "Our 'market survey' of dental companies around the world, particularly in the US, helped us understand their needs. We also learned a lot about the regulatory processes in other countries, and this information was essential in focusing our research in the right direction."

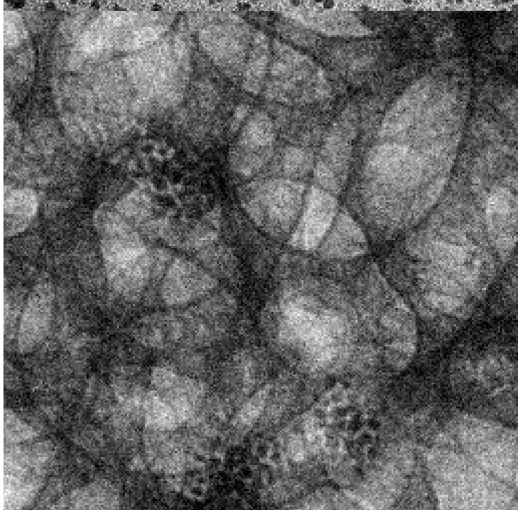
Pitching to angel investors

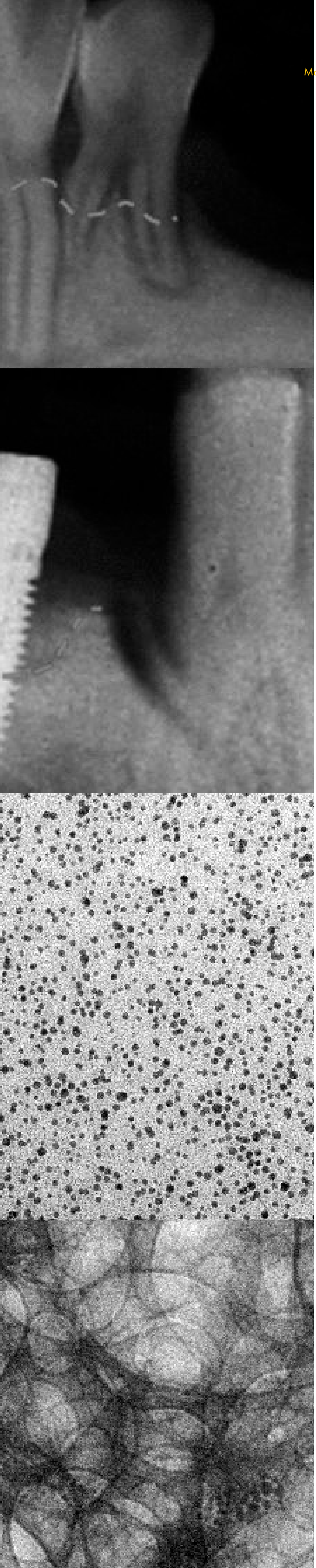
The next step was getting her work in front of investors and to this end MacDiarmid Board Chair and angel investor Dr Ray Thomson supported her to pitch to angel investors at Pitch on a Peak in Queenstown. (Pitch on a Peak is detailed in the 2015 Annual Report.) "Ray Thomson, along with NZTE, helped me refine my 'pitch' to key people in the investment community at Pitch on a Peak in Queenstown. I had to develop a three minute speech that outlined the problem and showed our solution. This gave me insight into the kinds of things investors needed to know."

Having met and talked with angel investors, and learning that investors required further information, Dr Meledandri then teamed up with University of Otago Professor of Periodontics and Dental Implantology Warrick Duncan to create animal model studies.









Tailored design

While the animal studies were taking place, her team also began designing a product that could be classified as a medical (rather than therapeutic) device. Dr Meledandri says this was the point at which investors became interested.

"This was key—once we developed an actual filling material, that would be classed as a medical device, investors really took notice. The medical device angle led to serious interest from Powerhouse."

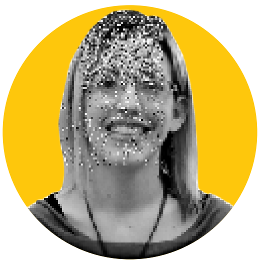
Developing business skills

Dr Meledandri says she decided she needed more business skills and resources before she could further develop her ideas.

"The MacDiarmid supported me on a Get Funded course in 2016, and TEC funded me for an Entrepreneurship Workshop. Both of these courses helped me begin to think like a businessperson. The next step for us will be to put a recent PhD graduate into a company and the MacDiarmid Internship Programme will help us do this."

National recognition

Dr Meledandri says being nominated by the MacDiarmid Institute for the KiwiNet Awards in 2016 helped her further refine her pitch and put her in front of investors and business media. She was joint winner of the Norman F. B. Barry Foundation Emerging Innovator Award. Dr Meledandri also won a 2016 MBIE Smart Ideas grant for this work.



Dr Carla Meledandri

Professor David Williams

MacDiarmid Principal Investigator Professor David Williams is no stranger to the marketplace, having developed and launched his first company Capteur Sensors and Analysers Ltd, in the UK in 1992.

"Capture Sensors and Analysers made heated metal oxide sensors and was based on my research at the UK Atomic Energy Authority, Harwell, and at University College London."

His second company, Aeroqual, uses materials science to create new sensors for industry. "Aeroqual is now a real success story employing 30 people and turning over $8 million a year," he said.

(Aeroqual took the top award in the Most Innovative Hi-Tech Hardware Solution category at the 2016 NZ Hi-Tech Awards for its compact air quality monitoring station.)

Tech transfer support

Professor Williams' third company, Air Quality Ltd, was established in 2013 and uses materials science to create sensing networks that provide reliable data, for example, for vehicle fleet exhaust emissions or wastewater treatment or carbon monoxide emissions.

"We're currently employing five people, mostly postdoctoral researchers. We've been able to do this in part because of the MacDiarmid's support for tech-transfer and funding for PhD students who then go on to become employees in the company. Along with Aeroqual, Beca and UoA, we've just won a new MBIE grant for high-density networks of urban air quality measurement instruments.

A fourth spin-out company, Orbis—Milk on a Disc, will provide farmers with information such as the protein content and fat content of milk, and can also help them assess the health of the cow regarding pregnancy, mastitis, nutritional status etc.

This originally came out of an E.T.S. Walton Visiting Fellowship from the Science Foundation Ireland (SFI). I was also a principal investigator supported by the SFI in the Biomedical Diagnostics Institute at Dublin City University. 'Point of Cow' was born there: the original was created by other PIs in that Institute. Two years later I began working with Cather (MacDiarmid Principal Investigator and The University of Auckland Professor Cather Simpson) and we secured University of Auckland funding for some students to help move things along, and it wasn't long afterwards that investors suggested we start a company. There had been MacDiarmid support for the diagnostics and fluid fabrication right through."

Aeroqual is a real success employing 30 people and turning over $8 million a year.

How do we make an idea like this investment-ready?

Meeting the money

"So our next step was to present to angel investors at Pitch on a Peak in Queenstown, and this is something (MacDiarmid Chair) Ray Thomson pointed us to. Once we had Powerhouse on board, we secured a Callaghan Innovation incubator loan, further private investment and more University of Auckland funding. We have enough now to get going and are also connecting with Fonterra. Our next target is to produce a prototype some time in 2018!"

Professor Williams' potential fifth company 'Spot Check' is a collaboration with MacDiarmid Principal Investigator Professor Jadranka Travas-Sejdic. Spot Check uses materials science to provide low-cost, on-the-spot detection of DNA signatures of infectious and chronic diseases, and won the prestigious Velocity 100k Challenge in 2016.

"Little clicks all kind of happened," Professor Williams says. "I suggested to (Research Associate) Nihan—try this—and she emailed back—"Sir it works!". We now have a patent filed and the next question is—how do we make an idea like this investment-ready? UniServices is supporting us with a couple of postdocs, and we have to now show investors that this is an investible proposition."

Professor Williams says being part of the MacDiarmid Institute gave them a chance to try new things out, without the need to write long and formal proposals, and the chance to talk within the Institute with people who are interesting and good.

"With the MacDiarmid we have the chance to be part of a community where it feels ok and good to take basic science out of the lab and make something work."

Professor David Williams

Professor Cather Simpson

A chance conversation with an investor from the dairy industry led to Professor Cather Simpson developing an award-winning start-up company which aims to revolutionise sperm sorting for the dairy sector.

Back in 2010, at a business function, an investor outlined to her the problems facing the dairy industry. As Professor Simpson recounts, she headed straight back to her lab and challenged students to come up with solutions within 24 hours. One of the students' ideas involved using lasers to generate a force, a concept that became key to the technology behind the start-up company. Professor Simpson then worked with Auckland UniServices and Pacific Channel Ltd to form Engender in 2011.

"We'd never made a microfluidic chip before, never done any of these things, but by 2012 we had a patent and were starting to secure investor funds to prove we could make a chip and actually do this stuff. We then managed to show we could move sperm with light. By 2016 we were working with two of the world's largest artificial insemination companies, and we secured a major fundraise of $4.5 million to bring the company through the last stage before 'real' commercialisation."

Professor Simpson's advice to other scientists wanting to take the commercialisation route is to be flexible.

"My take home message is embrace flexibility. You've also got to be adaptive, persistent and to say 'yes'. Think—what skills do I have? Remember it's a tremendous amount of work, so think what can I make this commercially feasible and still make it intellectually stimulating?"

Professor Cather Simpson

Embrace flexibility—be adaptive, persistent and say 'yes'.

Professor Cather Simpson

First place medal in AgTech at the Silicon Valley Forum Tech World Cup

Baldwins Researcher Entrepreneur Award at the 2016 KiwiNet Research Commercialisation Awards and went on to the BNZ Supreme Award—for overall excellence in all core areas of research commercialisation

AgFunder Innovation Award: 5 Most Innovative International Start-ups at Series A and Beyond, Engender Technologies

TIN200 Most Promising Early Stage Companies Award (New Zealand)

Professor Simpson, who is also involved in another company (Orbis Diagnostics with Professor Williams) says that MacDiarmid Board Chair Dr Ray Thomson and Commercialisation Developer Richard Pinfold has helped her navigate the commercial side of things.

"The MacDiarmid Insitute helped arrange key meetings after the Pitch on a Peak and from that we had a visit from the head of the Enterprise Angel team."

Professor Simpson won the Baldwins Researcher Entrepreneur Award at the 2016 KiwiNet Research Commercialisation Awards and went on to the BNZ Supreme Award—for overall excellence in all core areas of research commercialisation. She was also named a Ministry of Primary Industries Champion for Engender and for Orbis and their Primary Growth Partnership research on milk.

Professor Simpson says another success of the MacDiarmid Insitute is that it provides opportunities for scientists in her area to be heavily networked. Plus there is commercial funding support to help scientists develop a patenting strategy. Looking ahead, she welcomes the MacDiarmid Insitute's scheme to foster entrepreneurial spirit in its scientists.

"I want to help our young scientists in particular to spin-out their own companies—create their own jobs so they can leave the university. One of our most important products is our students—giving them a path into business."

Professor Cather Simpson

We want to give our students a path into business—to enable them to create their own jobs.

2.2

Mapping our spin-outs

Stage 1
Product gains industry recognition and an increased public profile. Potential to attract early investment/partnering with business mentors.

1

Lab

Spot Check (a collaboration between Principal Investigators and The University of Auckland Professors Jadranka Travas-Sejdic and David Williams), uses materials science to provide low-cost, on-the-spot detection of DNA signatures of infectious and chronic diseases, and won the prestigious ***Velocity 100k Challenge*** in 2016.

At a ***Get Funded*** workshop in 2016, MacDiarmid Principal Investigator and University of Canterbury Professor Maan Alkaisi developed a pitch for investment for his innovation using nanopyramids on glass to trap light to make photovoltaic (PV) powered greenhouses for food production. He is now collaborating with New Zealand and international industry and is seeking government funding to take this idea to the next stage.

CloudSpec, led by two MacDiarmid alumni, Dr Brendan Darby and Dr Matthias Meyer, and by Principal Investigator and Victoria University of Wellington Professor Eric Le Ru uses light to analyse cloudy solutions, such as paint, wastewater, algae growth, bioliquids and foods and beverages (including beer and wine). With ***KiwiNet Tier 2 pre-seed funding*** to validate their testing process with one of the key players in the New Zealand food and beverage industry, CloudSpec is working closely with investors and industry experts on the best business model going forward.

A ***Medical Dosimeter***, being developed by Principal Investigator and Victoria University of Wellington researcher Dr Grant Williams, is an optics-based device that accurately ensures the correct dose of radiation is given to cancer patients. Aiming for the hospital radiotherapy market, Dr Williams has an ***MBIE*** grant to develop advanced prototypes.

Stage 2

Start-up team works intensively with a tech incubator to take the product to market.

2

Auramer Bio Ltd is developing aptamers, new antibodies made from DNA and designed to bind to very specific targets. These can be made in a lab rather than extracted from animals, produced quickly and at a fraction of the cost. Aptamers can target hormones for fertility treatment, or methamphetamine for drug testing, etc. MacDiarmid Principal Investigator and Victoria University of Wellington Associate Professor Justin Hodgkiss is working with a ***tech incubator*** to take this to the next step.

Principal Investigator and University of Otago researcher Dr Carla Meledandri has developed a specially formulated, non-staining antimicrobial, silver nanoparticle formulation to arrest tooth decay (dental caries) and make teeth more resistant to recurrent infection. The product can be commercialised to manufacturers, distributors and health insurance companies. Dr Meledandri is working with a ***tech incubator*** to take this to the next step.

Hi-Aspect Ltd, a company led by Principal Investigator and Auckland Professor Juliet Gerrard, is healing skin with biomaterials—a new protein-based nanomaterial for use in skincare products and wound dressings. Professor Gerrard is working with a ***tech incubator*** to take this to the next step.

Principal Investigators and The University of Auckland Professors Cather Simpson and David Williams have established ***Orbis Diagnostics Ltd***. Orbis is developing an affordable disc in each dairy shed that will tell farmers the protein and fat content of each cow's milk, and help them assess the health of the cow regarding pregnancy, mastitis, nutritional status etc. Orbis is working with a ***tech incubator*** and Pacific Channel to take this to the next step.

Noble Bond Ltd uses nanogold in a boutique range of colours generated by surface plasmon resonance effects, to colour wool for high-value international luxury apparel and rug markets. It also incorporates nanosilver entities into wool to impart antimicrobial properties. The research and business development is led by Emeritus Investigator and Victoria University of Wellington Professor Jim Johnston. Noble Bond is working with a number of UK and European companies in its commercialisation pathway. Wools of New Zealand Ltd has taken up a shareholding in Noble Bond.

Stage 3
Company is in secondary fundraise, close to market, or in production.

3

Marketplace

Engender Technologies uses materials science plus photonics to sort sperm for the dairy industry. Principal Investigator and The University of Auckland Professor Cather Simpson is perfecting these techniques in the lab ahead of in vitro fertilization trials and then field trials. Engender has secured major fundraising and investment including from two of the world's largest artificial insemination companies. A ***second stage capital raise*** saw Engender successfully complete a $4.5 million fundraising.

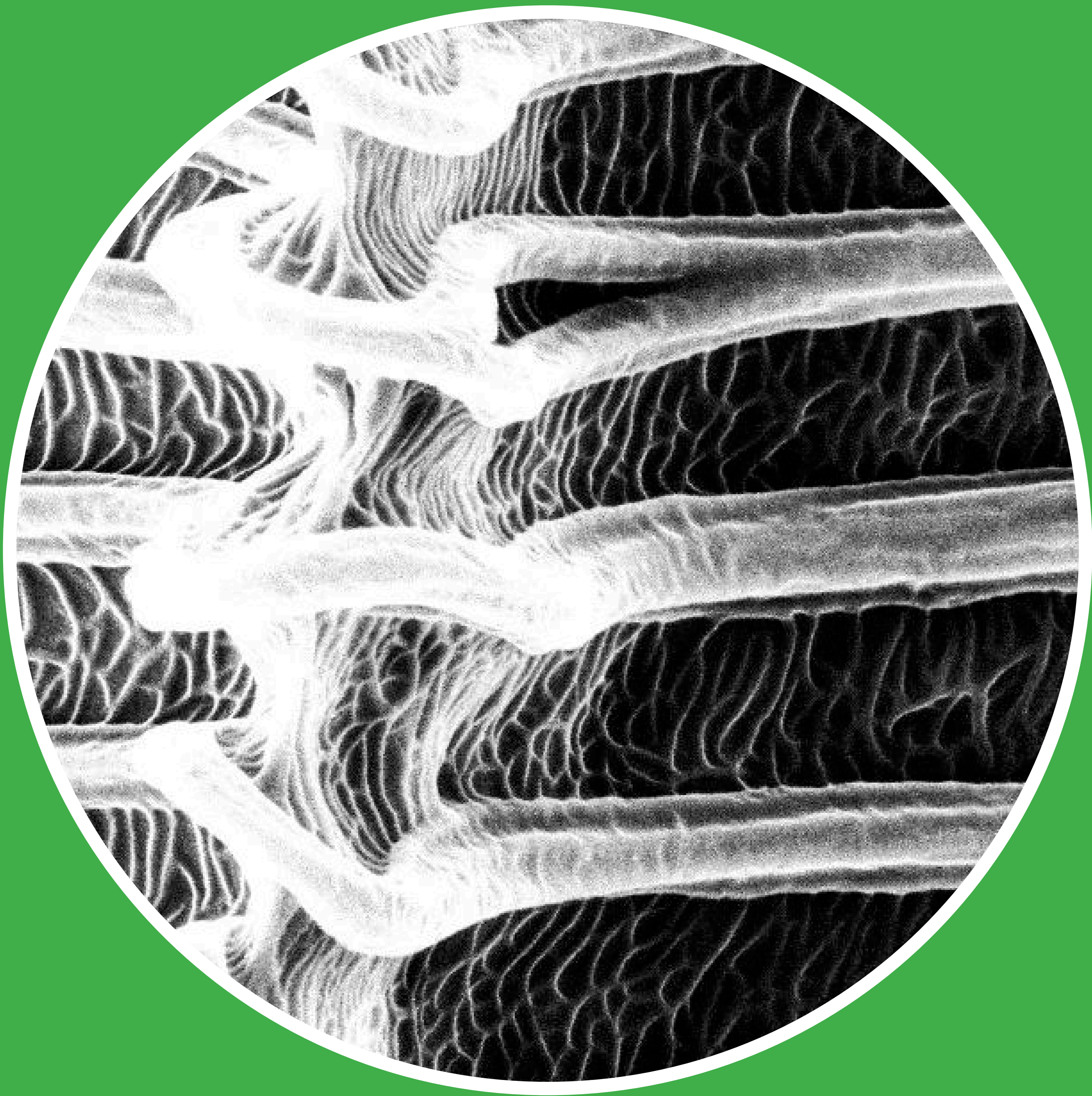
Air Quality Ltd established by Principal Investigator and University of Auckland Professor David Williams uses materials science to ***manufacture*** sensing networks that provide reliable data, for example, for vehicle fleet exhaust emissions or wastewater treatment or carbon monoxide emissions. It currently employs five people, mostly postdoctoral researchers.

Boutiq Science Ltd is a spin-off company from Victoria University of Wellington and the MacDiarmid Institute, founded by former Principal Investigator Professor Richard Tilley and operated by MacDiarmid alumnus Dr Anna Henning. Boutiq aims to be a leading supplier of unique nanoparticles to the research science and engineering community, and with assistance from ViclLink Ltd, has expanded to begin the commercialisation and ***manufacture*** of nanoparticles for targeted biomedical applications.

Aeroqual, also established by Principal Investigator Professor David Williams, uses materials science to manufacture new sensors for industry. The company now employs 30 people and turns over $8 million a year.

3. Into the community

3. Into the community



At the MacDiarmid Institute we're passionate about taking science out of the laboratory and into the community. This has been at the heart of the MacDiarmid from the very beginning, built as it was on Sir Paul Callaghan's vision of inspiring teachers, students and communities.

We've partnered with Nanogirl, the House of Science and others to extend our reach.

As science teachers up and down the country will tell you, it’s easy enough to get kids to study a cute animal or plant a seed. But when things get really, really tiny, and we enter the world of nanoscience, where physics doesn’t behave the way you expect it to, keeping kids interested is much more of a challenge.

It’s a challenge the MacDiarmid Institute has risen to.

So we’ve continued to engage in ways that create a more inclusive pipeline for the sciences and you’ll read about this on the following pages. In developing these partnerships, we have been mindful that New Zealand’s future needs students inspired to continue in chemistry and engineering and physics as well as biology. Students passionate in these subjects will carry on to university where they may find themselves in the world of nanoscience.

In all of these activities, we rely on the enthusiasm and initiative of our researchers and students to do this work. We are incredibly fortunate to work with the people we do.

3.1 Extending our engagement – taking Kōrero to the next level

House of Science and the Nanogirl show

Sometimes an idea comes along that is so successful that you want to take it to the next level. This is what happened with the MacDiarmid Institute's Kōrero with Scientists workshops, where teachers and MacDiarmid scientists spend two hours exploring basic physical science concepts like magnets, light, and acids and bases.

"We have had such consistently great enthusiastic feedback about Kōrero from primary school teachers and early childhood educators over the past three years. And the MacDiarmid Investigators really enjoy it too," says MacDiarmid Deputy Director Associate Professor Nicola Gaston.

She says the problem became—how to extend this popular workshop to greater numbers of teachers (and therefore students).

"We ran successful workshops again in 2016 and the question clearly was—how do we build on the resources we already have but take it to a bigger audience? How do we increase young people's engagement and involvement in physical sciences? There's obviously an appetite—the teachers all report that the kids really get a kick out of the experiments we teach."

Partnering with MacDiarmid Investigator Michelle Dickinson (A.K.A. Nanogirl) was one obvious choice.

"We partnered with the Nanogirl Live Tour 2016. There is strong synergy between our efforts towards increasing engagement and involvement in physical sciences, and Michelle's work on public science literacy and engagement. And it was a chance to get the resources we'd developed for the Kōrero workshops out to a much bigger audience."

The Nanogirl Live Show, Little Bang, Big Bang, toured seven centres nationally, playing to a combined audience of 9,868. The MacDiarmid science sponsorship helped the Nanogirl programme include free school visits (involving 10,491 students) in which the teaching materials from the MacDiarmid Kōrero workshops were used and distributed. 55% of the children in the audiences at the shows and school visits were female, and 59% were from decile 1-5 schools.

Associate Professor Gaston said that another avenue to expand Kōrero became apparent in the House of Science, which provides science resource kits and professional development to schools and teachers. Science resource kits (colloquially known as 'science boxes') are designed to engage students in hands-on science activities in the classroom. The kits comprise materials and instructions for teaching at all levels throughout the primary curriculum.

"The MacDiarmid Institute will sponsor eight of these boxes to House of Science branches throughout New Zealand," Associate Professor Gaston said. "Our scientists are involved with designing the experiments and training the teachers. It just means that the Kōrero materials science experiments and teacher training can now go out on a much wider scale—to many more parts of New Zealand."

Sometimes an idea comes along that is so successful that you want to take it to the next level.

3.1

House of Science CEO Chris Duggan said that having more science kits will mean the programme can be extended to other regions. “We’re thrilled about making the science boxes available to other parts of New Zealand. We get such wonderful feedback from teachers and students.”

Eight ‘MacDiarmid’ physical science boxes will be developed with resources involving light, acids and bases and magnets and the other materials which have been used for the Kōrero workshops.

Associate Professor Gaston says a vibrant future New Zealand needs people who understand the physical sciences—physical chemistry and physics. “We are excited that these science boxes will hopefully get kids interested in the physical sciences in particular. And Kōrero will continue to inspire new approaches to outreach. “We’ll continue to host workshops plus we have some other exciting developments in our sights for 2017.”

In 2016 the lead investigators for the Kōrero programme were MacDiarmid Principal Investigators Associate Professor Duncan Macgillivray (University of Auckland), Professor Eric Le Ru (Victoria University of Wellington) and Professor Paul Kruger (University of Canterbury).

My dream is for every student to have access to a physics teacher who can inspire a life-long passion for science in general and physics in particular.

3.2
Reaching out to physics teachers

For most of us, teaching physics to anybody would be hard (if not impossible) at the best of times. But imagine trying to teach physics to a class of Year 13 students if you yourself had little university physics training.

Unfortunately this is the reality for more than half of New Zealand secondary school physics teachers.

And it is the problem the MacDiarmid Institute started to solve through its physics teachers' workshops, a popular hands-on programme for high-school physics teachers, run in 2015 and 2016.

"Only about one-third of physics teachers in New Zealand actually have a degree in physics," said MacDiarmid Principal Investigator and Victoria University of Wellington Professor Michele Governale who, together with MacDiarmid Principal Investigator and Victoria University of Wellington Associate Professor Ben Ruck, initiated the programme in 2015. "My dream is for every student in New Zealand to have access to a physics teacher who can inspire a life-long passion for science in general and physics in particular. Unfortunately this is not yet the case."

3.2

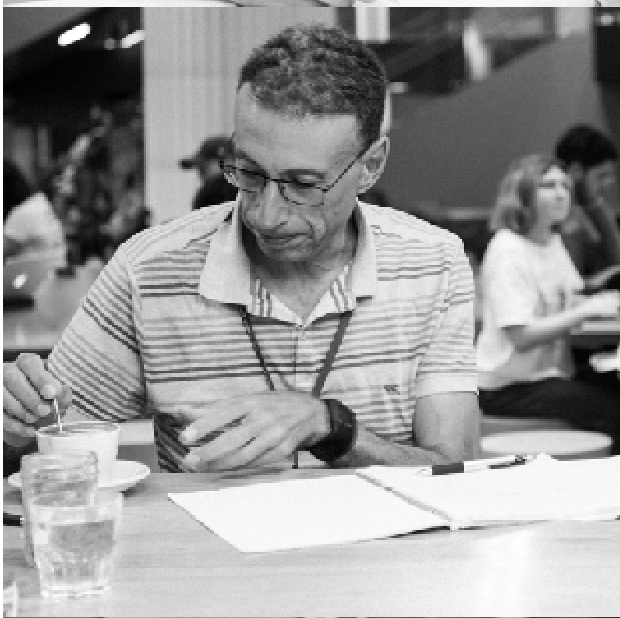
After successful workshops in Wellington in 2015 and in Auckland and Dunedin in 2016 (the latter in collaboration with the Dodd-Walls CoRE), it became clear to all involved that the programme needed to expand to include all of New Zealand. The good news is it is now being picked up by the New Zealand Institute of Physics (NZIP) and taken nationwide.

Ahead of its nationwide debut, the programme has a new name—'Physics Matters—PD for Physics Teachers'. A pilot phase is hoped to reach 200 teachers in 2017.

Longer term, Professor Governale and Associate Professor Ruck plan to be able to offer three levels of workshops: Back to Uni, Physics Fit and Fundamentals.

Associate Professor Ruck says that supporting the physics teachers benefits not only the students, but the economy.

"Having enough graduates skilled in physics is a key component to creating wealth through high-value manufacturing. We've seen how these workshops give teachers the skills to inspire students to keep on with the physical sciences. Now we're ready to do this on a much bigger scale."



3.3
Enriching the PhD and Postdoc experience

Training PhD and Postdoctoral students is a big part of our work and in 2016 we initiated an annual 'Spring Development Programme', a multi-day student workshop.

Deputy Director Justin Hodgkiss explains.

"Our students were ending up with great science credentials but lacking key skills that would influence their success post-study. We've initiated an annual workshop, rotating the themes of Science Communication, Commercialisation and Leadership (including science in policy) over three years."

The first day was led by MacDiarmid Principal Investigator and Victoria University of Wellington Associate Professor Justin Hodgkiss and MacDiarmid Postdoctoral researchers Dr Baptiste Auguie and Dr Nick Monahan, and covered the fundamentals of effective technical science writing, effective oral presentations, graphics and posters.

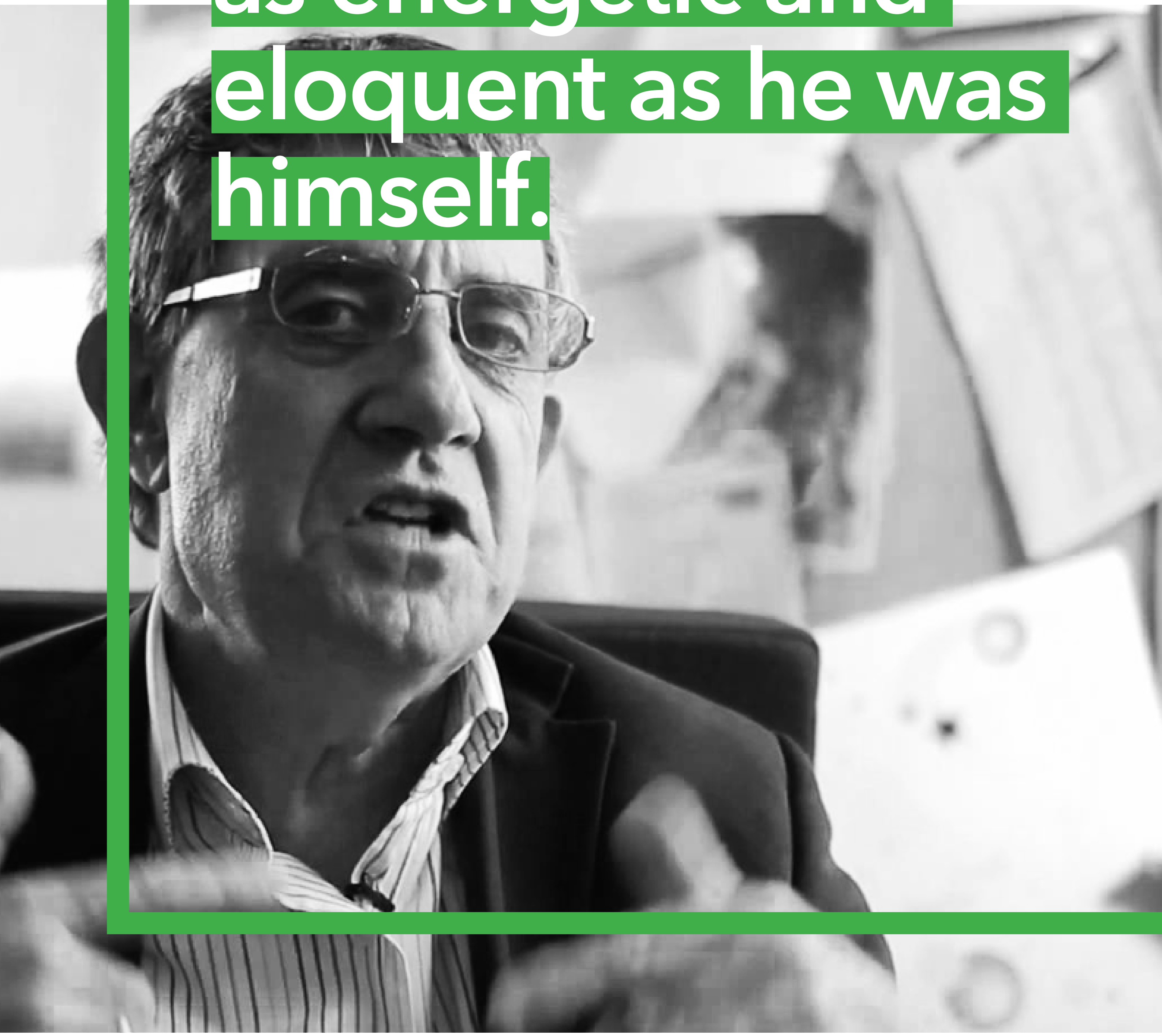
The second day was led by the Science Media Centre's Dacia Herbulock and included talks by Siouxsie Wiles on social media, Damien Christie on video and 'real-life' interviews with Ara New Zealand Broadcasting School journalism students.

PhD student Felicia Ullstad says the programme was great. "The session by Dr Nick Monahan on oral presentations was so inspiring I went and re-did my entire talk for a conference the week after. I ended up with the prize for best student talk at the conference."

The session by Dr Nick Monahan on oral presentations was so inspiring that I went and redid my entire talk—I ended up with the prize for best student talk at the conference.

Felicia Ullstad

A film about Sir Paul must be as energetic and eloquent as he was himself.



3.4
Honouring our origins—the Paul Callaghan story

MacDiarmid Institute funding has been pivotal in helping bring about the first documentary about Sir Paul Callaghan. Sir Paul, who established the MacDiarmid Institute and was the Institute's first Director, played a major role in New Zealand as a scientist, environmentalist, public commentator, lecturer and mentor.

Director/producer Shirley Horrocks said the documentary will showcase Sir Paul's work and ideas.

"I want to convey his life's work, from his passionate advocacy of scientific research and original studies on nuclear magnetic resonance through to his many ideas for New Zealand as 'a place where talent wants to live', and his vision of our natural environment as what marks our country out as unique in the world."

Ms Horrocks said having met and worked with Sir Paul, she feels passionate about telling his story to a new generation.

"A film about Sir Paul must be as energetic and eloquent as he was himself. And while remaining clear to a broad audience, it must also contain some real scientific substance."

She says the idea of a documentary about Sir Paul has struck many other organisations as a timely project and a valuable resource.

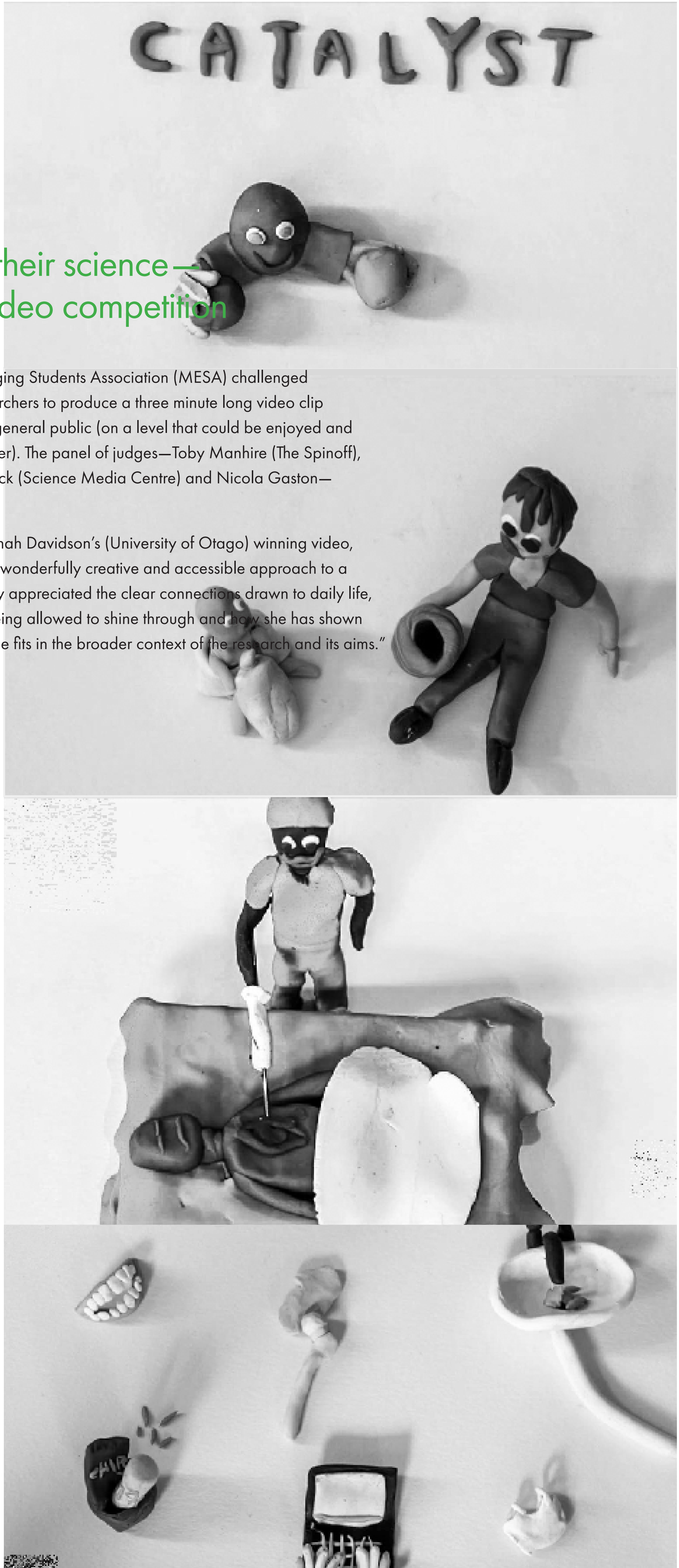
"The MacDiarmid's lead in contributing to it has so far been followed by seven New Zealand universities, along with the Royal Society of New Zealand and the Ministry of Business, Innovation and Employment.

We're looking forward to taking this first ever documentary about Sir Paul to all sorts of audiences, hoping to keep his legacy alive and inspire a new generation of young scientists."

3.5
Students share their science—MESA 3-min video competition

This year the MacDiarmid Emerging Students Association (MESA) challenged MacDiarmid students and researchers to produce a three minute long video clip presenting their research to the general public (on a level that could be enjoyed and understood by a curious teenager). The panel of judges—Toby Manhire (The Spinoff), Peter Griffin and Dacia Herbulock (Science Media Centre) and Nicola Gaston—reviewed the videos.

These slides are taken from Hannah Davidson's (University of Otago) winning video, for what the judges said was a "wonderfully creative and accessible approach to a challenging topic. We especially appreciated the clear connections drawn to daily life, the personality of the scientist being allowed to shine through and how she has shown how her small piece of the puzzle fits in the broader context of the research and its aims."



3.6
MESA bootcamp—an adventurous academic experience

The MacDiarmid Emerging Scientists Association (MESA) ran its fifth annual three-day 'bootcamp'—an 'adventurous academic experience in a remote location' at the Forest and Bird Lodge on Mt Ruapehu. This year the camp explored instrumentation and other advanced equipment for new materials research. MacDiarmid Associate Investigator Dr Jenny Malström joined the students and postdocs in a long weekend of intensive research. This year's bootcamp focused on specialised equipment.

Advanced materials research relies heavily on specialised instruments for characterisation, and the development of better equipment for measuring existing materials, instrumentation and automation, photoluminescence spectroscopy, probing biological and materials interfaces.

3.7
Clustering for impact

The Cluster Symposium 2016 took place in Christchurch on 28-29 November 2016. The scientific programme spanned full two days and included eight sessions on cluster-related science. Talks covered experimental research in physics and chemistry as well as computational/theoretical work in the areas of both fundamental and applied cluster science.

3.8
Building a new science audience—partnering with The Spinoff

The Spinoff Science: We are delighted to have been able to help The Spinoff set up a science section—for the chance to get lively-written science stories in front of The Spinoff's young and engaged (and growing) audience. The science section has also given us the opportunity to get some well written and accessible stories on MacDiarmid hi-tech materials science and innovation—an area of science not commonly read or understood by young New Zealanders—in front of this audience. On launching in November 2016, The Spinoff science section contained 19 posts, which attracted a total of 91,729 page views, with the average time spent on each page over six minutes.

3.9
The science of stuff we use to make things

In 2016 MacDiarmid Investigators again traveled to six regional centres in New Zealand to deliver public science lectures. A Materials History of the World covered materials history both within western science and from the perspective of indigenous Pacific materials heritage and culture and looked to the future impact of materials science has on our lives. Based in part on research and slides generously provided by Professor Richard Walter of the Department of Archaeology and Anthropology, University of Otago, the lectures were held in Napier, Tauranga, Wanaka, Invercargill, Whanganui and Nelson between July and September 2016. The lectures drew large crowds and feedback (through a written exit survey) was consistently and overwhelmingly positive.

We thank our people—Dr Michelle Dickinson, Dr Franck Natali, Dr Catherine Whitby, Dr Geoff Willmott, Associate Professor Duncan Macgillivray, Dr Natalie Plank, Associate Professor Nicola Gaston, Professor Richard Blaikie, Dr Laura Domigan, Associate Professor Mark Waterland, Professor Penny Brothers, Dr Vladimir Golovko.

MacDiarmid Emeritus Investigator and University of Otago Deputy Vice-Chancellor Professor Richard Blaikie, who gave the lecture in Invercargill, said the content of the lecture resonated well in the deep south.

"There's a connection to indigenous materials, especially in Invercargill, where we could talk about the very important quarry sites in Bluff and the modern materials processes just across the harbour at Tiwai Point."

Professor Blaikie said he thoroughly enjoyed giving the lecture.

"I'm a Southlander so any opportunity to go to the fine city of Invercargill I'll jump on. And the Regional Lecture Series sits with the philosophy of the Institute and also the broader objective of MacDiarmid research in particular, where we have a culture of service; speaking about science—and materials science in particular—is what we do."

We have a culture of service; speaking about and teaching science.

The MacDiarmid team inspired us, as Maori and Pacific youth, to get out there and keep discovering—the possibilities are endless.

3.10
Discovering nanoscience

Our NanoCamp and DiscoveryCamp continue to attract high numbers of applications from Year 12 and 13 secondary students. This year, 10 times as many students applied for NanoCamp as there were places, and four times as many as there were places for DiscoveryCamp.

The five-day all-expenses paid residential programmes deliver practical lab experience with MacDiarmid Institute investigators. This year the programmes were run by Associate Professor Guy Jameson (University of Otago), Professor Maan Alkaisi (Canterbury) and Professor Shane Telfer (Massey University).

Perhaps one of the best validations for our science is the number and calibre of international scientists and universities wishing to collaborate.

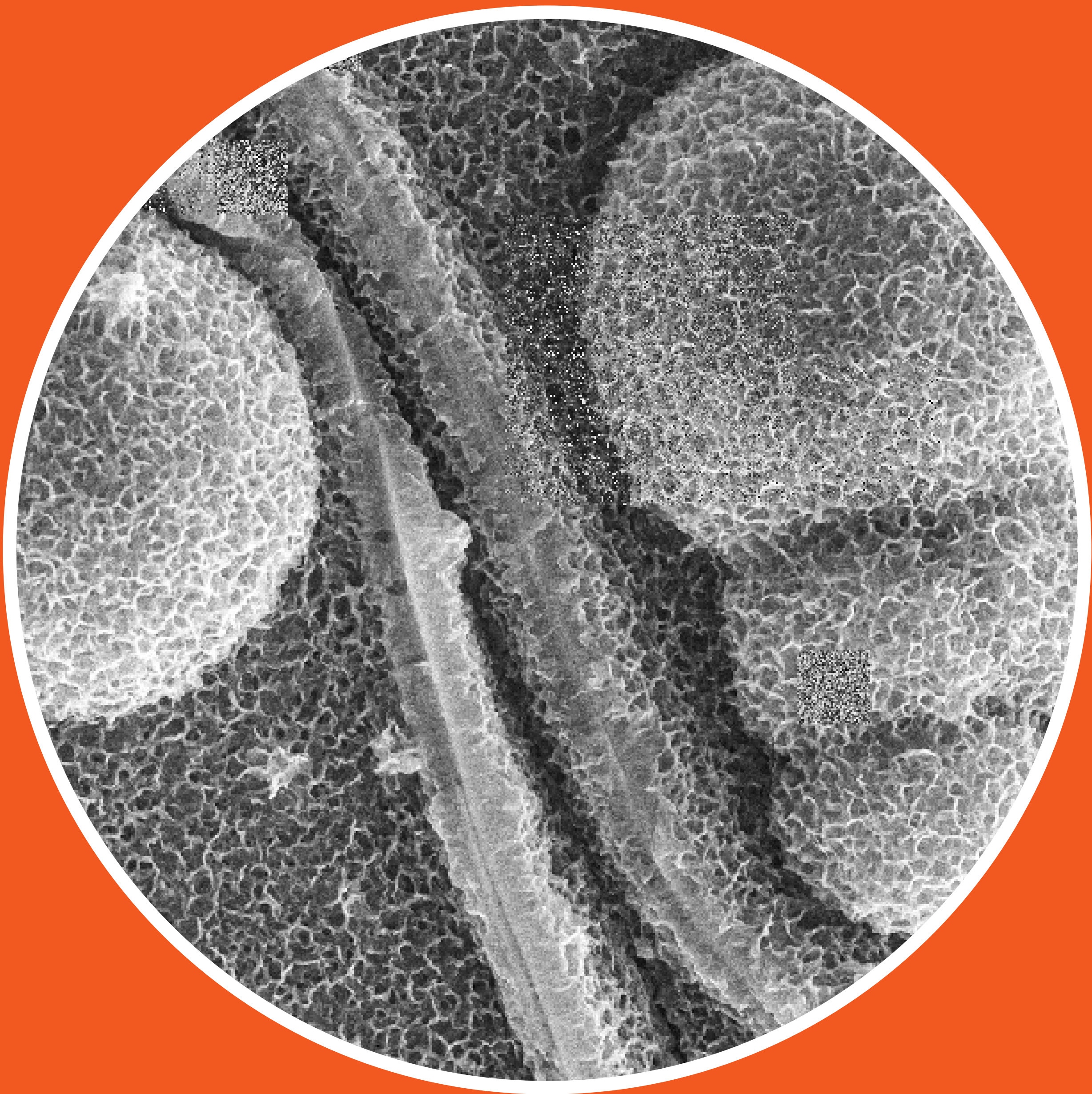
3.11
Internationally engaged

We have formal Memorandums of Understanding (MoU) with the Australian National Fabrication Facility and the Centre for Convergent Bio-Nano Science and Technology in Australia and in 2016 signed an MoU with the National Institute for Materials Science (NIMS) in Japan. We have several other MoUs in the pipeline.

All MacDiarmid researchers have strong and ongoing collaborations with international partners, including with members of our International Science Advisory Board (ISAB), many of whom are based at Ivy League universities and top research colleges and institutions around the world.

4. Into the metrics

4. Into the metrics



4.1 Journal covers

Nicola Gaston and coworkers

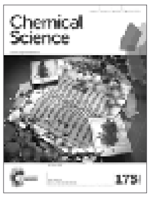
'Interaction of boron nitride nanosheets with model cell membranes'

ChemPhysChem 2016

Thomas Nann and coworkers

'SWCNT photocathodes sensitised with InP/ZnS core–shell nanocrystals'

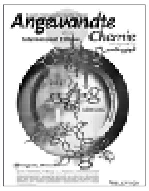
Chem. C 2016



Sally Brooker and coworkers

'Reversible quantitative guest sensing via spin crossover of an iron(II) triazole'

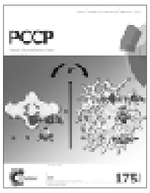
Chem.Sci. 2016



Sally Brooker and coworkers

'Non-porous iron(II)-based sensor: crystallographic insights into a cycle of colorful guest-induced topotactic transformations'

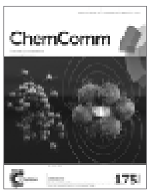
Angew. Chem. Int. Ed. 2016



Nicola Gaston and coworkers

'Phosphine passivated gold clusters: how charge transfer affects electronic structure and stability'

Phys. Chem. Chem. Phys. 2016



Carla Meledandri and coworkers

'Size-selectable nanoparticle assemblies with magnetic anisotropy tunable across the superparamagnetic to ferromagnetic range'

Chem. Commun. 2016

Sally Brooker and coworkers

'Di-zinc lactide polymerization catalysts: hyper-activity by control of ligand conformation and metallic cooperativity'

Angew. Chem. Int. Ed. 2016

4.2 Awards

Margaret Brimble	NZ Association of Scientists Marsden Medal (Lifetime Achievement in Science) Royal Society of Chemistry Australasian Lectureship
Michelle Dickinson	Women of Influence Award for Innovation and Science
Nicola Gaston	CMMSE Prize from the International Conference on Computational and Mathematical Methods in Science and Engineering 2016. 'For work on the properties of atomic clusters'
Vladimir Golovko	The University of Canterbury Supreme Sustainability Award 2016
Guy Jameson	Hill Tinsley Medal, New Zealand Association of Scientists
Jerome Leveneur	Technology Valley Awards 2016, Outstanding Individual
Carla Meledandri	Norman F.B. Barry Foundation Emerging Innovator Award at the 2016 KiwiNet Commercialisation Awards University of Otago Division of Science Industry Link Award 2016 New Zealand Institute of Chemistry Shimadzu Industrial and Applied Chemistry Prize, 2016
Cather Simpson	First place medal in AgTech at the Silicon Valley Forum Tech World Cup AgFunder Innovation Award: 5 Most Innovative International Start-ups at Series A and Beyond, Engender Technologies. TIN200 Most Promising Early Stage Companies Award (NZ) Named a Ministry for Primary Industries Champion for projects like Engender and Orbis and Primary Growth Partnership research on milk BNZ Supreme Award at the 2016 KiwiNet Research Commercialisation Awards—for overall excellence in all core areas of research commercialisation Baldwins Researcher Entrepreneur Award at the 2016 KiwiNet Research Commercialisation Awards
Jadranka Travas-Sejdic, David Williams, and their team 'SpotCheck'	Winner The University of Auckland Velocity challenge
Geoff Waterhouse	Chinese Academy of Sciences International Cooperation Award for Young Scientists for outstanding collaborative research with Professor Tierui Zhang
David Williams	Aeroqual, a company co-founded by Principal Investigator Professor David Williams, won the Endace Innovative Hardware Product Award at the 2016 Hi-Tech Awards for an air quality monitoring device

4.3
Funding successes

2016 MacDiarmid Investigator (MI) Marsden winners

MI Investigators	Title
Dr Shen Chong Victoria University of Wellington	Nanostructuring in iron-based wires for ultra-high current density
Dr Anna Garden University of Otago	A green approach to denitrification of water
Associate Professor Justin Hodgkiss Victoria University of Wellington	The origin of UV photoprotection in the brown skin pigment eumelanin
Professor Eric Le Ru Victoria University of Wellington	Probing the optical absorption of molecules adsorbed on metallic nanoparticles
Dr Jenny Malmström University of Auckland	Nano-containers for signals to cells—when and where they are needed

2016 MBIE Smart Ideas grants awarded to MacDiarmid Investigators

MI Investigators	Title
Jadranka Travas-Sejdic & team University of Auckland	Elastomeric, conductive and functionalised electrospun nanofibres for high-performance anti-fouling microfiltration membranes
Michelle Dickinson & team, University of Auckland	Fundamental redesign of percutaneous drains for effective drainage and reduced infection
Andreas Markwitz & team, GNS Science	Ion sources and silicon-28 islands for quantum bits
Justin Hodgkiss & team, Victoria University of Wellington	Aptamers for customisable analytical devices: application to methamphetamine detection
Simon Brown & team, University of Canterbury	A neuromorphic computer chip: computational hardware that works like the brain
Maan Alkaisi, Vladimir Golovko, Thomas Nann, Aaron Marshall University of Canterbury, Victoria University of Wellington	Development of a solar redox flow battery for direct solar energy capture and storage
Carla Meledandri & team University of Otago	"Silverbone"—Otago's nanosilver technology plus NZ-manufactured bone graft produces unique antibacterial biomaterial

2016 MBIE Research Programme grants

MI investigators	Title
Jim Johnston & team Victoria University of Wellington	Enhanced Geothermal Energy Recovery Through Nanotechnology: An innovative enduring solution to the worldwide silica deposition problem
Keith Gordon & team University of Otago	Capturing the true value of NZ meat: objective measurement of meat quality in beef, lamb and venison

2016 Rutherford Discovery Fellowships

Dr Jenny Malmström, University of Auckland

Baptiste Auguié (MacDiarmid alumnus) Victoria University of Wellington

2016 Rutherford Foundation Postdoctoral Scholarships

Ben Mallett MacDiarmid alumnus (and now working with Principal Investigator Professor Cather Simpson), University of Auckland

Nick Monahan (MacDiarmid alumnus and now working with Principal Investigator Associate Professor Justin Hodgkiss) Victoria University of Wellington

2016 KiwiNet $25k Emerging Innovator Awards

Dr Brendan Darby (MacDiarmid alumnus and now with Principal Investigator Professor Eric Le Ru), Victoria University of Wellington

Dr Nick Monahan (MacDiarmid alumnus and now with Principal Investigator Associate Professor Justin Hodgkiss) Victoria University of Wellington

4.4 Financials 2016

	2016
CoRE funding	4,518,755
Other funding (mainly interest income)	175,129
Total revenue	4,693,884
Salaries and salary-related costs	
Director and principal investigators	603,362
Post Doctoral Fellows	405,415
Research/Technical Assistants	142,614
Others	317,825
Total salaries and salary-related costs	1,469,216
Other costs	
Overheads	1,294,059
Project costs	741,787
Travel	416,674
Postgraduate Students	772,149
Total other costs	3,224,668
Total expenditure	4,693,884

4.5
At a glance

Broad category	Detailed category	Year 2
Headcounts by category	Emeritus Investigators	15
	Principal Investigators	32
	Associate Investigators	23
	Postdoctoral researchers	18
	Students	204
	Total	292
Peer reviewed research outputs by type	Journal articles	230
	Book chapters	5
	Conference papers	14
	Total	249

Commercial activities	To report for 2016
Patent applications	15
Patents granted	5
New spin-outs	3
Total	23

Governance Representative Board

Dr Raymond Thomson
Chair of the Board

Mr Will Charles
General Manager, Tech Div,, Uni Services, University of Auckland

Professor Don Cleland
Head of School and Professor of Process Engineering, Massey University

Dr Ian Graham
Director Research, GNS Science

Professor Wendy Lawson
Pro Vice-Chancellor Science, University of Canterbury

Dr Wayne Ngata
Ministry of Education

Professor Vernon Squire
Deputy Vice-Chancellor, Academic & International, University of Otago

Dr Geoff Todd
Managing Director, VicLink Limited, Victoria University of Wellington

Professor Mike Wilson
Pro Vice-Chancellor Science, Engineering, Architecture & Design
Victoria University of Wellington

Ex-Officio

Professor Thomas Nann
Director of the MacDiarmid Institute, Victoria University of Wellington

Associate Professor Nicola Gaston
Deputy Director Stakeholder Engagement, University of Auckland

Associate Professor Justin Hodgkiss
Deputy Director Commercialisation and Industry Engagement, Victoria University of Wellington

Industry Advisory Group

Paul Adams
CEO, EverEdge IP

Simon Arnold
CEO
Arnold Consulting

Lewis Gradon
Managing Director and Chief Executive Officer
Fisher & Paykel Healthcare

Michael McIlroy
Engineering Manager – Research & Development
Rakon Ltd

Greg Shanahan
Managing Director and Co-founder
Veriphi Ltd

Barbara Webster
General Manager, Business Development and Innovation
Scott Technology

International Science Advisory Board

Professor Sir Richard Friend
Cavendish Professor of Physics University of Cambridge, Great Britain
Organic Optoelectronics

Professor Justin Gooding
Scientia Professor and founding Co-Director of The Australian Centre for NanoMedicine School of Chemistry, University of New South Wales Australia
Nano-medicine and electrochemistry

Professor Michael Kelly FRS
Prince Philip Professor of Technology, University of Cambridge, UK
Electro-optic materials and devices

Professor Jeffrey Long
Professor of Chemical & Biomolecular Engineering, UC Berkeley
Inorganic and solid state chemistry

Professor Daniel Nocera
The Henry Dreyfus Professor of Energy and Professor of Chemistry MIT, USA
Catalysis, energy

Professor Teri Odom
Associate Chair of the Department of Chemistry
Designing structured nanoscale materials with exceptional properties

Professor Ivan Parkin
Professor of Physics and Head of Nanoscience Group UC San Diego USA
Nanostructured, organic, magnetic and superconducting materials

Professor Thomas Schimmel
Research Unit Chair, Karlsruhe Institute of Technology
Scanning probe microscopy and nanolithography

Professor Michelle Simmons
Professor of Physics, University of New South Wales
Quantum physics

Professor Matt Trau
Australian Institute for Bioengineering & Nanotechnology
Deputy Director, The University of Queensland
Nanoscience, nanotechnology and molecular diagnostics

Professor David Williams
Chief Research Scientist and Laboratory Manager, Hitachi Cambridge Laboratory, Cambridge, UK
Nano engineered electronic devices

Science Executive

Professor Thomas Nann
Director
Victoria University of Wellington

Associate Professor Justin Hodgkiss
Deputy Director, Commercialisation and Industry Engagement
Victoria University of Wellington

Associate Professor Nicola Gaston
Deputy Director, Stakeholder Engagement
University of Auckland

Professor Keith Gordon
Science Leader: Materials for Energy Capture & Utilisation University of Otago

Professor Roger Reeves*
Science Leader: Materials for High Value Technologies, University of Canterbury

Professor Simon Brown*
Principal Investigator, University of Canterbury

Professor Jadranka Travas-Sejdic*
Principal Investigator Representative
University of Auckland

Professor Juliet Gerrard*
Principal Investigator Representative
University of Canterbury

Dr Simon Granville
Associate Investigator Representative
Robinson Research Institute

Professor Shane Telfer
Principal Investigator Representative
Massey University

Dr Geoff Willmott
Principal Investigator Representative
Callaghan Innovation

Mr Shaymal Prasad
MESA Chairperson
Victoria University of Wellington

* Partial year

MacDiarmid Emerging Scientist Association (MESA) 2016

Shyamal Prasad
Chair
PhD Student
Victoria University of Wellington

Leo Browning
Secretary & Treasurer
PhD Student
Victoria University of Wellington

Alex Nieman
PhD Student
University of Canterbury

Ankita Gangotra
PhD Student
University of Auckland

Cherie Tollamache
PhD Student
University of Auckland

Felicia Ullstad
PhD Student
Victoria University of Wellington

Harry Warring
PhD Student
Victoria University of Wellington

Justinas Butkus
Deputy Director
Commercialisation and Industry Engagement

Kathryn Schroeder
PhD Student
Victoria University of Wellington

Madhuri Kumari
PhD Student
University of Otago

Matheu Broom
PhD Student
University of Auckland

Nina Novikova
PhD Student
University of Auckland

Parth Vashishtha
Industry Engagement
PhD Student
Victoria University of Wellington

Emeritus Investigators

Professor Blaikie, Richard, University of Otago

Dr Brown, Ian, Callaghan Innovation

Professor Buckley, Bob, Victoria University of Wellington

Professor Davenport, Sally, Victoria University of Wellington

Professor Evans, John, University of Otago

Professor Hall, Simon, Massey University

Professor Johnston, Jim, Victoria University of Wellington

Professor Kaiser, Alan, Victoria University of Wellington

Dr Kemmitt, Tim, Callaghan Innovation

Professor MacKenzie, Ken, Victoria University of Wellington

Professor McGrath, Kate, Victoria University of Wellington

Professor Metson, Jim, University of Auckland

Professor Reid, Mike, University of Canterbury

Professor Tallon, Jeff, Victoria University of Wellington

Professor Tilley, Richard, University of New South Wales

Principal Investigators

Professor Alkaisi, Maan, University of Canterbury

Dr Allen, Martin, University of Canterbury

Professor Brooker, Sally, University of Otago

Professor Brothers, Penny, University of Auckland

Professor Brown, Simon, University of Canterbury

Professor Downard, Alison, University of Canterbury

Associate Professor Gaston, Nicola, University of Auckland

Professor Gerrard, Juliet, University of Canterbury

Professor Gordon, Keith, University of Otago

Associate Professor Governale, Michele, Victoria University of Wellington

Dr Halpert, Jonathan, Victoria University of Wellington

Associate Professor Hodgkiss, Justin, Victoria University of Wellington

Associate Professor Kruger, Paul, University of Canterbury

Professor Le Ru, Eric, Victoria University of Wellington

Dr Markwitz, Andreas, GNS Science

Dr McGillivray, Duncan, University of Auckland

Dr Meledandri, Carla J., University of Otago

Professor Nann, Thomas, Victoria University of Wellington

Dr Natali, Franck, Victoria University of Wellington

Dr Plank, Natalie, Victoria University of Wellington

Professor Reeves, Roger, University of Canterbury

Associate Professor Ruck, Ben, Victoria University of Wellington

Professor Simpson, Cather, University of Auckland

Professor Telfer, Shane, Massey University

Professor Travas-Sejdic, Jadranka, University of Auckland

Professor Trodahl, Joe, Victoria University of Wellington

Associate Professor Waterhouse, Geoff, University of Auckland

Professor Williams, Martin (Bill), Massey University

Professor Williams, David, University of Auckland

Dr Williams, Grant, Victoria University of Wellington

Dr Willmott Geoff, Callaghan Innovation

Professor Züelicke, Ulrich, Victoria University of Wellington

Associate Investigators

Professor Brimble, Margaret, University of Auckland

Dr Bumby, Chris, Victoria University of Wellington

Dr Carder, Damian, Callaghan Innovation

Dr Chong, Shen, Victoria University of Wellington

Dr Dickinson, Michelle University of Auckland

Associate Professor Galvosas, Petrik, Victoria University of Wellington

Dr Garden, Anna, University of Otago

Dr Golovko, Vladimir, University of Canterbury

Dr Granville, Simon, Victoria University of Wellington

Professor Hendy, Shaun, University of Auckland

Dr Ingham, Bridget, Callaghan Innovation

Associate Professor Jameson, Guy, University of Otago

Professor Jameson, Geoff, Massey University

Dr Kennedy, John, GNS Science

Dr Leveneur, Jerome, GNS Science

Dr Lucas, Nigel, University of Otago

Dr Malmström, Jenny, University of Auckland

Dr Nock, Volker, University of Canterbury

Professor Smith, Kevin, University of Auckland

Dr Storey, James, Robinson Research Institute

Associate Professor Waterland, Mark, Massey University

Dr Whitby, Catherine, Massey University

Dr Wimbush, Stuart, Victoria University of Wellington

Postdoctoral Researchers

Anton, Eva, Victoria University of Wellington

Bose, Saurabh, University of Canterbury

Bradley, Siobhan, Victoria University of Wellington

Chen, Kai, Victoria University of Wellington

Domigan, Laura, University of Auckland

Dubuis, Guy, Victoria University of Wellington

Goreham, Renee, Victoria University of Wellington

Hammerschmidt, Luke, University of Auckland

Hilder, Tamsyn, Victoria University of Wellington

Kernreiter, Thomas, Victoria University of Wellington

Ludbrook, Bartholomew, Victoria University of Wellington

Maerkl, Junji (Tobias), University of Canterbury

Medini, Karima, University of Auckland

Monahan, Nicholas, Victoria University of Wellington

Roy, Prathik, University of Canterbury

Soffe, Rebeccca, University of Canterbury

Weissert, Lena, University of Auckland

Yang, Hui, Massey University

Administration Team

Centre Manager, Jacqui FitzGerald, Victoria University of Wellington

Strategic Engagement Analyst, Vanessa Young, Victoria University of Wellington

Administrator, Sonia Hutton, Victoria University of Wellington

Research Engineer, Gary Turner, University of Canterbury

Students

Afsar, Saeedeh, PhD, Victoria University of Wellington

Agbenyegah, Gordon, PhD, University of Auckland

Ahmed, Zuned, PhD, University of Canterbury

Akers, Peter, PhD, University of Auckland

Amalathas, Amalraj Peter, PhD, University of Canterbury

Andrade, Isabela, PhD, University of Auckland

Ashmead, Helen, PhD, University of Canterbury

Alkas, Adil, PhD, Massey University

Al-Azri, Zakiya, PhD, University of Auckland

Al-Zeer, Mohammad, PhD, Victoria University of Wellington

Ashforth, Simon, PhD, University of Auckland

Ayedmir, Nihan, PhD, University of Auckland

Baek, Paul, PhD, University of Auckland

Bakker, Caroline, PhD, University of Canterbury

Banholtzer, Mortiz, PhD, Victoria University of Wellington

Baldhoff, Tobias, PhD, University of Canterbury

Baranov, Anton, PhD, University of Canterbury

Barnsley, Jono, PhD, University of Otago

Bell, Kalib, PhD, University of Canterbury

Bennington, Michael, PhD, University of Otago

Blackwood, Sebastian, PhD, Massey University

Bhatia, Rishabh, PhD, Victoria University of Wellington

Baharudin, Luqmanulhakim, PhD, University of Canterbury

Bhugra, Vaibhav, PhD, Victoria University of Wellington

Bogunovic, Dijana, PhD, University of Auckland

Bourke, Levi, PhD, University of Otago

Broom, Matheu, PhD, University of Auckland

Brown, Gabriella, PhD, University of Otago

Browning, Leo, PhD, Victoria University of Wellington

Burke-Govey, Conor, PhD, Victoria University of Wellington

Butkus, Justinas, PhD, Victoria University of Wellington

Canever, Nicolo, PhD, Victoria University of Wellington

Cink, Ruth, PhD, University of Auckland

Chan, Eddie, PhD, University of Auckland

Chan, Jay, PhD, Victoria University of Wellington

Chan, Valentine, PhD, Victoria University of Wellington

Chan, Andrew, PhD, University of Auckland

Chen, Lida, PhD, University of Canterbury

Chaudhary, Omer, PhD, University of Auckland

Chen, Shuxiong, PhD, Massey University

Chen, Wan-ting, PhD, University of Auckland

Conroy, Frankie, PhD, University of Auckland

Cook, Michelle, PhD, Victoria University of Wellington

Cotton, Gemma, PhD, University of Otago

Couture, Pierre, PhD, GNS

Crump, Wayne, PhD, Victoria University of Wellington

Cryer, Mathew, PhD, Victoria University of Wellington

Damavanti, Mona, PhD, University of Auckland

Darby, Brendan, PhD, Victoria University of Wellington

Davidson, Hannah, PhD, University of Otago

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Authors	Title	Journal
Amalathas, A.P., **Alkaisi, M.M.**	Upright nanopyramid structured cover glass with light harvesting and self-cleaning effects for solar cell applications	*Journal of Physics D: Applied Physics* **49**, (2016)
Amalathas, A.P., **Alkaisi, M.M**.	Effects of film thickness and sputtering power on properties of ITO thin films deposited by RF magnetron sputtering without oxygen	*Journal of Materials Science: Materials in Electronics* **27**, 11064-11071 (2016)
Murray, L.M., **Nock, V**., **Evans, J.J.**, **Alkaisi, M.M.**	The use of substrate materials and topography to modify growth patterns and rates of differentiation of muscle cells	*Journal of Biomedical Materials Research – Part A* **104**, 1638-1645 (2016)
McNeill, A.R., Hyndman, A.R., **Reeves, R.J.**, **Downard, A.J**., **Allen, M.W.**	Tuning the band bending and controlling the surface reactivity at polar and nonpolar surfaces of ZnO through phosphonic acid binding	*ACS Applied Materials and Interfaces* **8**, 31392-31402 (2016)
Blesić, S.M., Stratimirović, D.I., Ajtić, J.V., Wright, C.Y., **Allen, M.W.**	Novel approach to analysing large data sets of personal sun exposure measurements	*Journal of Exposure Science and Environmental Epidemiology* **26**, 613-620 (2016)
Køster, B., Søndergaard, J., Nielsen, J.B., **Allen, M.**, Bjerregaard, M., Olsen, A., Bentzen, J.	Effects of smartphone diaries and personal dosimeters on behavior in a randomized study of methods to document sunlight exposure	*Preventive Medicine Reports* **3**, 367-372 (2016)
Dang, G.T., Uchida, T., Kawaharamura, T., Furuta, M., Hyndman, A.R., Martinez, R., Fujita, S., **Reeves, R.J**., **Allen, M.W.**	Silver oxide Schottky contacts and metal semiconductor field-effect transistors on SnO2 thin films	*Applied Physics Express* **9**, (2016)
Dobbinson, S., Niven, P., Buller, D., **Allen, M.**, Gies, P., Warne, C.	Comparing handheld meters and electronic dosimeters for measuring ultraviolet levels under shade and in the sun	*Photochemistry and Photobiology* **92**, 208-214 (2016)
Kumari M., Ding B., **Blaikie R.**	Enhanced resonant absorption in dye-doped polymer thin-film cavities for water vapour sensing	*Sensors and Actuators, B: Chemical* **231**, 88-94 (2016)
Xingxing Chen, Min Qiu, **Richard J. Blaikie**, Boyang Ding	Illumination dependent optical properties of plasmonic nanorods coupled to thin-film cavities	*Plasmonics* **11**, 1101-1107 (2016)
Strover, L.T., **Malmström, J.**, Stubbing, L.A., **Brimble, M.A.**, **Travas-Sejdic, J**.	Electrochemically-controlled grafting of hydrophilic brushes from conducting polymer substrates	*Electrochimica Acta* **188**, 57-70 (2016)
Dolan, C., Drouet, F., Ware, D.C., **Brothers, P.J.**, Jin, J., **Brimble, M.A.**, **Williams, D.E.**	A new high-capacity metal ion-complexing gel containing cyclen ligands	*RSC Advances* **6**, 23645-23652 (2016)
Medini, K., Mansel, B.W., **Williams, M.A.K.**, **Brimble, M.A.**, **Williams, D.E.**, **Gerrard, J.A.**	Controlling gelation with sequence: towards programmable peptide hydrogels	*Acta Biomaterialia* **43**, 30-37 (2016)
Rodríguez-Jiménez, S., Feltham, H.L.C., **Brooker, S.**	Non-porous iron (II)-based sensor: Crystallographic insights into a cycle of colorful guest-induced topotactic transformations	*Angewandte Chemie – International Edition* **55**, 15067-15071 (2016)
Miller, R.G., Southon, P.D., Kepert, C.J., **Brooker, S.**	Commensurate CO<inf>2</inf> Capture, and Shape Selectivity for HCCH over H2CCH2, in Zigzag Channels of a Robust CuI(CN)(L) Metal-Organic Framework	*Inorganic Chemistry* **55**, 6195-6200 (2016)
Malthus, S.J., Cameron, S.A., **Brooker, S.**	First row transition metal complexes of di-o-substituted-diarylamine-based ligands (including carbazoles, acridines and dibenzoazepines)	*Coordination Chemistry Reviews* **316**, 125-161 (2016)
Hogue, R.W., Feltham, H.L.C., Miller, R.G., **Brooker, S.**	Spin Crossover in Dinuclear N4S2 Iron (II) Thioether-Triazole Complexes: Access to [HS-HS], [HS-LS], and [LS-LS] States	*Inorganic Chemistry* **55**, 4152-4165 (2016)
Miller, R.G., Brooker, S.	Reversible quantitative guest sensing via spin crossover of an iron (ii) triazole	*Chemical Science* **7**, 2501-2505 (2016)
Malthus, S.J., Wilson, R.K., Larsen, D.S., **Brooker, S.**	Acridine-based ligands from cobalt (II) mediated rearrangement of diphenylamine-based starting materials	*Supramolecular Chemistry* **28**, 98-107 (2016)
Janzen, D.E., Juchum, M., Presow, S.R., Ronson, T.K., Mohr, W., Clérac, R., Feltham, H.L.C., **Brooker, S.**	Trigonal (-3) symmetry octahedral lanthanide (III) complexes of zwitterionic tripodal ligands: luminescence and magnetism	*Supramolecular Chemistry* **28**, 125-140 (2016)

Authors	Title	Journal
White, N.G., **Brooker, S.**	New complexation behaviour of the potentially bis-terdentate triazole based ligands PMAT and PMPT: FeIII4 oxo-bridged metallomacrocycles	*Polyhedron* **103**, 283-287 (2016)
Dhers, S., Feltham, H.L.C., Rouzières, M., Clérac, R., **Brooker, S.**	Macrocyclic {3d-4f} SMMs as building blocks for 1D-polymers: selective bridging of 4f ions by use of an O-donor ligand	*Dalton Transactions* **45**, 18089-18093 (2016)
Thevenon, A., Romain, C., Bennington, M.S., White, A.J.P., Davidson, H.J., **Brooker, S.**, Williams, C.K.	Dizinc lactide polymerization catalysts: hyperactivity by control of ligand conformation and metallic cooperativity	*Angewandte Chemie – International Edition* **55**, 8680-8685 (2016)
Fang, H., Jing, H., Zhang, A., Ge, H., Yao, Z., **Brothers, P.J**., Fu, X.	Synthesis, electronic structure, and reactivity studies of a 4-coordinate square planar germanium(IV) cation	*Journal of the American Chemical Society* **138**, 7705-7710 (2016)
Liu, B., Novikova, N., Simpson, M.C., Timmer, M.S.M., Stocker, B.L., Söhnel, T., Ware, D.C., **Brothers, P.J.**	Lighting up sugars: Fluorescent BODIPY-: Gluco -furanose and -septanose conjugates linked by direct B-O-C bonds	*Organic and Biomolecular Chemistry* **14**, 5205-5209 (2016)
Calloch, P., **Brown**, **I.W.M., MacKenzie, K.J.D.,** Hanna, J.V., Rees, G. J.	Synthesis and properties of newβSialon/TiN composites via a novel AlxTiy intermediate	*Ceramics International* **42**, 2330-2338 (2016)
Geoff Smith, **Ian Brown**, Alex Kirchner, Peter McGavin, Martin Ryan, Matt Sharp.	Engineering properties of cellular Ti-6Al-4V structures fabricated by electron beam melting	*Key Engineering Materials* **704**, 318-324 (2016)
Pantoja, A.E., Jiang, Z., Badcock, R.A., **Bumby, C.W.**	Impact of stator wire width on output of a dynamo-type hts flux pump	*IEEE Transactions on Applied Superconductivity* **26**, (2016)
Jiang, Z., Long, N.J., Staines, M., Badcock, R.A., **Bumby, C.W.**, Buckley, R.G., Amemiya, N.	AC loss measurements in HTS coil assemblies with hybrid coil structures	*Superconductor Science and Technology* **29**, (2016)
Bumby, C.W., Pantoja, A.E., Sung, H.-J., Jiang, Z., Kulkarni, R., Badcock, R.A.	Through-wall excitation of a magnet coil by an external-rotor hts flux pump	*IEEE Transactions on Applied Superconductivity* **26**, (2016)
Bumby, C.W., Jiang, Z., **Storey, J.G**., Pantoja, A.E., Badcock, R.A.	Anomalous open-circuit voltage from a High-Tc superconducting dynamo	*Applied Physics Letters* **108**, (2016)
Jiang, Z., **Bumby, C.W.**, Badcock, R.A., Sung, H.-J., Slade, R.A.	A novel rotating HTS flux pump incorporating a ferromagnetic circuit	*IEEE Transactions on Applied Superconductivity* **26**, (2016)
Bumby, C.W., Badcock, R.A., Sung, H.-J., Kim, K.-M., Jiang, Z., Pantoja, A.E., Bernardo, P., Park, M., Buckley, R.G.	Development of a brushless HTS exciter for a 10 kW HTS synchronous generator	*Superconductor Science and Technology* **29**, (2016)
Jiang, Z., **Bumby, C.W.**, Badcock, R.A., Long, N.J., Sung, H.J., Park, M.	A rotating flux pump employing a magnetic circuit and a stabilized coated conductor HTS stator	*Journal of Magnetics* **21**, 239-243 (2016)
Chong, S.V., **Williams, G.V.M.**, Moody, R.L.	The effect of manganese incorporation in Bi2xe3 on the thermal, electrical transport and magnetic properties	*Journal of Alloys and Compounds* **686**, 245-251 (2016)
Anton, E.M.**, Granville, S.,** Engel, A., Chong, S.V.**, Governale, M., Züelicke, U.,** Moghaddam, A.G.**, Trodahl, H.J., Natali, F.,** Vézian, S.**, Ruck, B.J.**	Superconductivity in the ferromagnetic semiconductor samarium nitride	*Physical Review B – Condensed Matter and Materials Physics* **94**, (2016)
Georgieva, N.M., Rybicki, D., Guehne, R., **Williams, G.V.M.**, **Chong, S.V.**, Kadowaki, K., Garate, I., Haase, J.	Se 77 nuclear magnetic resonance of topological insulator Bi2Se3	*Physical Review B – Condensed Matter and Materials Physics* **93**, (2016)
Sambale, S., **Williams, G.V.M., Chong, S.V**	The effect of oxygen content on the magnetic and transport properties of FeSr2Y1.5Ce0.5CuxOx+x	*Physica B: Condensed Matter* **487**, 68-72(2016)
Brooksby, P.A., Shields, J.D., Farquhar, A.K., **Downard, A.J.**	Reduction of nitrophenyl films in aqueous solutions: how many electrons?	*ChemElectroChem* **3**, 2021-2026 (2016)
Farquhar, A.K., Fitchett, C.M., Dykstra, H.M., **Waterland, M.R.**, Brooksby, P.A., **Downard, A.J.**	Diels-alder reaction of anthranilic acids: a versatile route to dense monolayers on flat edge and basal plane graphitic carbon substrates	*ACS Applied Materials and Interfaces* **8**, 23389-23395 (2016)

Authors	Title	Journal
Farquhar, A.K., Dykstra, H.M., **Waterland, M.R.**, **Downard, A.J.**, Brooksby, P.A.	Spontaneous modification of free-floating few-layer graphene by aryldiazonium ions: electrochemistry, atomic force microscopy, and infrared spectroscopy from grafted films	*Journal of Physical Chemistry C* **120**, 7543-7552 (2016)
Lee, L., Gunby, N.R., Crittenden, D.L., **Downard, A.J.**	Multifunctional and stable monolayers on carbon: a simple and reliable method for backfilling sparse layers grafted from protected aryldiazonium ions	*Langmuir* **32**, 2626-2637 (2016)
Menanteau, T., Dias, M., Levillain, E., **Downard, A.J.**, Breton, T.	Electrografting via diazonium chemistry: the key role of the aryl substituent in the layer growth mechanism	*Journal of Physical Chemistry C* **120**, 4423-4429 (2016)
Lee, L., Brooksby, P.A., Hapiot, P., **Downard, A.J.**	Electrografting of 4-nitrobenzenediazonium ion at carbon electrodes: catalyzed and uncatalyzed reduction processes	*Langmuir* **32**, 468-476 (2016)
McMorran, D.A., Fitzpatrick, M.G., Cunninghame, R.G., **Downard, A.J.**, Robinson, W.T., Hanton, L.R.	X-ray structures and dynamic solution behaviours of five-coordinate nickel(II) complexes containing di- and tritertiary arsine ligands	*Australian Journal of Chemistry* **69**, 512-523 (2016)
Duschl, M., Pohlmeier, A., Brox, T.I., **Galvosas, P.**, Vereecken, H.	Effect of magnetic pore surface coating on the NMR relaxation and diffusion signal in quartz sand	*Magnetic Resonance in Chemistry* **54**, 975-984 (2016)
Brox, T.I., Douglass, B., **Galvosas, P.**, Brown, J.R.	Observations of the influence of Taylor-Couette geometry on the onset of shear-banding in surfactant wormlike micelles	*Journal of Rheology* **60**, 973-982 (2016)
Williamson, N.H., Röding, M., **Galvosas, P.**, Miklavcic, S.J., Nydén, M.	Obtaining T<inf>1</inf>-T<inf>2</inf> distribution functions from 1-dimensional T<inf>1</inf> and T<inf>2</inf> measurements: the pseudo 2-D relaxation model properties of FeSr2Y1.5Ce0.5Cu2 O8+x	*Journal of Magnetic Resonance* **269**, 186-195 (2016)
Zong, F., d'Eurydice, M.N., **Galvosas, P.**	Fast reconstruction of highly undersampled MR images using one and two dimensional principal component analysis	*Magnetic Resonance Imaging* **34**, 227-238 (2016)
Ghadamgahi, S., Williamson, B.E., **Golovko, V.B.**	Activity of catalysts derived from Au101 Immobilized on activated carbon	*Catalysis Letters* **146**, 1027-1032 (2016)
Schacht, J., **Gaston, N.**	From the superatom model to a diverse array of super-elements: a systematic study of dopant influence on the electronic structure of thiolate-protected gold clusters	*ChemPhysChem* **17**, 3237-3244 (2016)
Hilder, T.A., **Gaston, N.**	Interaction of boron nitride nanosheets with model cell membranes	*ChemPhysChem* **17**, 1573-1578 (2016)
Steenbergen, K.G., **Gaston, N.**	A two-dimensional liquid structure explains the elevated melting temperatures of gallium nanoclusters	*Nano Letters* **16**, 21-26 (2016)
L. Hammerschmidt, J. Schacht, **N. Gaston**	First-principles calculations of the electronic structure & bonding in metal cluster-fullerene materials considered within the superatomic framework	*Phys. Chem. Chem. Phys.* **18**, 32541 (2016)
D. Mollenhauer, **N. Gaston**	Phosphine passivated gold clusters: how charge transfer affects electronic structure and stability	*Phys. Chem. Chem. Phys.* **18**, 29686-29697 (2016)
Hettiarachchi, C.A., Melton, L.D., **Williams, M.A.K.**, **McGillivray, D.J**., **Gerrard, J.A.**, Loveday, S.M.	Morphology of complexes formed between -lactoglobulin nanofibrils and pectins is influenced by the pH and structural characteristics of the pectins	*Biopolymers*, 819-831 (2016)
Yewdall, N.A., Venugopal, H., Desfosses, A., Abrishami, V., Yosaatmadja, Y., Hampton, M.B., **Gerrard, J.A.**, Goldstone, D.C., Mitra, A.K., Radjainia, M.	Structures of Human Peroxiredoxin 3 Suggest Self-Chaperoning Assembly that Maintains Catalytic State	*Structure* **24**, 1120-1129 (2016)
Hettiarachchi, C.A., Melton, L.D., **McGillivray, D.J**., Loveday, S.M., **Gerrard, J.A.**, **Williams, M.A.K.**	-Lactoglobulin nanofibrils can be assembled into nanotapes via site-specific interactions with pectin	*Soft Matter* **12**, 756-768 (2016)
Maryam Khoshouei Mazdak Radjainia, Amy J. Phillips, **Gerrard, J.A.**, Alok K. Mitra, Jürgen M. Plitzko, Wolfgang Baumeister, Radostin Danev	Volta phase plate cryo-EM of the small protein complex Prx3	*Nature Communications* **7**, (2016)

Authors	Title	Journal
Al Qahtani, H.S., Kimoto, K., Bennett, T., Alvino, J.F., Andersson, G.G., Metha, G.F., **Golovko, V.B.**, Sasaki, T., Nakayama, T.	Atomically resolved structure of ligand-protected Au9 clusters on TiO2 nanosheets using aberration-corrected STEM	*Journal of Chemical Physics* **144**, (2016)
Steven, J.T., **Golovko, V.B.**, Johannessen, B., Marshall, A.T.	Electrochemical stability of carbon-supported gold nanoparticles in acidic electrolyte during cyclic voltammetry	*Electrochimica Acta* **187**, 593-604 (2016)
Al Qahtani, H.S., Higuchi, R., Sasaki, T., Alvino, J.F., Metha, G.F., **Golovko, V.B.**, Adnan, R., Andersson, G.G., Nakayama, T.	Grouping and aggregation of ligand protected Au9 clusters on TiO2 nanosheets	*RSC Advances* **6**, 110765-110774 (2016)
Sosan, A., Svistunenko, D., Straltsova, D., Tsiurkina, K., Smolich, I., Lawson, T., Subramaniam, S., **Golovko, V.**, Anderson, D., Sokolik, A., Colbeck, I., Demidchik, V.	Engineered silver nanoparticles are sensed at the plasma membrane and dramatically modify the physiology of Arabidopsis thaliana plants	*Plant Journal* **85**, 245-257 (2016)
White, T.B. Reuben, **Golovko V.B.**, Andersson, Gunther G., Metha, Gregory F.	A systematic density functional theory study of the complete de−ligation of Ru3(CO)12, ChemistrySelect 3	*Chemistry Select* **6**, 1163-1167 (2016)
Huff, G.S., Lo, W.K.C., Horvath, R., Turner, J.O., Sun, X.-Z., Weal, G.R., Davidson, H.J., Kennedy, A.D.W., McAdam, C.J., Crowley, J.D., George, M.W., **Gordon, K.C.**	Excited states of triphenylamine-substituted 2-pyridyl-1,2,3-triazole complexes	*Inorganic Chemistry* **55**, 12238-12253 (2016)
Shillito, G.E., Larsen, C.B., McLay, J.R.W., **Lucas, N.T.**, **Gordon, K.C.**	Effect of bridge alteration on ground- and excited-state properties of ruthenium(ii) complexes with electron-donor-substituted dipyrido[3,2-a:2β3βc] phenazine ligands	*Inorganic Chemistry* **55**, 11170-11184 (2016)
Horvath, R., Huff, G.S., **Gordon, K.C.**, George, M.W.	Probing the excited state nature of coordination complexes with blended organic and inorganic chromophores using vibrational spectroscopy	*Coordination Chemistry Reviews* **325**, 41-58 (2016)
Larsen, C.B., Van Der Salm, H., Shillito, G.E., **Lucas, N.T.**, **Gordon, K.C.**	Tuning the rainbow: systematic modulation of donor-acceptor systems through donor substituents and solvent	*Inorganic Chemistry* **55**, 8446-8458 (2016)
Gallaher, J.K., Chen, K., Huff, G.S., Prasad, S.K.K., **Gordon, K.C.**, **Hodgkiss, J.M.**	Evolution of nonmirror image fluorescence spectra in conjugated polymers and oligomers	*Journal of Physical Chemistry Letters* **7**, 3307-3312 (2016)
Lisak, G., Wagner, K., Wagner, P., Barnsley, J.E., **Gordon, K.C.**, Bobacka, J., Wallace, G.G., Ivaska, A., Officer, D.L.	A novel modified terpyridine derivative as a model molecule to study kinetic-based optical spectroscopic ion determination methods	*Synthetic Metals* **219**, 101-108 (2016)
Preston, D., Barnsley, J.E., **Gordon, K.C**., Crowley, J.D.	Controlled formation of Heteroleptic (Pd2(La)2(Lb)2)4+ Cages	*Journal of the American Chemical Society* **138**, 10578-10585 (2016)
Barnsley, J.E., Scottwell, S.O., Elliott, A.B.S., **Gordon, K.C.**, Crowley, J.D.	Structural, electronic, and computational studies of heteroleptic Cu(I) complexes of 6,6βdimesityl-2,2β bipyridine with ferrocene-appended ethynyl-2,2β bipyridine ligands	*Inorganic Chemistry* **55**, 8184-8192 (2016)
Elliott, A.B.S., Horvath, R., Sun, X.-Z., Gardiner, M.G., Müllen, K., **Lucas, N.T.**, George, M.W., **Gordon, K.C.**	Long-lived charge transfer excited states in HBC-polypyridyl complex hybrids	*Inorganic Chemistry* **55**, 4710-4719 (2016)
McKay, A.P., Lo, W.K.C., Preston, D., Giles, G.I., Crowley, J.D., Barnsley, J.E., **Gordon, K.C.**, McMorran, D.A.	Palladium(II) and platinum(II) complexes of ((2-pyridyl)pyrazol-1-ylmethyl)benzoic acids: Synthesis, Solid state characterisation and biological cytotoxicity	*Inorganica Chimica Acta* **446**, 41-53 (2016)
Hong, S., Park, J.-H., Han, A.-R., Ko, K.-W., Eom, J.H., Namgoong, S.K., Lo, A.S.V., **Gordon, K.C.**, Yoon, S., Han, C.-H.	Salicylic acid-based organic dyes acting as the photosensitizer for solar cells	*Journal of Nanoscience and Nanotechnology* **16**, 4880-4885 (2016)
Elliott, A.B.S., Lewis, J.E.M., Van Der Salm, H., McAdam, C.J., Crowley, J.D., **Gordon, K.C.**	Luminescent cages: Pendant emissive units on (Pd2L4)4+ "Click" cages	*Inorganic Chemistry* **55**, 3440-3447 (2016)
Barnsley, J.E., Shillito, G.E., Larsen, C.B., Van Der Salm, H., Wang, L.E., **Lucas, N.T.**, **Gordon, K.C.**	Benzo[c][1,2,5]thiadiazole donor-acceptor dyes: a synthetic, spectroscopic, and computational study	*Journal of Physical Chemistry A* **120**, 1853-1866 (2016)

Authors	Title	Journal
Zhao, L., Wagner, P., Barnsley, J.E., Clarke, T.M., **Gordon, K.C.**, Mori, S., Mozer, A.J.	Enhancement of dye regeneration kinetics in dichromophoric porphyrin-carbazole triphenylamine dyes influenced by more exposed radical cation orbitals	*Chemical Science* **7**, 3506-3516 (2016)
Kodali, G., Mancini, J.A., Solomon, L.A., Episova, T.V., Roach, N., Hobbs, C.J., Wagner, P., Mass, O.A., Aravindu, K., Barnsley, J.E., **Gordon, K.C.**, Officer, D.L., Dutton, P.L., Moser, C.C.	Design and engineering of water-soluble light-harvesting protein maquettes	*Chemical Science* **8**, 316-324 (2016)
Hussein, R., Jaurigue, L., **Governale, M.**, Braggio, A.	Double quantum dot Cooper-pair splitter at finite couplings	*Physical Review B – Condensed Matter and Materials Physics* **94**, (2016)
Kernreiter, T., **Governale, M.**, **Züelicke, U**.	Quantum capacitance of an HgTe quantum well as an indicator of the topological phase	*Physical Review B - Condensed Matter and Materials Physics* **93**, (2016)
Droste, S., **Governale, M.**	Finite-time full counting statistics and factorial cumulants for transport through a quantum dot with normal and superconducting leads	*Journal of Physics Condensed Matter* **28**, (2016)
Valentini, S., **Governale, M.**, Fazio, R., Taddei, F.	Finite-frequency noise in a topological superconducting wire	*Physica E: Low-Dimensional Systems and Nanostructures* **75**, 15-21 (2016)
Kernreiter, T., **Governale, M.**, **Züelicke, U.**, Hankiewicz, E.M.	Anomalous spin response and virtual-carrier-mediated magnetism in a topological insulator	*Physical Review X* **6**, (2016)
Hunze, A., **Granville, S.**, Greenbank, W.	Magnetoresistance of electrochemically produced InSb	*Materials Research Innovations* **20**, 518-523 (2016)
Farrell, I. L., Hyndman, A.R. , **Reeves, R.J.**, **Williams, G.V.M.**, **Granville, S.**	Growth and characterisation of Ba2FeMoO6 thin films by pulsed laser deposition	*Thin Solid Films* **625**, 24-28 (2016)
Warring, H., **Trodahl, H.J.**, **Plank, N.O.V.**, **Natali, F.**, **Granville, S.**, **Ruck, B.J.**	Magnetic tunnel junctions incorporating a near-zero-moment ferromagnetic semiconductor	*Physical Review Applied* **6**, (2016)
Ludbrook, B.M., **Ruck, B.J.**, **Granville, S.**	Perpendicular magnetic anisotropy in Co2MnGa and Co<inf>2</inf>Fe<inf>Mn<inf>0.6</inf>si	*Journal of Applied Physics* **120**, (2016)
Raudsepp, A., **Williams, M.A.K.**, **Hall, S.B.**	Effects of non-Gaussian Brownian motion on direct force optical tweezers measurements of the electrostatic forces between pairs of colloidal particles	*Eur. Phys. J. E* **39**, 70-78 (2016)
Raudsepp, A., **Williams, M.A.K.**, **Hall, S.B.**	Multidimensional mapping of the restoring force of an optical trap using triangular wave	*J. Mod. Optics* **63**, 2308-2314 (2016)
Banger, K., Warwick, C., Lang, J., Broch, K., **Halpert, J.E.**, Socratous, J., Brown, A., Leedham, T., Sirringhaus, H.	Identification of dipole disorder in low temperature solution processed oxides: its utility and suppression for transparent high performance solution-processed hybrid electronics	*Chemical Science* **7**, 6337-6346 (2016)
Hendy, S.C.	Science for policy: the need for a Commission for Science	*Research Policy* **12**, (2016)
Lukman, S., Chen, K., **Hodgkiss, J.M.**, Turban, D.H.P., Hine, N.D.M., Dong, S., Wu, J., Greenham, N.C., Musser, A.J.	Tuning the role of charge-transfer states in intramolecular singlet exciton fission through side-group engineering	*Nature Communications* **7**, (2016)
Huang, W., Chandrasekaran, N., Prasad, S.K.K., Gann, E., Thomsen, L., Kabra, D., **Hodgkiss, J.M.**, Cheng, Y.-B., McNeill, C.R.	Impact of fullerene mixing behavior on the microstructure, photophysics, and device performance of polymer-fullerene solar cells	*ACS Applied Materials and Interfaces* **8**, 29608-29618 (2016)
Zheng, H.Y., Alsager, O.A., Zhu, B., **Travas-Sejdic, J.**, **Hodgkiss, J.M.**, **Plank, N.O.V.**	Electrostatic gating in carbon nanotube aptasensors	*Nanoscale* **8**, 13659-13668 (2016)
Webb, J.E.A., Chen, K., Prasad, S.K.K., Wojciechowski, J.P., Falber, A., Thordarson, P., **Hodgkiss, J.M.**	Quantifying highly efficient incoherent energy transfer in perylene-based multichromophore arrays	*Physical Chemistry Chemical Physics* **18**, 1712-1719 (2016)
Davidson R.J., Ainscough E.W., Brodie A.M., Freeman G.H., **Jameson, G.B.**	Structural features of di(1-adamantyl) benzylphosphane complexes of Cu(I) and Ag(I)	*Polyhedron* **119**, 584-589 (2016)
Soares da Costa T.P., Desbois S, Ketaren N.E., Siddiqui T, Zammit L.M., Dogovski C, Gorman M.A., Paxman J.J., Robins-Browne R.M., Parker M.W., **Jameson, G.B.**, Hall N.E., Panjikar S, Perugini M.A.	Structural insights dispel current dogma defining allosteric inhibition of an essential antibiotic target	*Structure* **24**, 1282-1291 (2016)

Authors	Title	Journal
Lo, W.K., Castillo, C.E., Gueret, R., Fortage, J., Rebarz, M., Sliwa, M., Thomas, F., McAdam, C.J., **Jameson, G.B.**, McMorran, D.A., Crowley, J.D., Collomb, M.N., Blackman, A.G.	Synthesis, characterization, and photocatalytic H2-evolving activity of a family of [Co(N4Py)(X)]n+ complexes in aqueous solution	*Inorganic Chemistry* **55**, 4564-4581 (2016)
Donovan, K.A., Atkinson, S.C., Kessans, S.A., Peng, F., Cooper, T.F., Griffin, M.D.W., **Jameson, G.B.**, Dobson, R.C.J.	Grappling with anisotropic data, pseudo-merohedral twinning and pseudo-translational non-crystallographic symmetry: a case study involving pyruvate kinase	*Acta Crystallographica Section D: Biological Crystallography* **72**, 512-519 (2016)
Lang, E.J.M., Heyes, L.C., **Jameson, G.B.**, Parker, E.J.	Calculated pKa variations expose dynamic allosteric communication networks	*Journal of the American Chemical Society* **138**, 2036-2045 (2016)
Hall, N., Orio, M., Gennari, M., Wills, C., Florian, Molton, F., Philouze, C., Halcrow, M.A., **Jameson, G.B.,** Duboc, C., Blackman, A.G.	Multifrequency cw-EPR and DFT studies of a dynamic Jahn-Teller effect in a mononuclear Cu(II) complex	*Inorganic Chemistry* **55**, 1497-1504 (2016)
Lee, S.J., Doussot, C., Baux, A., Liu, L., **Jameson, G.B.**, Richardson, C., Pak, J., Trousselet, F., Coudert, F-X, **Telfer, S.G.**	Multicomponent metal-organic frameworks as defect-tolerant materials	*Chemistry of Materials* **28**, 368-375 (2016)
Kent, L.M., Loo, T.S., Melton, L.D., Mercadante, D., **Williams, M.A.K.**, **Jameson, G.B.**	Structure and properties of non-processive, salt-requiring, acidophilic pectin methylesterases from aspergillus niger provide insights into the key determinants of processivity control	*Journal of Biological Chemistry* **291**, 1289-1306 (2016)
Dugar, S., Izarova, N.V., Mal, S.S., Fu, R., Joo, H-C, Lee, Uk, Dalal, N.S., Pope, M.T., **Jameson, G.B.**, Kortz, U.	Characterization of PtIV-containing polyoxometalates by high-resolution solid-state 195Pt and 51V NMR spectroscopy	*New Journal of Chemistry* **40**, 923-927 (2016)
Davidson, R.J., Ainscough, E.W., Brodie, A.M., **Jameson, G.B.**, **Waterland, M.R.**	Chemical and physical behaviour of heteroleptic 2,6-bis(1H-benzimidazol-2-yl)pyridine and 2,2β6β2βterpyridine substituted tricyclophosphazene ruthenium(II) complexes	*Polyhedron* **103**, 217-226 (2016)
Sahu, S., Zhang, B., Pollock, C.J., Dürr, M., Davies, C.G., Confer, A.M., Ivanović-Burmazović, I., Siegler, M.A., **Jameson, G.N.L.**, Krebs, C., Goldberg, D.P.	Aromatic C-F hydroxylation by nonheme iron(IV)-oxo complexes: structural, spectroscopic, and mechanistic investigations	*Journal of the American Chemical Society* **138**, 12791-12802 (2016)
Fellner, M., Siakkou, E., Faponle, A.S., Tchesnokov, E.P., de Visser, S.P., Wilbanks, S.M., **Jameson, G.N.L.**	Influence of cysteine 164 on active site structure in rat cysteine dioxygenase	*Journal of Biological Inorganic Chemistry* **21**, 501-510 (2016)
Fellner, M., Aloi, S., Tchesnokov, E.P., Wilbanks, S.M., **Jameson, G.N.L.**	Substrate and pH-dependent kinetic profile of 3-mercaptopropionate dioxygenase from pseudomonas aeruginosa	*Biochemistry* **55**, 1362-1371 (2016)
Phonsri, W., Martinez, V., Davies, C.G., **Jameson, G.N.L.**, Moubaraki, B., Murray, K.S.	Ligand effects in a heteroleptic bis-tridentate iron(III) spin crossover complex showing a very high T1/2 value	*Chemical Communications* **52**, 1443-1446 (2016)
Phonsri, W., Davies, C.G., **Jameson, G.N.L.**, Moubaraki, B., Murray, K.S.	Spin crossover, polymorphism and porosity to liquid solvent in heteroleptic iron(III) {quinolylsalicylaldimine/thiosemicarbazone-salicylaldimine} complexes	*Chemistry – A European Journal* **22**, 1322-1333 (2016)
Tchesnokov, E.P., Faponle, A.S., Davies, C.G., Quesne, M.G., Turner, R., Fellner, M., Souness, R.J., Wilbanks, S.M., De Visser, S.P., **Jameson, G.N.L.**	An iron-oxygen intermediate formed during the catalytic cycle of cysteine dioxygenase	*Chemical Communications* **52**, 8814-8817 (2016)
Kolb, A.N.D., **Johnston, J.H.**	Colour tuneable anisotropic, water-dispersible gold nanoparticles stabilized by chitosan	*Gold Bulletin* **49**, (2016)
Prakash, T., **Williams, G.V.M.**, **Kennedy, J.**, Rubanov, S.	Ni1-x Fex nanoparticles made by low energy dual ion implantation into SiO<inf>2</inf>	*Materials Research Express* **3**, (2016)
Kaviyarasu, K., Manikandan, E., **Kennedy, J.**, Maaza, M.	Synthesis and analytical applications of photoluminescent carbon nanosheet by exfoliation of graphite oxide without purification	*Journal of Materials Science: Materials in Electronics* **27**, 13080-13085 (2016)
Kasinathan, K., **Kennedy, J.**, Elayaperumal, M., Henini, M., Malik, M.	Photodegradation of organic pollutants RhB dye using UV simulated sunlight on ceria based TiOx nanomaterials for antibacterial applications	*Scientific Reports* **6**, (2016)

Authors	Title	Journal
Kaviyarasu, K., Fuku, X., Mola, G.T., Manikandan, E., **Kennedy, J.**, Maaza, M.	Photoluminescence of well-aligned ZnO doped CeO2 nanoplatelets by a solvothermal route	*Materials Letters* **183**, 351-354 (2016)
Chaudhary, O.J., Calius, E.P., **Kennedy**, J.V., **Dickinson, M.**, Loho, T., **Travas-Sejdic, J.**	Poly(dimethylsiloxane) grafted with adhesive polymeric chains provide a route towards cost effective dry adhesives	*European Polymer Journal* **84**, 13-21 (2016)
Prakash, T., **Williams, G.V.M.**, **Kennedy, J.**, Rubanov, S.	High spin-dependent tunneling magnetoresistance in magnetite powders made by arc-discharge	*Journal of Applied Physics* **120**, (2016)
Kaviyarasu, K., Manikandan, E., **Kennedy, J.**, Jayachandran, M., Maaza, M.	Rice husks as a sustainable source of high quality nanostructured silica for high performance Li-ion battery requital by sol-gel method – a review	*Advanced Materials Letters* **7**, 684-696 (2016)
Kaviyarasu, K., Ayeshamariam, A., Manikandan, E., **Kennedy, J.**, Ladchumananandasivam, R., Umbelino Gomes, U., Jayachandran, M., Maaza, M.	Solution processing of CuSe quantum dots: photocatalytic activity under RhB for UV and visible-light solar irradiation	*Materials Science and Engineering B: Solid-State Materials for Advanced Technology* **210**, 1-9 (2016)
Arulkumaran, S., Ranjan, K., Ng, G.I., **Kennedy, J.**, Murmu, P.P., Bhat, T.N., Tripathy, S.	Thermally stable device isolation by inert gas heavy ion implantation in AlGaN/GaN HEMTs on Si	*Journal of Vacuum Science and Technology B: Nanotechnology and Microelectronics* **34**, (2016)
Sathyaseelan, B., Manikandan, E., Lakshmanan, V., Baskaran, I., Sivakumar, K., Ladchumananandasivam, R., **Kennedy, J.**, Maaza, M.	Structural, optical and morphological properties of post-growth calcined TiO<inf>2</inf> nanopowder for opto-electronic device application: ex-situ studies	*Journal of Alloys and Compounds* **671**, 486-492 (2016)
Trompetter, W.J., Ancelet, T., Davy, P.K., **Kennedy, J.**	Fugitive emissions from nanopowder manufacturing	*Journal of Nanoparticle Research* **18**, (2016)
Kaviyarasu, K., Manikandan, E., **Kennedy, J.**, Jayachandran, M., Ladchumananandasiivam, R., De Gomes, U.U., Maaza, M.	Synthesis and characterization studies of NiO nanorods for enhancing solar cell efficiency using photon upconversion materials	*Ceramics International* **42**, 8385-8394 (2016)
Kennedy, J., Murmu, P.P., **Leveneur, J.**, **Markwitz, A.**, Futter, J.	Controlling preferred orientation and electrical conductivity of zinc oxide thin films by post growth annealing treatment	*Applied Surface Science* **367**, 52-58 (2016)
Yang, H., Bradley, S.J., Chan, A., **Waterhouse, G.I.N.**, **Nann, T.**, **Kruger, P.E.**, **Telfer, S.G.**	Catalytically active bimetallic nanoparticles supported on porous carbon capsules derived from metal-organic framework composites	*Journal of the American Chemical Society* **138**, 11872-11881 (2016)
Gholami, G., Zhu, K., Ward, J.S., **Kruger, P.E.**, Loeb, S.J.	Formation of a polythreaded, metal-organic framework utilizing an interlocked hexadentate, carboxylate linker	*European Journal of Inorganic Chemistry* **2016**, 4524-4529 (2016)
Hauer, P., Grand, J., Djorovic, A., **Willmott, G.R.**, **Le Ru, E.C.**	Spot size engineering in microscope-based laser spectroscopy	*Journal of Physical Chemistry C* **120**, 21104-21113 (2016)
Somerville, W.R.C., Auguié, B., **Le Ru, E.C.**	Smarties: user-friendly codes for fast and accurate calculations of light scattering by spheroids	*Journal of Quantitative Spectroscopy and Radiative Transfer* **174**, 39-55 (2016)
Auguié, B., Somerville, W.R.C., Roache, S., **Le Ru, E.C.**	Numerical investigation of the Rayleigh hypothesis for electromagnetic scattering by a particle	*Journal of Optics* **18**, (2016)
Markwitz, A., Gupta, P., Mohr, B., Hübner, R., **Leveneur, J.**, Zondervan, A., Becker, H.-W.	Near-surface hydrogen depletion of diamond-like carbon films produced by direct ion deposition	*Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms* **371**, 230-234 (2016)
Chiluka, R., Gamble, A.B., **Lucas, N.T.**, Hawkins, B.C., Bhumkar, A., Achanta, P.S., Bobbala, R.K.	Flavone C-glycosides from trichuriella monsoniae (L.f.) Bennet	*Natural Product Research* **30**, 2235-2237 (2016)
Rodpun, K., **Lucas, N.T.**, Tan, E.W., **Meledandri, C.J.**	development of solvent-dispersible coordination polymer nanocrystals and application as efficient heterogeneous catalysts	*Crystal Growth and Design* **16**, 3940-3946 (2016)
Smith, R.J., Mills, D.A., Nhu, D., Tan, E.W., **Lucas, N.T.**, Hawkins, B.C.	the synthesis of multifunctionalized 1,3-oxazin-4-ones from donor-acceptor cyclopropanes	*Journal of Organic Chemistry* **81**, 2099-2105 (2016)
Wright, J.R., Crowley, J.D., **Lucas, N.T.**	Carbon-rich "click" 1,2,3-triazoles: hexaphenylbenzene and hexa-peri-hexabenzocoronene-based ligands for Suzuki-Miyaura catalysts	*Chemical Communications* **52**, 12976-12979 (2016)
Falah, M., **MacKenzie, K.J.D.**, Knibbe, R., Page, S.J., Hanna, J.V.	New composites of nanoparticle Cu (I) oxide and titania in a novel inorganic polymer (geopolymer) matrix for destruction of dyes and hazardous organic pollutants	*Journal of Hazardous Materials* **318**, 772-782 (2016)

Authors	Title	Journal
M.I.M. Alzeer, **MacKenzie, K.J.D.**, Keyzers, A.	Porous aluminosilicate inorganic polymers (geopolymers): a new-class of environmentally benign heterogeneous solid acid catalysts	*Applied Catalysis* **524**, (2016)
Nourbakhsh, A., Abbaspour, S., Masood, M., Mirsattari, S.N., **MacKenzie, K.J.D.**	Photocatalytic properties of mesoporous TiO2 nanocomposites modified with carbon nanotubes and copper	*Ceramics International* **42**, (2016)
Tawfik, A., Abd-El-Raoof, F., **MacKenzie, K.J.D.**, Komarneni, S.	K-based geopolymer from metakaolin: roles of K/Al ratio and water or steam curing at different temperatures	*Materiales de Construccion* **66**, (2016)
Baek, P., Kerr-Phillips, T., Damavandi, M., Chaudhary, O.J., **Malmström, J.**, Chan, E.W.C., Shaw, P., Burn, P., Barker, D., **Travas-Sejdic, J.**	Highly processable, rubbery poly(n-butyl acrylate) grafted poly(phenylene vinylene)s	*European Polymer Journal* **84**, 355-365 (2016)
Nieuwoudt, M.K., Martin, J.W., Oosterbeek, R.N., Novikova, N.I., Wang, X., **Malmström, J.**, **Williams, D.E.**, **Simpson, M.C.**	Gold-sputtered Blu-ray discs: simple and inexpensive SERS substrates for sensitive detection of melamine	*Analytical and Bioanalytical Chemistry* **408**, 4403-4411 (2016)
Aydemir, N.**, Malmström, J.**, **Travas-Sejdic, J.**	Conducting polymer based electrochemical biosensors	*Physical Chemistry Chemical Physics* **18**, 8264-8277 (2016)
Strover, L.T., **Malmström, J.**, **Travas-Sejdic, J.**	Graft copolymers with conducting polymer backbones: A versatile route to functional materials	*Chemical Record* **16**, 393-418 (2016)
Xu, G., **Malmström, J.**, Edmonds, N., Broderick, N., **Travas-Sejdic, J.**, Jin, J.	Investigation of the reduction of graphene oxide by lithium triethylborohydride	*Journal of Nanomaterials* **2016**, (2016)
Baek, P., Aydemir, N., Chaudhary, O.J., Wai Chi Chan, E., **Malmström, J.**, Giffney, T., Khadka, R., Barker, D., **Travas-Sejdic, J.**	Polymer electronic composites that heal by solvent vapour	*RSC Advances* **6**, 98466-98474 (2016)
Gupta, P., **Williams, G.V.M.**, **Markwitz, A.**	Ferromagnetic order in diamond-like carbon films by co-implantation	*Journal of Physics D: Applied Physics* **49**, (2016)
Kirby, N., Cowieson, N., Hawley, A.M., Mudie, S.T., **McGillivray, D.J.**, Kusel, M., Samardzic-Boban, V., Ryan, T.M.	Improved radiation dose efficiency in solution SAXS using a sheath flow sample environment	*Acta Crystallographica Section D: Structural Biology* **72**, 1254-1266 (2016)
Ryan, T.M., Xun, Y., Cowieson, N.P., Mata, J.P., Jackson, A., Pauw, B.R., Smith, A.J., Kirby, N., **McGillivray, D.J.**	Combined pressure and temperature denaturation of ribonuclease A produces alternate denatured states	*Biochemical and Biophysical Research Communications* **473**, 834-839 (2016)
Ryan, T.M., Griffin, M.D.W., **McGillivray, D.J.**, Knott, R.B., Wood, K., Masters, C.L., Kirby, N., Curtain, C.C.	Apolipoprotein C-II adopts distinct structures in complex with micellar and submicellar forms of the amyloid-inhibiting lipid-mimetic dodecylphosphocholine	*Biophysical Journal* **110**, 85-94 (2016)
Zare, D., Allison, J.R., **McGrath, K.M.**	Molecular Dynamics Simulation of βLactoglobulin at different oil/water interfaces	*Biomacromolecules* **17**, 1572-1581 (2016)
Griffiths, M.R., Raudsepp, A., **McGrath, K.M.**, **Williams, M.A.K.**	Measuring the interaction between a pair of emulsion droplets using dual-trap optical tweezers	*RSC Advances* **6**, 14538-14546 (2016)
Stolarczyk, J.K., **Meledandri, C.J.**, Clarke, S.P., Brougham, D.F.	Size selectable nanoparticle assemblies with magnetic anisotropy tunable across the superparamagnetic to ferromagnetic range	*Chemical Communications* **91**, 13337-13340 (2016)
Majeed, I., Nadeem, M.A., Al-Oufi, M., Nadeem, M.A., **Waterhouse, G.I.N.**, Badshah, A., **Metson, J.B.**, Idriss, H.	On the role of metal particle size and surface coverage for photo-catalytic hydrogen production: a case study of the Au/CdS system	*Applied Catalysis B: Environmental* **182**, 266-276 (2016)
Nguyen, C.L., Preston, A., Tran, A.T.T., **Dickinson, M.**, **Metson, J.B.**	Adhesion enhancement of titanium nitride coating on aluminum casting alloy by intrinsic microstructures	*Applied Surface Science* **377**, 174-179 (2016)
McIntosh, G.J., **Metson, J.B.**	Surface area characteristics of furfuryl-alcohol-derived inverse opal carbons produced from silica inverse opal templates	*Journal of Materials Science* **51**, 2573-2584 (2016)
Chandrasekaran, S., Vijayakumar, S., **Nann, T.**, **Voelcker, N.H.**	Investigation of porous silicon photocathodes for photoelectrochemical hydrogen production	*International Journal of Hydrogen Energy* **41**, 19915-19920 (2016)
Schroeder, K.L., Goreham, R.V., **Nann, T.**	Graphene quantum dots for theranostics and bioimaging	*Pharmaceutical Research* **33**, 2337-2357 (2016)

Authors	Title	Journal
Chandrasekaran, S., **Nann, T.**, **Voelcker, N.H.**	Silicon nanowire photocathodes for photoelectrochemical hydrogen production	*Nanomaterials* **6**, (2016)
Elmas, S., Ambroz, F., Chugh, D., **Nann, T.**	Microfluidic chip for the photocatalytic production of active chlorine	*Langmuir* **32**, 4952-4958 (2016)
Röding, M., Bradley, S.J., Williamson, N.H., Dewi, M.R., **Nann, T.**, Nydén, M.	The power of heterogeneity: parameter relationships from distributions	*PLoS ONE* **11**, (2016)
Macdonald, T.J., Tune, D.D., Dewi, M.R., Bear, J.C., McNaughter, P.D., Mayes, A.G., Skinner, W.M., Parkin, I.P., Shapter, J.G., **Nann, T.**	SWCNT photocathodes sensitised with InP/ZnS core-shell nanocrystals	*Journal of Materials Chemistry C* **4**, 3379-3384 (2016)
Elmas, S., Beelders, W., Nash, J., Macdonald, T.J., Jasieniak, M., Griesser, H.J., **Nann, T.**	Photo-doping of plasma-deposited polyaniline (PAni)	*RSC Advances* **6**, 70691-70699 (2016)
Chan, J.R., Vézian, S., **Trodahl, J.**, Khalfioui, M.A., Damilano, B., **Natali, F.**	Temperature-induced four-fold-on-six-fold symmetric heteroepitaxy, rocksalt smn on hexagonal aln	*Crystal Growth and Design* **16**, 6454-6460 (2016)
Vézian, S., Damilano, B., **Natali, F.**, Khalfioui, M.A., Massies, J.	AlN interlayer to improve the epitaxial growth of SmN on GaN (0001)	*Journal of Crystal Growth* **450**, 22-27 (2016)
Ng, V.-V., Sellier, M., **Nock, V.**	Marangoni-induced actuation of miscible liquid droplets on an incline	*International Journal of Multiphase Flow* **82**, 27-34 (2016)
Khodabocus, M.I., Sellier, M., **Nock, V.**	Slug self-propulsion in a capillary tube mathematical modeling and numerical simulation	*Advances in Mathematical Physics* **2016,** (2016)
Ivanovskikh, K.V., Hughes-Currie, R.B., **Reid, M.F.**, Wells, J.P.R., Sokolov, N.S., **Reeves, R.J.**	Synchrotron spectroscopy of confined carriers in CdF2-CaF2 superlattices	*Journal of Applied Physics* **119**, (2016)
Horvath, S.P., **Reid, MF**., Wells, J.P.R., Yamaga, M.	High precision wavefunctions for hyperfine states of low symmetry materials suitable for quantum information processing	*Journal of Luminescence* **169**, 773-776 (2016)
Hughes-Currie, R.B., Ivanovskikh, K.V., R Wells, J.P.R., **Reid, M.F.**, Gordon, R.A.	The determination of dopant ion valence distributions in insulating crystals using XANES measurements	*Journal of Physics Condensed Matter* **28**, (2016)
Mahlik, S., Lazarowska, A., Grinberg, M., Wells, J.P.R., **Reid, M.F.**	Luminescence properties of MgF2:Yb2+ at high hydrostatic pressure	*Journal of Luminescence* **169**, 788-793 (2016)
Anton, E.-M., McNulty, J.F., **Ruck, B.J.**, Suzuki, M., Mizumaki, M., Antonov, V.N., Quilty, J.W., Strickland, N., **Trodahl, H.J.**	NdN: An intrinsic ferromagnetic semiconductor	*Physical Review B – Condensed Matter and Materials Physics* **93**, (2016)
McNulty, J.F., **Ruck, B.J.**, **Trodahl, H.J.**	On the ferromagnetic ground state of SmN	*Physical Review B - Condensed Matter and Materials Physics* **93**, (2016)
Nieuwoudt, M.K., Holroyd, S.E., McGoverin, C.M., **Simpson, M.C.**, **Williams, D.E.**	Rapid, sensitive, and reproducible screening of liquid milk for adulterants using a portable Raman spectrometer and a simple, optimized sample well	*Journal of Dairy Science* **99**, 7821-7831 (2016)
Oosterbeek, R.N., Ward, T., Ashforth, S., Bodley, O., Rodda, A.E., **Simpson, M.C.**	Fast femtosecond laser ablation for efficient cutting of sintered alumina substrates	*Optics and Lasers in Engineering* **84**, 105-110 (2016)
Bogunovic, D., Raymond, S.G., Janssens, S., Clarke, D., Bodley, O., Ashforth, S., **Simpson, M.C.**, Quilty, J.W.	Refractive index gratings in electro-optic polymer thin films	*Applied Optics* **55**, 4676-4682 (2016)
Arul, R., Oosterbeek, R.N., Robertson, J., Xu, G., Jin, J., **Simpson, M.C.**	The mechanism of direct laser writing of graphene features into graphene oxide films involves photoreduction and thermally assisted structural rearrangement	*Carbon* **99**, 423-431 (2016)
Kho, J.L.H, Airey, M., **Simpson, M.C.**	The future of organic solar energy harvesting complexes	*Solar Energy: Systems, Performance and Recent Developments* **5**, 165-196 (2016)
Nieuwoudt, M.K., Holroyd, S.E., McGoverin, C.M., **Simpson, M.C.**, **Williams, D.E.**	Screening for adulterants in liquid milk using a portable Raman mini-spectrometer with immersion probe	*Applied Spectroscopy* **71**, 308-312 (2016)
Lamoureux B., Singh V.R., Jovic V., Kuyyalil J., Su T.-Y., **Smith K.E.**	Structural and electronic properties of thermally evaporated V2O5 epitaxial thin films	*Thin Solid Films* **615**, 409-414 (2016)

Authors	Title	Journal
Polley, C.M., Jovic, V., Su, T-Y., Saghir, M., Balasubramanian, T., Balakrishnan, G., Laverock, J., **Smith K.E.**	Observation of surface states on heavily indium doped SnTe(111), a superconducting topological crystalline insulator	*Physical Review B* **93**, (2016)
Storey, J.G.	Hall effect and Fermi surface reconstruction via electron pockets in the high-T<inf>c</inf> cuprates	*EPL* **113**, (2016)
Ablott, T.A., Turzer, M., **Telfer, S.G.**, Richardson, C.	High temperature postsynthetic rearrangement of dimethylthiocarbamate-functionalized metal-organic frameworks	*Crystal Growth and Design* **16**, 7067-7073 (2016)
Ferguson, A., Liu, L., Tapperwijn, S.J., Perl, D., Coudert, F.-X., Van Cleuvenbergen, S., Verbiest, T., Van Der Veen, M.A., **Telfer, S.G.**	Controlled partial interpenetration in metal-organic frameworks	*Nature Chemistry* **8**, 250-257 (2016)
Perl, D., Bisset, S.W., **Telfer, S.G.**	Postcomplexation synthetic routes to dipyrrin complexes	*Dalton Transactions* **45**, 2440-2443 (2016)
Sertphon, D., Harding, D.J., Harding, P., Murray, K.S., Moubaraki, B., Adams, H., Alkaş, A., **Telfer, S.G.**	Substituent-influenced spin crossover in feiii quinolylsalicylaldiminates	*European Journal of Inorganic Chemistry* **2016**, 432-438 (2016)
Presley, K.F., Cheong, S., Cochran, A., **Tilley, R.D.**, Collins, J.E., Lannutti, J.J.	Upconverter-powered oxygen sensing in electrospun polymeric bilayers	*Sensors and Actuators, B: Chemical* **235**, 197-205 (2016)
Wu, Y., Kashi, M.B., Yang, Y., Gonçales, V.R., Ciampi, S., **Tilley, R.D.**, Gooding, J.J.	Light-activated electrochemistry on alkyne-terminated Si(100) surfaces towards solution-based redox probes	*Electrochimica Acta* **213**, 540-546 (2016)
Gonçales, V.R., Wu, Y., Gupta, B., Parker, S.G., Yang, Y., Ciampi, S., **Tilley, R.**, Gooding, J.J.	Stability of chemically passivated silicon electrodes in aqueous solutions: interplay between bias voltage and hydration of the electrolyte	*Journal of Physical Chemistry C* **120**, 15941-15948 (2016)
Graham, L., Collins, G., Holmes, J.D., **Tilley, R.D.**	Synthesis and catalytic properties of highly branched palladium nanostructures using seeded growth	*Nanoscale* **8**, 2867-2874 (2016)
Teh, G.B., **Tilley, R.D.**	Structural and magnetic studies of Co-Ti-substituted magnetoplumbite-type (M-type) strontium ferrites by sol-gel method	*Journal of Sol-Gel Science and Technology* **77**, 306-314 (2016)
Lian, J., Agban, Y., Cheong, S., Kuchel, R.P., Raudsepp, A., Williams, M.A.K., Rupenthal, I.D., Henning, A., **Tilley, R.D.**, Holmes, G., Prabakar, S.	ZnO/PVP nanoparticles induce gelation in type I collagen	*European Polymer Journal* **75**, 399-405 (2016)
Miller, H.A., Bellini, M., Vizza, F., Hasenöhrl, C., **Tilley, R.D.**	Carbon supported Au-Pd core-shell nanoparticles for hydrogen production by alcohol electroreforming	*Catalysis Science and Technology* **6**, 6870-6878 (2016)
Moraes Silva, S., Tavallaie, R., Sandiford, L., **Tilley, R.D.**, Gooding, J.J.	Gold coated magnetic nanoparticles: from preparation to surface modification for analytical and biomedical applications	*Chemical Communications* **52**, 7528-7540 (2016)
Uppalapati, D., Boyd, B.J., Garg, S., **Travas-Sejdic, J.**, Svirskis, D.	Conducting polymers with defined micro- or nanostructures for drug delivery	*Biomaterials* **111**, 149-162 (2016)
Ryskulova, K., Gulur Srinivas, A.R., Kerr-Phillips, T., Peng, H., Barker, D., **Travas-Sejdic, J.**, Hoogenboom, R.	Multiresponsive behavior of functional poly(p-phenylene vinylene)s in water	*Polymers* **8**, (2016)
Karaosmanoglu, H., Suthanthangjai, W., **Travas-Sejdic, J.**, Kilmartin, P.A.	Electrochemical analysis of beverage phenolics using an electrode modified with poly(3,4-ethylenedioxithiophene)	*Electrochimica Acta* **201**, 366-373 (2016)
Peng, H., Li, Y., Jiang, C., Luo, C., Qi, R., Huang, R., Duan, C.-G., **Travas-Sejdic, J.**	Tuning the properties of luminescent nitrogen-doped carbon dots by reaction precursors	*Carbon* **100**, 386-394 (2016)
Framil Carpeño, D., **Dickinson, M.**, Seal, C., Hyland, M.	Induced hydrophobicity in micro- and nanostructured nickel thin films obtained by ultraviolet pulsed laser treatment	*Physica Status Solidi (A) Applications and Materials Science* **213**, 2709-2713 (2016)
Naot, D., Watson, M., Callon, K.E., Tuari, D., Musson, D.S., Choi, A.J., Sreenivasan, D., Fernandez, J., Tu, P.T., **Dickinson, M.**, Gamble, G.D., Grey, A., Cornish, J.	Reduced bone density and cortical bone indices in female adiponectin-knockout mice	*Endocrinology* **157**, 3550-3561 (2016)
Framil Carpeño, D., Ohmura, T., Zhang, L., **Dickinson, M.**, Seal, C., Hyland, M.	Softening and compressive twinning in nanosecond ultraviolet pulsed laser-treated Ti6Al4V	*Scripta Materialia* **113**, 139-144 (2016)

Authors	Title	Journal
Trodahl, M.I., Rees, A.B.H., Newnham, R.M., Vandergoes, M.J.	Late holocene geomorphic history of Lake Wairarapa, North Island, New Zealand	*New Zealand Journal of Geology and Geophysics* **59**, 330-340 (2016)
Cao, Y., Geng, W., Shi, R., Shang, L., **Waterhouse, G.I.N.**, Liu, L., Wu, L.-Z., Tung, C.-H., Yin, Y., Zhang, T.	Thiolate-mediated photoinduced synthesis of Ultrafine Ag2S Quantum dots from silver nanoparticles	*Angewandte Chemie – International Edition* **55**, 14952-14957 (2016)
Yu, H., Shi, R., Zhao, Y., **Waterhouse, G.I.N.**, Wu, L.-Z., Tung, C.-H., Zhang, T.	Smart utilization of carbon dots in semiconductor photocatalysis	*Advanced Materials* **28**, 9454-9477 (2016)
Jovic, V., Idriss, H., **Waterhouse, G.I.N.**	Slow photon amplification of gas-phase ethanol photo-oxidation in titania inverse opal photonic crystals	*Chemical Physics* **479**, 109-121 (2016)
Cai, M., Takagi, H., Nakagaito, A.N., Li, Y., **Waterhouse, G.I.N.**	Effect of alkali treatment on interfacial bonding in abaca fiber-reinforced composites	*Composites Part A: Applied Science and Manufacturing* **90**, 589-597 (2016)
Majeed, I., Nadeem, M.A., Hussain, E., **Waterhouse, G.I.N.**, Badshah, A., Iqbal, A., Nadeem, M.A., Idriss, H.	On the Synergism between Cu and Ni for photocatalytic hydrogen production and their potential as substitutes of noble metals	*ChemCatChem* **8**, 3146-3155 (2016)
Nadeem, M.A., **Waterhouse, G.I.N.**, Idriss, H.	A study of ethanol reactions on O2-treated Au/TiO2: effect of support and metal loading on reaction selectivity	*Surface Science* **650**, 40-50 (2016)
Jia, X., Zhao, Y., Chen, G., Shang, L., Shi, R., Kang, X., **Waterhouse, G.I.N.**, Wu, L.-Z., Tung, C.-H., Zhang, T.	Ni3FeN Nanoparticles derived from ultrathin NiFe-layered double hydroxide nanosheets: an efficient overall water splitting electrocatalyst	*Advanced Energy Materials* **6**, (2016)
Zhao, Y., Jia, X., Chen, G., Shang, L., **Waterhouse, G.I.N.**, Wu, L.-Z., Tung, C.-H., Ohare, D., Zhang, T.	Ultrafine NiO nanosheets stabilized by TiO2 from monolayer NiTi-LDH precursors: an active water oxidation electrocatalyst	*Journal of the American Chemical Society* **138**, 6517-6524 (2016)
Zhao, Y., Jia, X., **Waterhouse, G.I.N.**, Wu, L.-Z., Tung, C.-H., O'Hare, D., Zhang, T.	layered double hydroxide nanostructured photocatalysts for renewable energy production	*Advanced Energy Materials* **6**, (2016)
Shang, L., Yu, H., Huang, X., Bian, T., Shi, R., Zhao, Y., **Waterhouse, G.I.N.**, Wu, L.-Z., Tung, C.-H., Zhang, T.	Well-dispersed ZIF-derived Co,N-Co-doped carbon nanoframes through mesoporous-silica-protected calcination as efficient oxygen reduction electrocatalysts	*Advanced Materials* **28**, 1668-1674 (2016)
Shang, L., Tong, B., Yu, H., **Waterhouse, G.I.N.**, Zhou, C., Zhao, Y., Tahir, M., Wu, L.-Z., Tung, C.-H., Zhang, T.	Cds nanoparticle-decorated cd nanosheets for efficient visible light-driven photocatalytic hydrogen evolution	*Advanced Energy Materials* **6**, (2016)
Sarda, N.G., Fujigaki, H., Ogita, Y., Chan, A., Murai, K.-I., **Waterhouse, G.I.N.**, Moriga, T.	Photoluminescence properties of (Ba1-(x+y) SrxEuy) 2Si6o12N2 phosphors for white LED applications	*Journal of Nano Research* **36**, 1-7 (2016)
Chen, G., Zhao, Y., Shang, L., **Waterhouse, G.I.N.**, Kang, X., Wu, L.-Z., Tung, C.-H., Zhang, T.	Recent advances in the synthesis, characterization and application of Zn+-containing heterogeneous catalysts	*Advanced Science* **3**, (2016)
Yu, H., Shang, L., Bian, T., Shi, R., **Waterhouse, G.I.N.**, Zhao, Y., Zhou, C., Wu, L., Tung, C., Zhang, T.	Nitrogen-doped porous carbon nanosheets templated from g-C3N4 as metal-free electrocatalysts for efficient oxygen reduction reaction	*Advanced Materials* **28**, 5080-5086 (2016)

Authors	Title	Journal
Swanson, A.J., Raymond, S.G., Janssens, S., Breukers, R.D., Bhuiyan, M.D.H., Lovell-Smith, J.W., **Waterland, M.R.**	Development of novel polymer coating for FBG based relative humidity sensing	*Sensors and Actuators, A: Physical* **249**, 217-224 (2016)
Joyce, P., **Whitby, C.P.**, Prestidge, C.A.	Nanostructuring biomaterials with specific activities towards digestive enzymes for controlled gastrointestinal absorption of lipophilic bioactive molecules	*Advances in Colloid and Interface Science* **237**, 52-75 (2016)
Whitby, C.P., Wanless, E.J.	Controlling pickering emulsion destabilisation: a route to fabricating new materials by phase inversion	*Materials* **9**, (2016)
Whitby, C.P., Khairul Anwar, H., Hughes, J.	Destabilising Pickering emulsions by drop flocculation and adhesion	*Journal of Colloid and Interface Science* **465**, 158-164 (2016)
Joyce, P., **Whitby, C.P.**, Prestidge, C.A.	Interfacial processes that modulate the kinetics of lipase-mediated catalysis using porous silica host particles	*RSC Advances* **6**, 43802-43813 (2016)
Yang, Z., Hemar, Y., Hilliou, L., Gilbert, E.P., McGillivray, D.J., **Williams, M.A.K.**, Chaieb, S.	Nonlinear behavior of gelatin networks reveals a hierarchical structure	*Biomacromolecules* **17**, 590-600 (2016)
Miskell, G., Salmond, J., Alavi-Shoshtari, M., Bart, M., Ainslie, B., Grange, S., McKendry, I.G., Henshaw, G.S., **Williams, D.E.**	Data verification tools for minimizing management costs of dense air-quality monitoring networks	*Environmental Science and Technology* **50**, 835-846 (2016)
Williams, G.V.M., Do, M.T.T., Middleton, A., Raymond, S.G., Bhuiyan, M.D.H., Kay, A.J.	Optical modulation of the diffraction efficiency in an indoline azobenzene/amorphous polycarbonate film	*Nanoscale Research Letters* **11**, (2016)
Donaldson, J., **Williams, G.V.M.**	Photoluminescence, radioluminescence, and thermoluminescence n NaMgF3 activated with Ni2+ and Er3+	*Journal of Luminescence* **173**, 279-285 (2016)
Weatherall, E., Hauer, P., Vogel, R., **Willmott, G.R.**	Pulse size distributions in tunable resistive pulse sensing	*Analytical Chemistry* **88**, 8648-8656 (2016)
Robson, S., **Willmott, G.R.**	Asymmetries in the spread of drops impacting on hydrophobic micropillar arrays	*Soft Matter* **12**, 4853-4865 (2016)
Radionova, A., Greenwood, D. R., **Willmott, G. R.**, Derrick, P. J.	Dual nano-electrospray and mixing in the Taylor cone	*Mass Spectrometry Letters* **7**, 21-25 (2016)
Knibbe, R., Strickland, N.M., **Wimbush, S.C.**, Puichaud, A.-H., Long, N.J.	Structure property relationships in a nanoparticle-free SmBCO coated conductor	*Superconductor Science and Technology* **29**, (2016)
Liao, R., Fialko, O., Brand, J., **Züelicke, U.**	Noncollinear drag force in Bose-Einstein condensates with Weyl spin-orbit coupling	*Physical Review A – Atomic, Molecular, and Optical Physics* **93**, (2016)
Reid M.F.	Theory of rare-earth electronic structure and spectroscopy	*Handbook on the Physics and Chemistry of Rare Earths* **50**, 47-64 (2016)
Bicheng Zhu. A. J. Hackett, J. **Travas-Sejdic**	Biosensing applications based on conducting polymers	*Encyclopedia of Polymer Science and Technology* 1-34 (2016)
Wimbush, S.C., Strickland, N.M., Long, N.J.	Flux pinning in superconductors	*Encyclopedia of Applied Physics* 1-22 (2016)
Wimbush, S.C.	Superconductors	*Materials for Sustainable Energy Applications: Conversion, Storage, Transmission, and Consumption* 641-692 (2016)
Sun-Waterhouse, D., **Waterhouse, G.I.N.**	Chapter 2 – Recent advances in the application of nanomaterials and nanotechnology in food industry	*Novel Approaches of Nanotechnology in Food* **1**, 21-26 (2016)