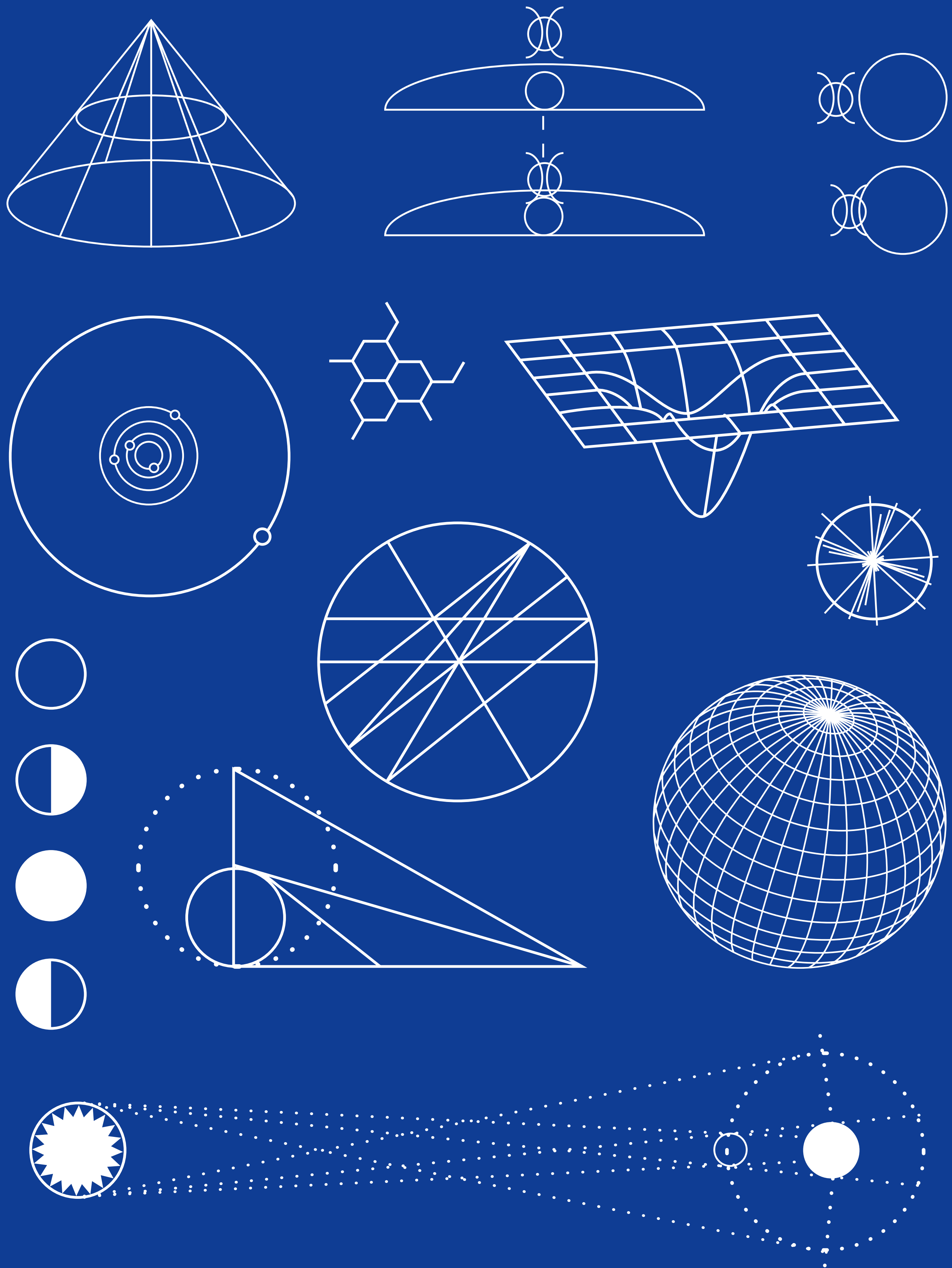
MACDIARMID INSTITUTE

ANNUAL REPORT 2020



From 2002 - 2020

656
PhD graduates

20
affiliated start-up companies created

852
research alumni

78
inventions patented

4000+
conference attendees

Contents

Nicola Gaston and Justin Hodgkiss
Co-Directors

2020 was an extraordinarily challenging year worldwide. It came as no surprise to us as directors of the Institute to find that in the midst of it all of this, the community that the MacDiarmid Institute has become is an amazing resource and support network.

The plans of many of our people were turned upside down. Over half of the PhD students we fund would ordinarily head offshore for a period after graduation, often for postdoctoral research. As international opportunities disappeared, we re-prioritised funding to create a range of internships and research associate positions for our fresh PhD graduates, often in industry-facing roles, in international collaborations, or new interdisciplinary projects that continue to hone the skills of Aotearoa New Zealand's future R&D leaders.

We offered 3-month scholarship extensions to over 60 PhD students as soon as the first lockdowns struck. As Aotearoa New Zealand moved out of lockdown, those students enthusiastically resumed their research knowing that they would have time to do the work that they spent the lockdown planning.

It will be talented and motivated people like these who will help Aotearoa New Zealand to rebuild and reshape a sustainable, inclusive, high-wage, zero-carbon economy in a post-Covid world. In 2020, more than ever, we were grateful to be able to invest in such people.

Our engagement plans were also quickly redeveloped in 2020, to address emerging needs. From our public lectures, to new podcasts and animations, to industry engagement – moving these conversations into the digital world has allowed us to strengthen our partnerships with stakeholders, as you will see throughout this report.

We were thrilled to be awarded funding to continue as a CoRE for 2021–2028. Our proposal addresses some of Aotearoa New Zealand's most significant emerging challenges, and was built on energy and ideas contributed from all parts of the Institute. We are excited to be given the opportunity to deliver on these plans in the coming years.

We were thrilled to be awarded funding to continue as a CoRE for 2021–2028.

The Government's decision to refund the Institute through to the end of 2028 recognises the Institute's pedigree, international reputation and track record.

Paul Atkins
Board Chair

It takes time, energy and sometimes a light sprinkle of magic dust to create a virtual entity that really works, that functions in almost every way as if it is a single high-performing 'bricks and mortar' organisation in its own right.

It takes a lot of skill to then get this virtual entity to produce outcomes and impact as good as any single physical entity, or better.

And it takes great people to have a vision for that, and turn it into reality.

The MacDiarmid Institute is all of this. It is an example of an Institute where growth and development over time has made it stronger, more cohesive as an entity, united in purpose, and ever more capable of delivering the extraordinary outcomes and demonstrable impacts that come from the engagement of outstanding talent at scale. This can only be achieved in Aotearoa New Zealand through such multiplier mechanisms as the MacDiarmid Institute.

The Government's decision to refund the Institute through to the end of 2028 recognises the Institute's pedigree, international reputation and track record. Most importantly, the decision also recognises the Institute's ambition and ability to continue delivering great outcomes for Aotearoa New Zealand's future, a zero-carbon future with materials science playing a pivotal role.

On behalf of myself and the Board, I would like to extend sincere thanks to the entire MacDiarmid Institute family for all the hard work that has led to this outstanding result.

In particular, I wish to thank our Co-Directors and Deputy Directors for their leadership, and the management team for all their excellent work supporting the Institute.

I also want to acknowledge those who work alongside the Institute and who enable us to extend our reach in all that we do. Our partners at the university tech transfer offices, our commercial industry collaborators and our colleagues within the wider education and outreach sectors.

The stories within this report are testament to the powerful impacts made possible by working together. I hope you enjoy reading it.

The MacDiarmid Institute for Advanced Materials and Nanotechnology

The University of Auckland · Massey University · Callaghan Innovation · University of Canterbury · University of Otago · GNS Science · Victoria University of Wellington Te Herenga Waka

Chapter 1.

TE MOANA NUI A KIWA

Mātauranga Māori has become imbedded within the research framework of the Institute. Led by Principal Investigator, Dr Pauline Harris, the research team includes Stakeholder Partner Iwi, Diane Bradshaw, and Principal Investigators, Derek Kawiti and Dr Craig Rofe. These researchers are working at the interface of multiple knowledge systems, bringing together Mātauranga Māori, Putaiao Māori and Science.

> **"What's really important to us is the capacity and capability development of Māori and Pacific peoples in the sciences."**

A key focus of the Institute's Te Moana Nui a Kiwa work is the capacity and capability development of future Māori and Pacific scientists, supported by scholarships, internships, and more, creating a pathway to success for these future scholars.

Building capability at the intersection of science, Pūtaiao Māori and Mātauranga Māori

The arrival of Covid has had a significant impact on the tourism industry. As a result, many businesses have had to pivot and develop new business approaches.

Our Partner, Whakarewarewa Village, is developing new and innovative approaches in response to the new tourism environment. We've continued to work closely to develop an education exhibit that showcases the Village, aligns materials science analyses alongside Mātauranga Māori that explores the synergies of these two knowledge systems. Planning is already in place to share the research that's been conducted in the village openly in a variety of ways, including Wānanga, educational resources and other outreach through local schools.

Two joint research papers about the research and work conducted were accepted for the World Geothermal Congress planned to run in Reykjavik, Iceland, in 2020. The Congress has been postponed to 2021.

Discovery Scholarships Programme

Our inaugural Discovery Scholarship Programme for Māori and Pacific peoples in tertiary science launched in 2020. The programme is led by Principal Investigator, Dr Pauline Harris, Senior Lecturer at Victoria University of Wellington, and is based on research looking at the barriers to Māori and Pacific students entering and staying in science. 15 Scholarships were awarded, paying up to $8k fees and up to $5k cash award, and were advertised widely, with emails to key groups, both directly and through our partners, as well as through social media and campaigns.

There were four awards categories available for 2020:

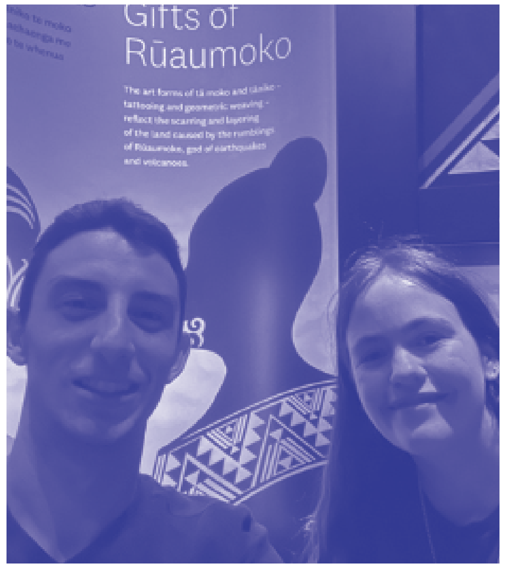
Te Kainga Rua Award - Second Chance Learner Award - This category is for mature students either returning to tertiary education after having some time away, or those that are undertaking tertiary courses for the first time.

Piki Ake Award - Step It Up Award - This category is for students who are passionate about science but have found it challenging to achieve highly. The aim of this particular award is to help enthusiastic students reach their potential and step up into achieving.

Te Taumata Award - High Achiever Award - This category is for students who have excelled in their studies (B+ average or higher) and are looking toward continuing their study in the field.

Te Mātauranga Pūtaiao Award – Māori Science Award - This category is for students who are studying Mātauranga Māori Science and are looking toward continuing their study in the field.

The Scholarships were hugely over-subscribed, showing the urgent need for this kind of support. The programme is being continued for 2021, with the addition of a new award for those who have previously received a Discovery Scholarship and wish to continue with their studies.



Far left: Whakarewarewa project Research Assistants Ben Nielsen and Juliet Nelson at Te Papa, where they met with Head of Experience, Design and Content, Frith Williams.

Below: Rachel Grant out in the sea being a kaitiaki and developing her skills observing.

> **"The goal I'm striving towards is to become a Kaitiaki o te Moana - a guardian of the sea. I wish to share with others how I view the ocean, to inspire people about the hidden wonders."**

RACHEL GRANT
TE TAUMATA AWARD RECIPIENT
TOI OHOMAI INSTITUTE OF TECHNOLOGY

Te Ao Pūtaiao Me Te Ao

Understanding the unique geological attributes and biological materials Kawhia – Aotea.

The geological origins and whakapapa of the Kawhia and Aotea region can be expressed in terms of three developmental steps that relate to the histories of Gondwana, Zealandia and Te Riu o Maui.

The oldest 'basement' rocks of the Kawhia-Aotea region are of Jurassic age, between 200 and 145 million years old. We know this from the study of the fossils they contain. There are

This research has geo-chemically fingerprinted these taonga, creating a digitised inventory of each item.

rocks of Jurassic age elsewhere in Aotearoa New Zealand, such as in south Otago and Southland, but they are best revealed to us in the Kawhia-Aotea region. These sedimentary rocks are very special from an international perspective because they accumulated on the very edge of a large Pacific-Ring-of-Fire volcano located in southeastern Gondwana, and more or less on the South Pole. At the time, there were no polar ice caps. Nevertheless, because of the polar location, the fossils they contain are of huge interest, and not least the Giant Ammonite discovered in the mid-1970s at the western end of Whakapirau Road, Taharoa. Local intra-plate volcanism has produced the Pirongia and Karioi basalt volcanoes which erupted between 2.74 and 1.6 million years ago. They dominate the landscape in the Kawhia and Aotea region and produce rich fertile soils of Hawaiiki-iti, an inlet of the Aotea harbour, with over half a millennia of traditional occupation, going back to the arrival of Tainui and Aotea waka. The area continued to be an important place throughout the history as evidenced in the many archaeological remains of centuries of occupation in the form of pā, storage pits, taro gardens, ovens and midden.

Kawhia museum contains local collections of artefacts from contributing regions on the west coast Aotea-South Kawhia that connects with Māori as individuals and groups, and in terms of special knowledge and cultural values. This research has geochemically fingerprinted these taonga, and will further lead to our understanding of the nature and relationship between taonga artifacts and their source locations. This research will create a digitized inventory of each item which will be showcased on the NZ Museums website to improve accessibility of the collections back to interested communities, including iwi, public, researchers and online museum visitors. DiscoveryCamp alumna, Isitokia Paasi, joined the project and worked with Stakeholder Partner, Iwi Diane Bradshaw, and Dr Karyne Rogers at GNS Science over the summer as one of our Alumni Summer Students, to support top talent and acknowledge the role of integration of knowledge bases on many levels with regard to 'Science and Society'.

We explore the knowledge that existed within Māori communities pertaining to traditional uses in a habour setting and also what technical capability and capacity these communities have or require to utilise natural resources as tools. Relating this with the additional recognition that connects whakapapa, mātauranga Māori and cultural identity. This materials research explores kaitiakitanga, veracity – truthfulness of the data, the place, the people and technology – in collaboration with geochemically connecting geological sites and the significance of these natural treasures within the region.

Below: Kawhia Museum Collections visit to GNS Science led by Kaumatua Rauangaanga Mahara.

Below right: Isitokia Paasi works to evaluate the geological and geochemical whakapapa and composition of stone artefacts from the Kawhia Museum.

Hangi stones research to continue

The research of former MacDiarmid Institute Principal Investigator, Dr Craig Rofe, (who in October took up a permanent Senior Māori advisory position within government) will continue, with plans for a summer RA to draw together his research on hangi stones and to develop this into resources for schools for the 2021 school year. Dr Rofe will remain with the MacDiarmid Institute as an Emeritus Investigator.

Te Ahi Tupua

Te Ahi Tupua, the largest 3D printed sculpture in the world, collaboratively designed by Principal Investigator, Derek Kawiti, and Māori Customary Artist, Stacy Gordine, of the New Zealand Māori Arts and Crafts Institute, was helicoptered into place in Rotorua's Hemo Gorge this year.

Derek Kawiti is a Senior Lecturer in Architecture at Victoria University of Wellington. His research includes understanding the implications of digital technologies in the convergence with Indigenous traditional knowledge. With a background in advanced parametric design methods, he is heavily involved in generative digital modelling, digital heritage and 'low' and 'high tech' digital fabrication. He founded the collaborative research lab – SITUA (Site of Indigenous Technologies Understanding Alliance) with Iwi, including Ngāi Tāmanuhiri - of Muriwai, Gisborne, and more recently with the New Zealand Māori Arts and Crafts Institute of Te Puia, Rotorua.

Left: Te Ahi Tupua, the largest 3D printed sculpture in the world.

Environmental monitoring and Maramataka

The environmental monitoring research of Dr Pauline Harris involves teaching people and communities how to monitor the environment and how to understand changes that may be occurring. These changes relate to pollution, deforestation, changing temperatures and more. Working within the framework of the Maramataka system, this reseach investigates if changes are being observed in the environment and if so, why? The research reaches into communities to teach people how to reconnect with their environment so they can monitor changes themselves. Dr Harris is producing videos, running wānanga and going into communities to work with people directly.

This research is being conducted in collaboration with the Society of Māori Astronomy Research and Traditions (SMART) that has some of the most knowledgeable Maramataka experts in Aotearoa New Zealand.

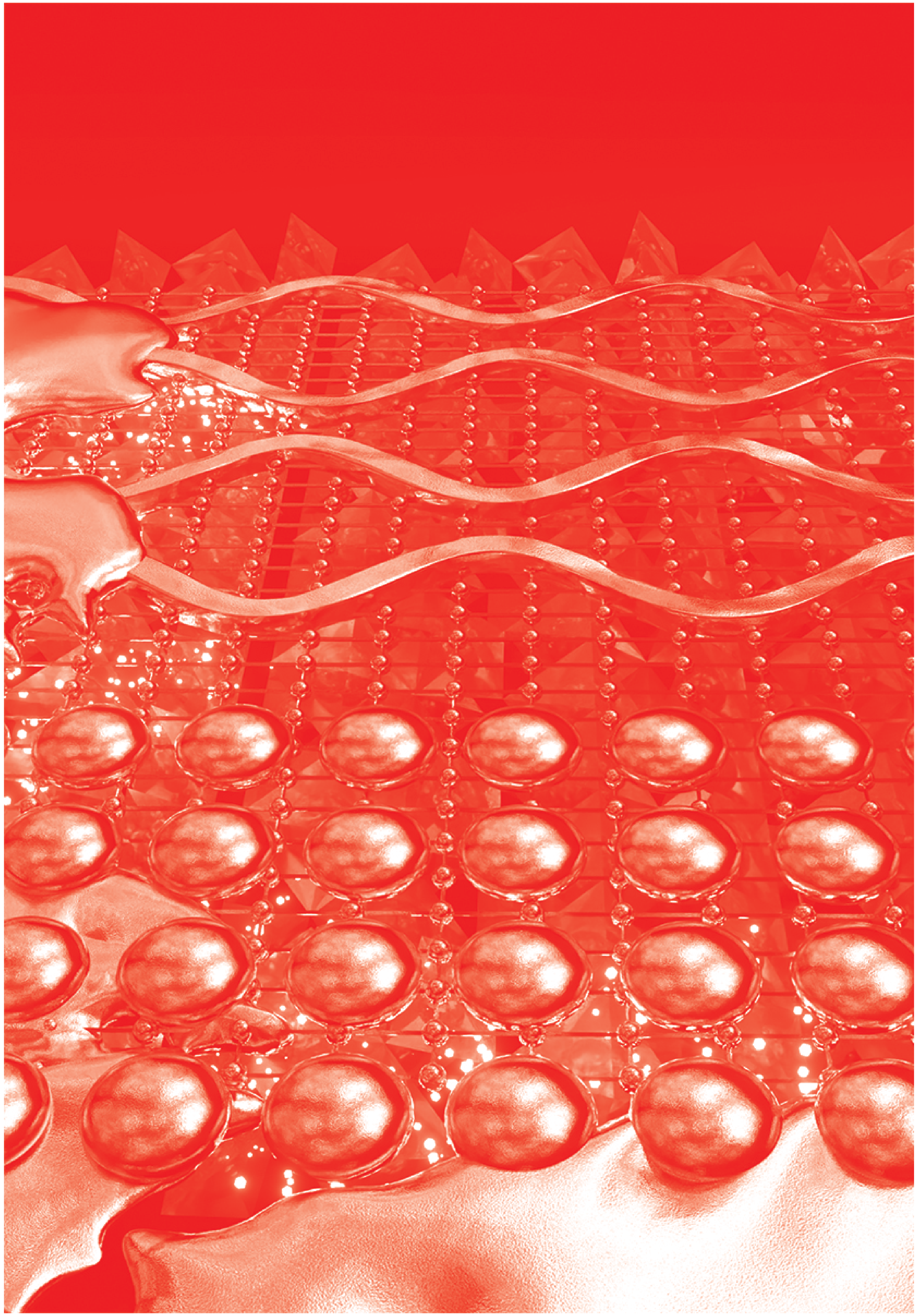
Dr Pauline Harris in the forest identifying and observing plants as a part of her Maramataka research.

Summer studentships for our DiscoveryCamp and Discovery Scholarship Alumni

NAME OF STUDENT	PROJECT TITLE	SUPERVISOR
Juliet Nelson	Whakarewarewa project	Pauline Harris (VUW); Nicola Gaston (UoA)
Rachel Grant	Environmental monitoring and remediation	Pauline Harris (VUW)
Sydnee Koia	Capturing Carbon Dioxide with Sorbent Materials	Paul Kruger (UoC)
Renee Harris	Replicating Mycelial Networks to Study Mass Transport in Fungi and Oomycetes	Volker Nock (UoC)
Lizzie Tafili	The link to polysulfide solvent sponges	Erin Leitao (UoA)
Isitokia (Kia) Paasi	Understanding the unique geological attributes and biological materials in Aotea-South Kawhia	Diane Bradshaw (GNS)
Ben Nielsen	Whakarewarewa Summer Project	Pauline Harris (VUW)

“A big highlight of our partnership for us is to be able to connect with the people of the village and experience their Matauranga, tikanga and te reo first hand.”

Students and researchers experiencing the welcome and hospitality of Whakarewarewa Village, Rotorua.



Chapter 2.

OUT OF THE LAB

Whether it is catalysing the generation of clean fuels, cutting the energy cost of industrial processes, or understanding mechanical forces in biology, MacDiarmid Institute researchers are addressing important questions that impact our lives and our environment. This work is carried forward by people who bring their diverse backgrounds to collaborations spanning different disciplines.

Here, we introduce you to some of our people and their work.

Reducing the energy costs of gas separation

For Dr Matthew Cowan it's all about working to make a difference for the environment. The MacDiarmid Institute Associate Investigator is developing technology he hopes will cut the amount of energy used to produce many common consumer products.

A senior lecturer in chemical and process engineering at the University of Canterbury, Dr Cowan is leading a project developing energy saving alternatives to the industrial gas separation and purification processes currently used to produce key raw materials used in plastics and chemicals.

The project received a $300,000 Marsden Fund Fast-Start grant in 2020 to explore creating the new membrane technology that could replace the current energy intensive distillation methods used to produce materials such as polyethylene and polypropylene.

Dr Cowan and his collaborators in Aotearoa New Zealand and internationally are examining ways to fabricate the metal-organic framework (MOF) membranes to be used in the process of gas separation.

"My whole idea behind these MOF membranes was to separate these gases without having to boil them and we should therefore be able to use much, much less energy to do that separation process," he says.

Dr Cowan's goal is to reduce the amount of energy we need to use every day to slow climate change and make lives richer.

"That's why I got into this (research). I wanted to make a difference for the environment and climate change."

But he is also a passionate believer in "getting research to where people can use it. That is the whole point."

He says some rough calculations suggest that globally the energy used separating these materials is between three and five times the amount of energy Aotearoa New Zealand uses every year.

"So I thought if we can save half that amount of energy then we can save an Aotearoa New Zealand's worth of energy and the carbon emissions associated with that."

The MOF membranes act like a molecular sieve. A pressure differential is created with high pressure on one side of the membrane and low pressure on the other and the gas flows from the high pressure area to the low pressure area.

The process can be used to separate ethylene from ethane or propylene from propane and that gas can then be purified. Current processes for gas separation are energy-intensive, complex and expensive.

He acknowledges the biggest challenge and the focus of the project is fabricating the membranes, but he says the research team has made some progress.

Dr Cowan is also pursuing other technological solutions to these energy intensive distillation processes.

He is collaborating with researchers in Texas, USA, on the potential of adsorbent materials for use in gas separation.

"They have sent us some materials to test including one last year, a completely new material made specifically for this project, that produced some exciting results.'

"Results from testing using this material featured on the covers and as a research articles in the International Edition of the prestigious scientific journal *Angewandte Chemie* and *ChemSusChem*."

Dr Cowan sees this work as part of a possible suite of solutions to the issue of reducing energy use alongside MOF membranes.

To cap a busy year, Dr Cowan also presented at Parliament at the Speaker's Science Forum which aims to present new research to MPs and decision-makers to inform the issues being addressed in Parliament.

"Amazing amounts of energy are hidden in the objects all around us."

His presentation 'Hidden Energy: Revolutionising hidden high-energy processes' focused on his research around improving the methods and technologies we use to purify all the building blocks of society.

"The kai we eat is separated from the earth, the water we drink is purified of bacteria, and our cutlery is shaped from metal refined from ore. Amazing amounts of energy are hidden in the objects all around us."

Dr Matthew Cowan assembling a cell for testing the mixed-gas permeation of new membrane materials.

The warm up: probing the fundamentals of room temperature superconductivity

It's arguably the 'holy grail' of solid-state physics - superconductors that operate at or near room temperature.

"It's definitely the dream," says Dr Shen Chong, Associate Investigator at the MacDiarmid Institute and Senior Scientist at the Robinson Research Institute.

"And whoever cracks it will surely get the Nobel Prize."

Superconductors were first discovered by another Nobel winner, Dutch physicist Kamerlingh Onnes. In 1911 he cooled elemental mercury to very low temperatures and observed that the electrical resistance disappeared. That was at a frosty 4 °K (-269 °C).

Since then, low-temperature superconductors, super-chilled with liquid helium, have come to be used to generate high-intensity magnetic fields for magnetic resonance imaging (MRI) scanners in hospitals, experimental nuclear fusion reactors and even the Large Hadron Collider.

> **"We're working towards the superconductors we'll need for high-intensity magnetic fields applications."**
> **DR SHEN CHONG**

High-temperature superconductors followed, allowing the temperature to rise to a relatively balmy 77 °K (–196.2 °C) the boiling point of the liquid nitrogen (LN_2) that keeps them cool. High-temperature superconductors increasingly show promise for real-world uses such as in motors and generators, power storage systems and even electricity lines.

In the labs at the Robinson Research Institute, scientists have developed and (with the company HTS-110 Ltd) commercialised a system for determining the characteristics of superconducting wires.

"What I'm trying to do is pursue new types of superconductors, understand how they work, and optimise their physical properties to make them cheaper."

Yet in doing so, Dr Chong grapples every day with a troubling trade-off.

Iron as an alternative

With liquid helium selling for around $60 a litre and in increasingly short supply and materials in high-temperature superconductors too delicate for many applications, the effort to discover new superconductors that can operate at higher temperatures is intensifying.

One path Dr Chong is exploring first opened up in 2008, when iron-based materials were discovered to have super-conductivity in ways that could give them advantages over conventional copper-oxide superconductors.

"We are looking at ways to modify iron-based superconductors so that they can carry higher electrical currents," says Dr Chong.

"Ultimately, it is about trying to increase the maximum magnetic field for superconducting magnets while ensuring that the cost is competative."

The applications of super-conductors that most appeals to him are their use in medical imaging equipment that can ultimately help save lives.

"The magnetic field in MRI machines is adequate at the moment, but to get the resolution you need to really look at the tissue in detail and perform chemical analysis at the same time, you need a high magnetic field." More efficient superconductors able to operate at higher temperatures could reduce the cost and improve the availability of MRI scanners as well as nuclear magnetic resonance (NMR) instruments, which allow the molecular structure of materials to be analysed.

"If we can make wires out of this iron material, it could be cheaper and more efficient than existing high-temperature superconductors," says Dr Chong, who has been with the Robinson Research Institute for nearly seven years and in 2016 received a Marsden Fund grant to pursue his research on iron-based wires.

Sensors and storage

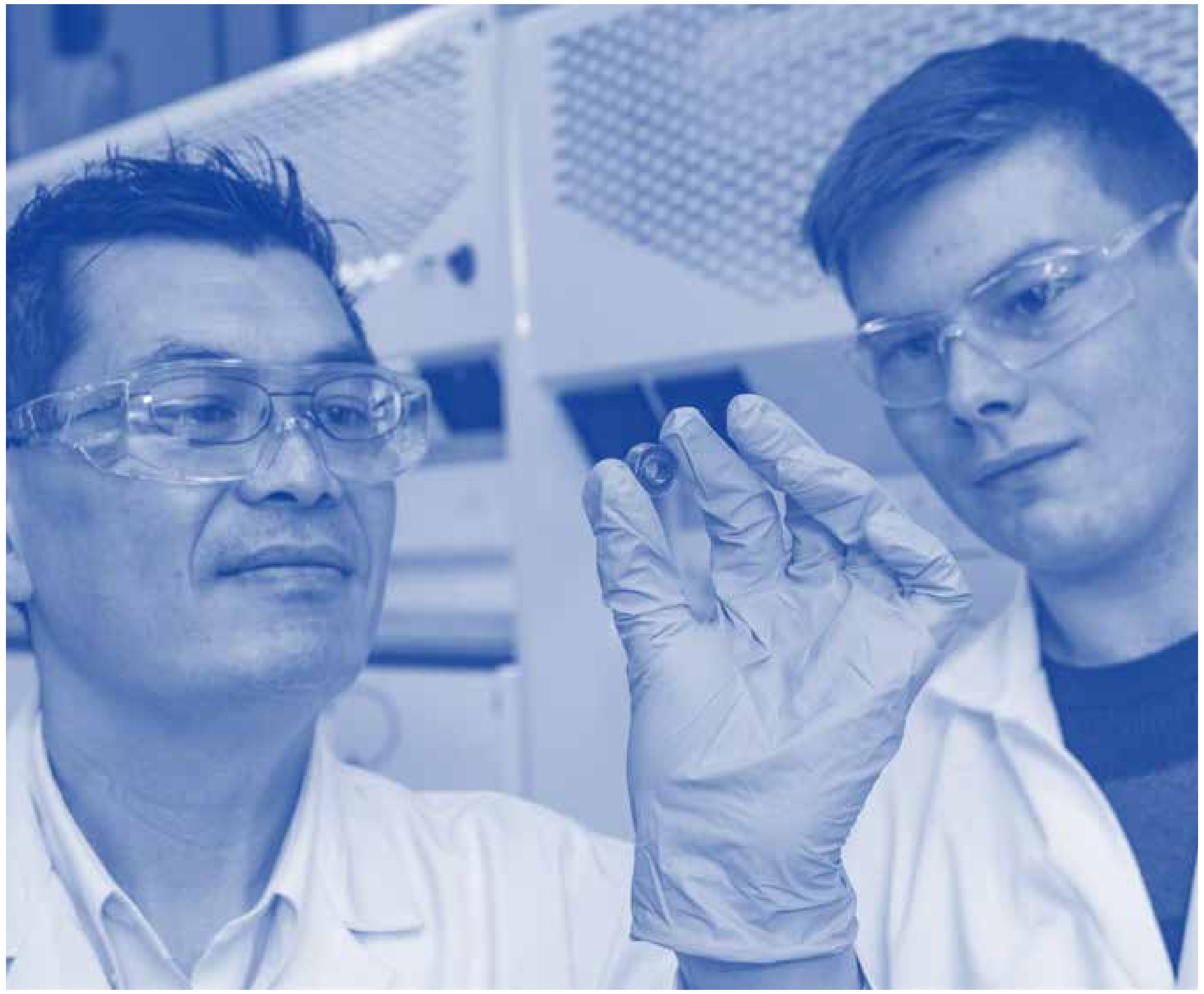
Dr Chong and MacDiarmid Institute Principal Investigator, Professor Grant Williams, are also exploring using sensors to create magnetic and temperature maps to monitor the health of our power generation and distribution infrastructure.

The pair are seeking to test field-test prototypes that would take advantage of the magnetochromic effect and photoluminescence to spot fluctuations in magnetic fields and temperature variations that indicate equipment failure may be imminent.

The sensors may be more accurate and safer to use than existing wired magnetic sensors and will be trialed with the Robinson Research Institute's partners in the electricity sector.

Yet another project Dr Chong is collaborating on seeks to develop luminescent materials that capture data in optical form very efficiently and could be used to reduce energy consumption in data centres for long term data storage.

"This could allow us to store data in 3D, allowing for massive improvements in storage density relative to conventional optical memory, such as Blu-ray discs," explains Dr Joe Schuyt, Dr Chong's



former PhD student and a MacDiarmid Institute collaborator.

"Our research aims to provide a means of long-term data storage - devices that can store data for centuries without loss of data, and without any electronics," adds Dr Schuyt.

The importance of resilience

Dr Chong said a highlight of his work was receiving the mentorship of Professor Jeff Tallon, a world leader in high-temperature superconductors and Emeritus Investigator at the MacDiarmid Institute.

"Jeff taught me that tiny things can make a big difference to your results," Dr Chong says.

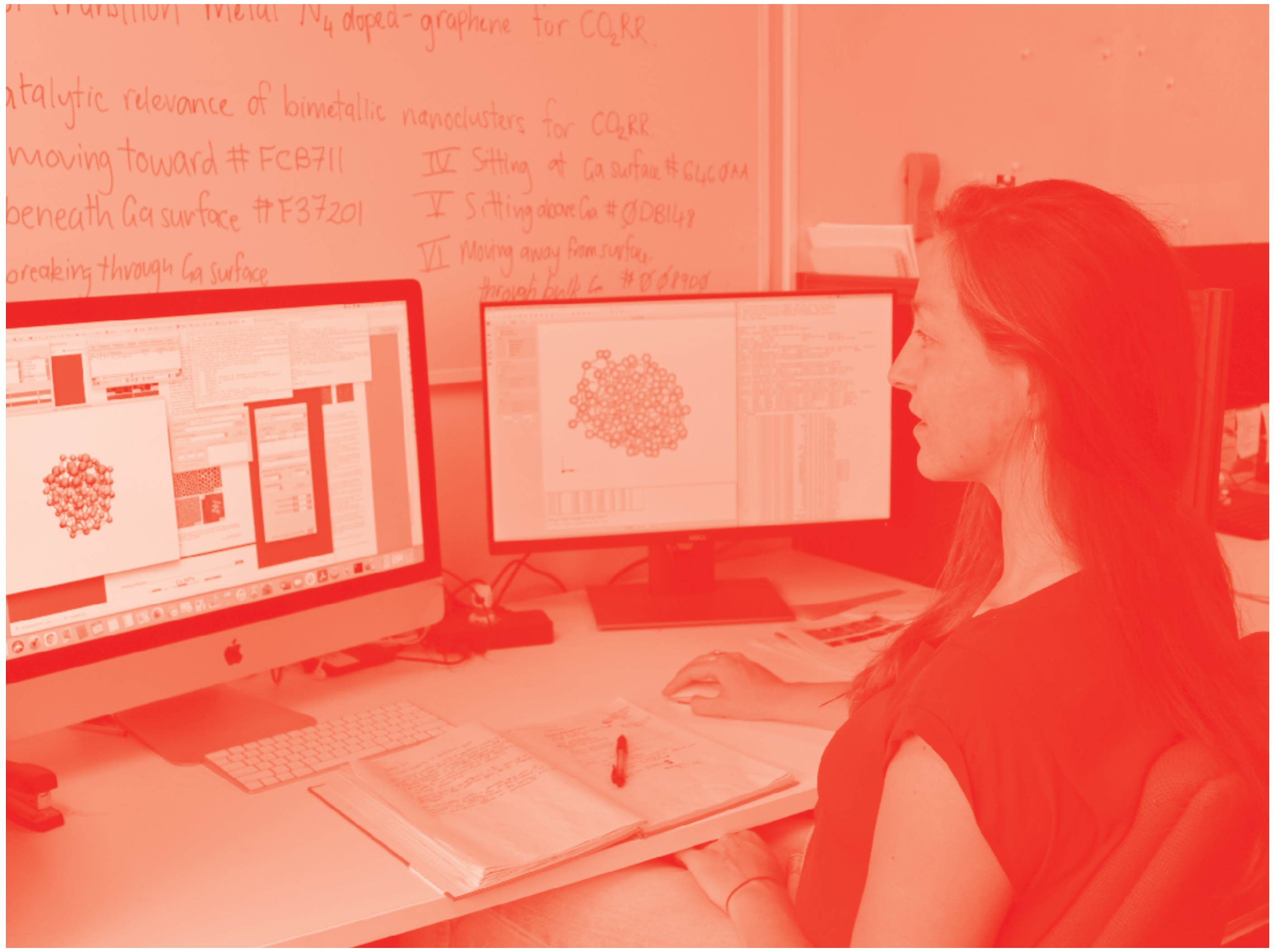
"He's also shown me how to be resilient in an environment where we are constantly having to look for new funding to keep doing our research."

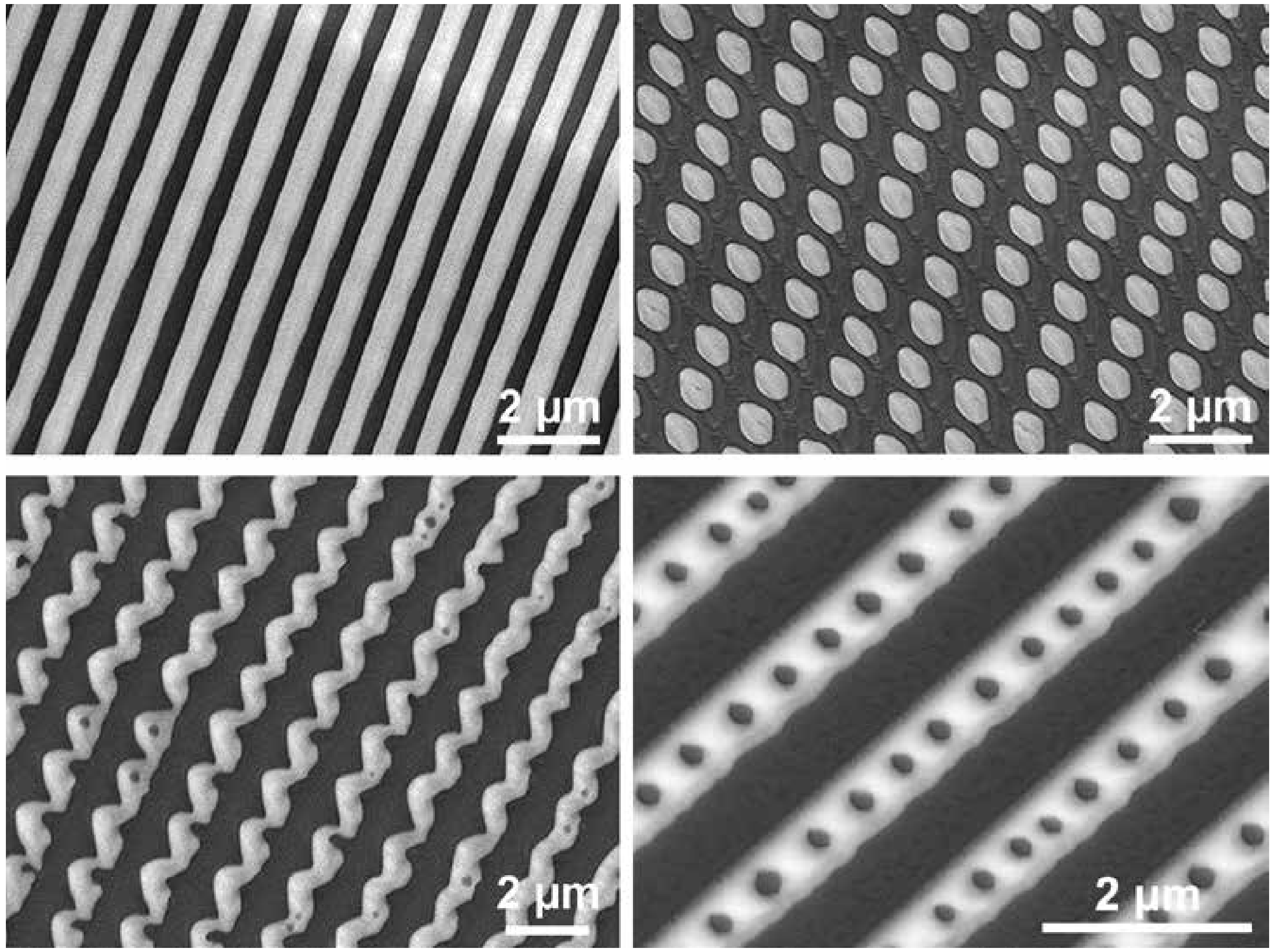
For now, the search for better superconductors continues.

Says Dr Chong: "The great thing about being part of the MacDiarmid Institute is the physicists, molecular chemists and crystallographers I get to work with. It is these types of collaborations that will move us towards our goal."

Dr Shen Chong and Research Assistant Fergus Robinson examining a freshly prepared iron-based composite sample.

> **"Storing data in 3D would give massive improvements in storage density. We're aiming for devices that can store data for centuries without loss of data and without any electronics."**
> **DR JOE SCHUYT**





Liquid metals that create nanostructure — it's the little details that count

A year of disrupted travel plans hasn't stopped PhD candidate and MacDiarmid Institute researcher, Stephanie Lambie, from successfully kick-starting a new collaboration with researchers at an Australian Centre of Excellence.

Lambie collaborated with MacDiarmid Institute Co-Director, Associate Professor Nicola Gaston, and Associate Investigator, Dr Krista Steenbergen, as well as Future Low Energy Electronics Technologies (FLEET) researchers at the University of New South Wales on the research, just published in Nature Nanotechnology.

The MacDiarmid Institute-FLEET team looked at the properties of liquid metals, in this case, bismuth-gallium alloys, which create nanoscale patterns, that could be useful in nanoelectronics, or that could play a role as catalysts to speed up chemical processes using low amounts of energy.

"We designed our calculations around the experiments that were carried out by the researchers at FLEET," says Lambie, who is completing her doctorate at the University of Auckland.

"A lot of these experimental techniques aren't designed to look at the subsurface metallic structure. Doing these computational calculations provides an extra level of insight."

FLEET Chief Investigator, Professor Kourosh Kalantar-Zadeh, explains the need for theoretical insight into pattern formation thus. "We serendipitously observed this deviation from the old metallurgy at the interface of liquid metals, where traces of secondary metals created fascinating patterns. Our colleagues at the MacDiarmid Institute, supported by the joint FLEET-MacDiarmid programme, were able to establish the underlying theory that governed the displacement of the secondary atoms toward the interfacial regions."

Potential applications of the patterning that these liquid metal alloys can create include nano-electronics, but perhaps most excitingly, the catalytic conversion of CO_2 into useful hydrocarbons for energy storage. Lambie says despite Covid-19 forcing her to shelve plans to visit her collaborators across the Tasman, the team has stayed productive.

"We meet virtually every couple of weeks. I'm still very keen to get over and see them and they are keen to have me."

Lambie is in her first year as a PhD student but into her fourth year as a MacDiarmid Institute collaborator, having worked with MacDiarmid Institute researchers, Dr Anna Garden and Associate Professor Franck Natali, as part of her master's degree.

"I like seeing the patterns and what we can figure out from them," says Lambie of the computational modelling work she undertakes.

"With this liquid metal technology, we aren't really sure what the potential applications will actually be. But it is cool and exciting and new and I spend a lot of time thinking about it."

As well as the collaborations with MacDiarmid Institute researchers that have been integral to her studies to date, Lambie, who completed her MSc with Associate Investigator, Dr Anna Garden at Otago, said a highlight had been working with inspiring women in science.

"I've worked with lots of amazing women who all know each other through MacDiarmid," she says.

"In this game, the finer details are just as important as the big scale changes."

MACDIARMID INSTITUTE RESEARCHER STEPHANIE LAMBIE

"I'm really grateful to have such awesome role models and mentors."

Lambie hoped a planned research trip to Berlin would come off in 2021 as the world opened up in the wake of Covid-19. In the meantime, she will continue her work on science that she admits appears obscure to that outside of the field.

"It's complicated. But in this game, the finer details are just as important as the big scale changes," she says.

"The biggest discoveries can only happen because other people have spent hours and hours iterating and refining."

Theoretical physics PhD student Stephanie Lambie analyses surface Bi patterning.

Potential applications of the liquid metal patterning include nano-electronics, but perhaps most excitingly, the catalytic conversion of CO_2 into useful hydrocarbons for energy storage.

The quest to unlock the green hydrogen revolution

It holds the promise of virtually emissions-free energy - using electrolysers to split water (H_2O) into hydrogen (H_2) and oxygen (O_2), and using the resulting H_2 to power fuel cells in cars, buses, trucks and trains.

Our own government has recognised the potential of using our extensive renewable energy resources to create hydrogen for local industry and transport and even to become a hydrogen exporter.

"We are talking about a two-dimensional material that is just three atoms thick."

DR ANNA GARDEN

There's just one major problem. The catalysts used in the electrolysers that produce the hydrogen currently rely on expensive and rare metals such as platinum to operate efficiently.

"Platinum sits in this Goldilocks zone," explains MacDiarmid Institute Associate Investigator, Dr Anna Garden, a lecturer in the Department of Chemistry at the University of Otago.

"To catalyse the conversion of protons and electrons into H_2, you need to bind the protons to the surface of the catalyst, which is where the reaction takes place. That forms hydrogen gas and then they leave again," says Dr Garden.

A catalyst for change

Platinum-based catalysts facilitate that two-step process with great efficiency but fail the economic test to make 'green hydrogen' production viable.

Dr Garden and her colleagues have spent the year exploring a potential alternative - molybdenum disulfide (MoS_2), a low-cost inorganic compound with properties similar to platinum for hydrogen evolution.

"It's been known to have some activity that's useful for this reaction, but it's not good enough yet," says Dr Garden.

Using computational modelling, she is able to determine what minute changes in the characteristics of MoS_2-based catalysts will mean for the efficiency of the process.

"We are talking about a two-dimensional material that is just three atoms thick. The complicating factor when studying H_2 evolution over MoS_2 is that we are dealing with an electrochemical process. Its surface, the contacting electrolyte and the applied voltage all influence H_2 production rates. This adds complexity," she says.

The computational models created by Dr Garden and her colleagues offer atomic-scale insights that can inform lab experiments using potential materials for catalysts. Along with MacDiarmid Institute student researchers at the University of Otago, Charlie Ruffman and Calum Gordon, and Professor Egill Skúlason from the University of Iceland, Dr Garden in June published a paper in the Journal of Physical Chemistry looking at the mechanisms for hydrogen evolution using MoS_2 catalysts.

Working through Covid

While the pandemic had disrupted research and the team's plans to present their findings at the first Commonwealth Chemistry Congress which was to be held this year in Trinidad and Tobago, Dr Garden said a highlight of 2020 had been working with PhD student, Charlie Ruffman.

"He's really the driving force behind this research and he came through the year astonishingly well," she says.

The MacDiarmid Institute had moved early to support student researchers through lockdown by giving them a three-month extension for their research projects.

Work would continue next year on MoS_2-based catalysts, including modelling the impact of wrapping the materials into nanotube form.

"We are not putting all of our eggs in one basket and these catalysts aren't any silver bullet, they won't allow us to completely replace fossil fuels," Dr Garden says.

"But they could help us create a more sustainable economy if we can get to that financial tipping point where the process of making hydrogen from electrolysis becomes competitive."

At his lab at the University of Auckland, MacDiarmid Institute Principal Investigator, Associate Professor Geoff Waterhouse, experiments with those 2D materials, testing their performance for hydrogen production.

"The ground-breaking computational work of Dr Garden's group provides valuable insights and cues about the types of 2D materials we should synthesize for this application."

His group takes bulk layered materials, then exfoliates these using chemical and electrochemical processes to give '2D nanosheets'.

Defects that deliver

"The 2D nanosheets expose numerous active sites for the hydrogen evolution reaction," says Associate Professor Waterhouse.

Defects on flat surfaces or at the edges of the 2D nanosheets are key to these materials being useful for the reaction.

"Defects are very good for the adsorption of water and promote electron transfer processes, key steps in the efficient electrocatalytic production of hydrogen from water," says Associate Professor Waterhouse.

"We can also use ultrasonic treatments to introduce holes in the 2D nanosheets, thereby creating additional defects for enhanced performance."

Associate Professor Waterhouse's group makes extensive use of X-ray based spectroscopies at the Australian Synchrotron based in Melbourne and similar facilities in Japan and China to examine the 2D nanosheet catalysts in detail. The use of such techniques, together with high resolution electron microscopy techniques, allows his team to 'visualise' at the atomic scale, the working surface of active 2D electrocatalysts. Another stream of work involves the development of 2D photocatalysts for hydrogen generation from water using direct sunlight.

"We could completely eliminate the electrical circuit altogether in H_2 production, simply by placing our semiconductor photocatalyst in water and exposing that system to sunlight," explains Associate Professor Waterhouse.

For both electrocatalytic and photocatalytic H_2 generation, the key challenge is making these technologies efficient and adoptable at scale, thus allowing them to compete with conventional forms of hydrogen production based on fossil fuel feedstocks.

Associate Professor Waterhouse normally spends four months of the year in China working with experts in the design and fabrication of 2D catalysts for hydrogen production, CO_2 reduction and N_2 fixation. "We've lost basically one year of experimental work this year, due to the impact of Covid-19."

Just another reason to celebrate the emerging synergies between computational and experimental efforts to address CO_2 reduction within the MacDairmid Institute.

"Defects are very good for the adsorption of water and promote electron transfer processes, key steps in the efficient electrocatalytic production of hydrogen from water."

ASSOCIATE PROFESSOR GEOFF WATERHOUSE

Members of the Garden group who are working on computational modelling of the hydrogen evolution reaction.

The emerging field of mechanobiology

Wellbeing and medical health is generally seen as the realm of biology rather than physics. But physics-biology collaborations are forging a new field – mechanobiology – a research area key to understanding health and disease.

We're familiar with the idea of chemical messaging: we know neurotransmitters pass messages to nerves and that hormones travel through blood to signal to cells throughout the body. But it's less well known that our cells are also constantly reading and reacting to mechanical signals.

MacDiarmid Institute Principal Investigator and Massey University Professor, Bill Williams, says that this is exactly what the new field of mechanobiology studies.

"Cellular mechanobiology looks at the physical structure of cells and their environments and the role that mechanics plays in sensing and actuation."

"Cancer tissues can be up to ten times stiffer than healthy tissues. So if we want to understand cancer we're going to need to measure the cell's materials properties."

PROFESSOR BILL WILLIAMS

We tend to associate 'mechanics' as something more on the size-scale of our cars, but it's micro-mechanics that he's talking about. The 'extracellular matrix' surrounding our cells is a protein-based scaffold, an example of which is connective tissue. This matrix can vary in stiffness (much like the difference between fresh or stale bread).

It turns out that the stiffness of the matrix has a big effect on the ability of our cells to function healthily and withstand disease. Changes in the stiffness of this matrix are thought to contribute to many types of disease, including cancer.

"Changes in the materials properties of this extracellular matrix, around our cells for exampl, can be transmitted through the cell membrane and into the cytoplasm where they can impact on gene expression."

Professor Williams says mechanobiology is hugely multidisciplinary, encompassing cell biology, bioengineering and biophysics and requires more than one measurement technique.

"If I gave you a slinky and asked you to measure the mechanics of the spring in different ways, all the measurements would report pretty much the same thing. But biological systems are typically spatially heterogenous and have mechanical properties that vary according to length and time scales. Typically you're measuring something slightly different when you apply a different technique."

He says that developing a suite of techniques for the measurement of the mechanical properties of soft biological materials has been a recurrent theme throughout the history of the MacDiarmid Institute and that the Institute is now well positioned with an impressive range of techniques including Optical Tweezers (his own research), AFM (Associate Investigator Dr Jenny Malmström), Microaspiration (Principal Investigator Associate Professor Geoff Willmott), and Micropillar bending (Principal Investigator Associate Professor Volker Nock) to address challenging problems.

"Cancer tissues, for example, can be up to ten times stiffer than healthy tissues. So for cancer it's important to measure the cell's materials properties – and since these are complex, we need to have several techniques up our sleeve."

A happy tearoom coincidence

He points out that the mechanobiology field is by definition extremely collaborative. One key collaboration came about by chance, from a tearoom discussion with Dr Tracy Hale from Massey University's School of Fundamental Sciences.

"We were chatting over a cup of tea, as you do, and I was talking about how we were working on bringing together several different techniques to measure the physical properties of cells. I mentioned that we were concentrating our efforts on standard cell samples in order to develop the techniques. But we needed an actual biological problem."

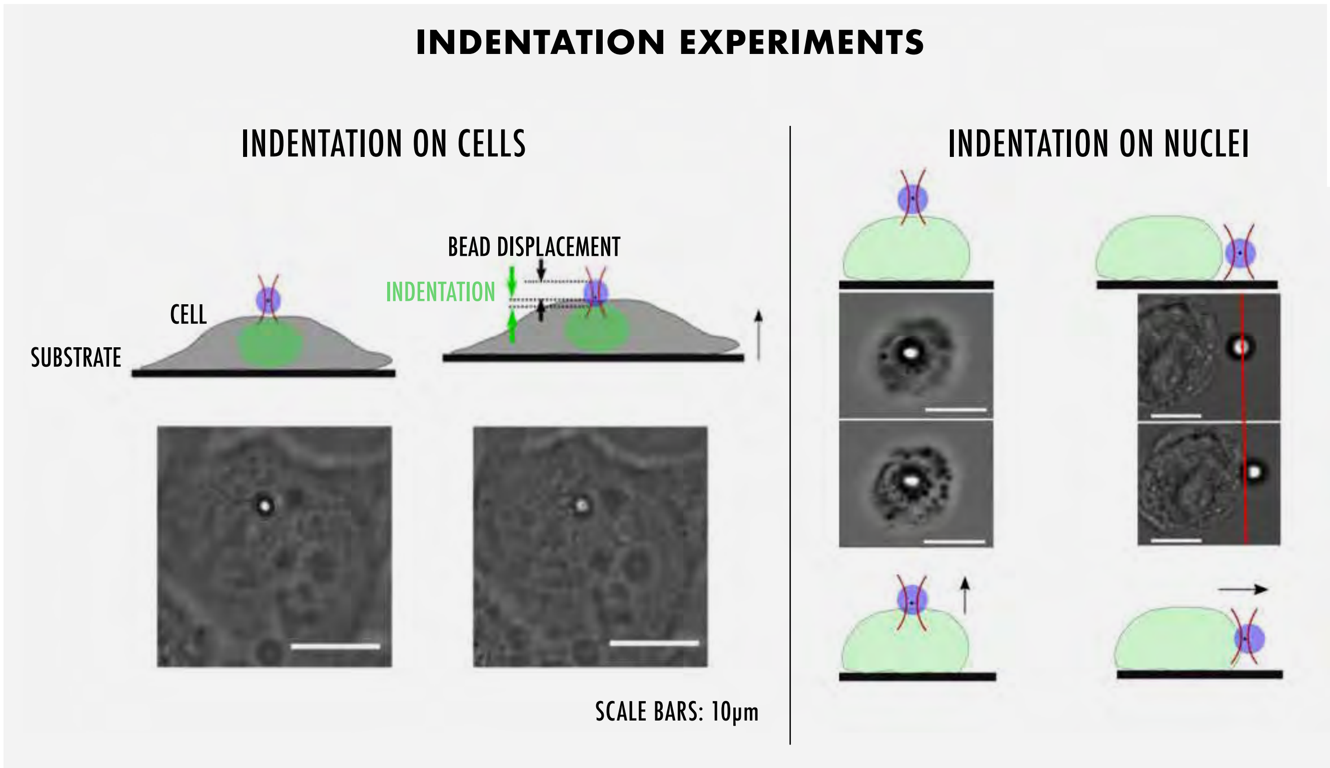
And it turned out that Dr Hale had managed to produce a line of breast cancer cells lacking in a particular protein (heterochomatin protein 1) – a protein that is found to be expressed less in the most invasive cancer cells. The hypothesis was that the downregulation of the protein affects the mechanics of the cell nucleus in a way that impacts on their ability to migrate through the body.

"She had managed to grow cells like that, along with a control cell line, and was actually looking for biophysical materials scientists to work with."

But why should we be doing this research here in NZ?

"It's part of a responsible society that we put tax dollars into science and medicine. And for that we need to be doing these things demonstrably at a world-class level."

"And yes there are big groups in the States doing this, but there's lots of competition between those groups. New Zealand is small enough that we can collaborate effectively – this type of collaboration is an example of the strength of a Centre of Research Excellence like the MacDiarmid. Although each of the three techniques we're using can be done elsewhere, first up, we're as good as anyone else is, and secondly, unlike them, we're all working together."



Left: Probing whole cells using indentation with a particle from the top.
Right: Probing nuclei extracted from cells, both probing from the top and the side.

"First up, we're as good as anyone else is, and secondly, unlike most groups overseas, we're all working together."

PROFESSOR BILL WILLIAMS

His MacDiarmid Institute collaborators on the breast cancer cell work include University of Auckland Associate Professor, Geoff Willmott, as well as PhD students, Susav Pradhan and Ankita Gangotra (who has just left NZ for a postdoc in the USA), and Research Assistant, Ayelen Tayagui, from the University of Canterbury. Associate Professor Volker Nock's lab has recently travelled to Auckland and Palmerston North to investigate the mechanics of fungal like organsims.

Professor Williams says that having already built up collaboration on the different mechanical measurements we can do within the Institute, we can now apply these more generally to other biological systems.

"Volker's been using his expertise in lab-on-a-chip force measurement to study the forces involved in the protrusion of hyphae of fungi (studying Myrtle Rust and Kauri Dieback)."

"The investment the Institute has already put in developing these techniques, calibrating and understanding them, means we can do exactly the right measurements. And now, with the help of Dr Hale, we can apply these to something else – these breast cancer cells – in fact anything that involves mechanical properties of cells."

For now, the MacDiarmid Institute teams have the mechanical properties of breast cancer cells firmly in their headlights, using multiple physics techniques to better understand the biological environments that keep us healthy.

"The investment the Institute has already put in developing these techniques, calibrating and understanding them – means we can do exactly the right measurements."

PROFESSOR BILL WILLIAMS

Internationally connected

Co-Director, Associate Professor Nicola Gaston, and Principal Investigator, Professor Sally Brooker, were invited to join a German Academic Exchange Service-funded delegation to Germany in January 2020.

The German Academic Exchange Service (DAAD) is the largest German support organisation in the field of international academic co-operation, akin in role (although not in scale) to Education Aotearoa New Zealand.

The aim of the visit was to increase connectivity between research centres in Germany and Aotearoa New Zealand, with sustainability broadly the theme of the visit. Along with representatives from some other CoREs, Associate Professor Gaston and Professor Brooker spent the week visiting Clusters of Excellence – very similar research centres, in Germany, to the CoREs – from Bonn, to Cologne, to Aachen, Hamburg, and Berlin. In particular, the delegation visited the Cluster of Excellence in Matter and Light for Quantum Computing (ML4Q), in Bonn; the Fuel Science Centre in Aachen; Advanced Imaging of Matter, in Hamburg; the Max Planck Institute for the Structure and Dynamics of Matter (also in Hamburg); and the Leibniz Institute for Crystal Growth in Berlin; as well as Unifying Systems in Catalysis, at the Technical University in Berlin.

The delegation, which included Education NZ, MBIE and MFAT, also met with several German Members of Parliament.

Associate Professor Gaston said that at a very personal level – as someone who was once funded by the DAAD to visit Germany on a research stay during her PhD – it was extremely positive to see the emphasis put by these policy makers on the importance of scientific exchange for the relationship between Aotearoa New Zealand and Germany.

"There is a lot we have in common as scientific communities."
ASSOCIATE PROFESSOR NICOLA GASTON

Professor Sally Brooker and Associate Professor Nicola Gaston enjoy lab visits in the Centre of Excellence facilities in Hamburg (left) and Bonn (right); bottom: the group of delegates included representatives of Riddet, Te Punaha Matatini, the BioProtection Research Centre, as well as MBIE and Berlin Embassy staff.

Awards 2020

Chris Bumby Victoria University of Wellington	Heavy Engineering Research Association (HERA) 2020 Innovation Award
Jim Johnston Victoria University of Wellington	Baldwins Researcher Entrepreneur Award - KiwiNet Research Commercialisation Awards 2020 BNZ Supreme Award - KiwiNet Research Commercialisation Awards 2020
Justin Hodgkiss Victoria University of Wellington	Prize in Industrial and Applied Chemistry – New Zealand Institute of Chemistry (NZIC)
Duncan McGillivray University of Auckland	New Zealand Institute of Chemistry (NZIC) Fellowship Bristol Benjamin Meaker Distinguished Visiting Professor Award – University of Bristol, Bristol, UK
Shane Telfer Massey University	College of Science Research Medal – Massey University
Geoff Waterhouse University of Auckland	2020 Maurice Wilkins Centre Prize for Chemical Science – New Zealand Institute of Chemistry (NZIC) 2020 Clarivate Web of Science Highly Cited Researcher List Fellow of the Royal Society of Chemistry (FRSC)

Funding successes

2020 Marsden Grants

Simon Brown University of Canterbury	"Correlations and randomness: Brain-like computation using nanoparticle networks"
Chris Bumby Victoria University of Wellington	"Ultra-precise control of magnetic flux quanta in high-Tc superconducting magnets"
Robin Fulton* Victoria University of Wellington	"Activating Substrates for Chemical Synthesis with Reactive Aluminium Reagents"
Tilo Söhnel University of Auckland	"Skyrmion systems: New Opportunities for Information Technologies"
Jadranka Travas-Sejdic University of Auckland	"A New Approach to Transient Organic Electronics"

*Contributing as an AI

Royal Society Fellowships

Nathaniel Davis (Rutherford Discovery Fellowship) Victoria University of Wellington	"Pushing the limits on renewable energy technology through hybrid organic/inorganic nanomaterials"
Charles Unsworth (James Cook Research Fellowship) University of Auckland	"Understanding how aggressive adult brain cancer talks"

2020 MBIE Funding

Margaret Brimble University of Auckland	"Waerau waikawa iti rongoā paturopi: New Generation Peptide Antibiotics" (Research Programme, Endeavour Fund)
Renwick Dobson University of Canterbury	"Understanding the interactions between plant-based protein and cellular agriculture" (Catalyst Fund)
Laura Domigan University of Auckland	"Investigating the interactions between plant proteins and cultured livestock cells" (Catalyst Fund)
Laura Domigan University of Auckland	"Crystallin biomaterials" (PreSeed Accelerator Fund)

Keith Gordon University of Otago	"Cyber-physical seafood systems: Intelligent and optimised green manufacturing for marine co-products" (Research Programme, Endeavour Fund)
Pauline Harris and **Stuart Wimbush** Victoria University of Wellington	"High magnetic field electric propulsion for space" (Research Programme, Endeavour Fund)
John Kennedy, Jerome Leveneur, Anna Garden, Vedran Jovic and **Aaron Marshall** GNS, University of Otago, Victoria University of Wellington and University of Canterbury	"Powering New Zealand's Green-Hydrogen economy: Next-generation electrocatalytic systems for energy production and storage" (Research Programme, Endeavour Fund)
James Storey, Chris Bumby and **Stuart Wimbush** Victoria University of Wellington	"High power electric motors for large-scale transport" (Advanced Energy Technology Platform, Strategic Science Investment Fund)
Jadranka Travas-Sejdic University of Auckland	"Selective capture, selective release: pulling intact cells from complex mixtures" (2017 Research Programme, Endeavour Fund - Covid extension)
Grant Williams Victoria University of Wellington	"Developing semiconductor thin films as radiation sensors" (Catalyst Fund)

2020 HRC (Health Research Council) Grants

Michel Nieuwoudt and **Cather Simpson** University of Auckland	Sir Charles Hercus Fellowship - "Photonic device for real-time measurement of ischaemic tissue margins in surgery"

2020 NSC (National Science Challenge) Grants

David Barker University of Auckland	"Novel engineered media for sustainable water treatment by biofabricating and valorising waste resources" (Science for Technological Innovation (SfTI) Spearhead)
Renwick Dobson University of Canterbury	"Host, Pathogen & Environment: targeting Austropuccinia psidii effectors as a novel control strategy" (New Zealand's Biological Heritage)
Jadranka Travas-Sejdic University of Auckland	"Remote detection of Phytophthora agathidicida" (New Zealand's Biological Heritage)

2020 Domestic Funding – Other

David Barker University of Auckland	Senzatek synthesis contract
David Barker University of Auckland	"Development of Tyrosyl-DNA phosphodiesterase 1 inhibitors for cancer therapy" Cancer Society of NZ Project grant Cancer Research Trust Research Grant
Margaret Brimble University of Auckland	"Design and Synthesis of Sulfonylheterocycles and Nitrooxymethylpyromellitic Diimide Derivatives, as Biomethanation Inhibitors in Ruminants" Pastoral Greenhouse Gas Research Limited "Development of Novel Peptidomimetics Against Pediatric Dental Caries" Cure Kids "Molecular Tools for Methane Mitigation" New Zealand Agricultural Greenhouse Gas Research Centre Innovation Fund 2020 "Sars-CoV-2 Virus Entry Inhibitors" Auckland Medical Research Foundation
James Crowley University of Otago	Donation to support anti-cancer and anti-bacterial drug projects (from P Lane)
Laura Domigan University of Auckland	"Melanosomes from livestock hair as radiation absorbing materials" Bioresource Processing Alliance (BPA) Student Project
Justin Hodgkiss Victoria University of Wellington	"Ultrafast Spectroscopy" KiwiNet Tier 2
Aaron Marshall University of Canterbury	Seed investment for Zincovery
Carla Meledandri University of Otago	"Gold nanoparticles: A novel treatment strategy for oral mucositis" New Zealand Dental Association Research Foundation Grant "Topical ultrasound contrast agent for oral cancer screening" Lottery Health Research Grant

Michel Nieuwoudt University of Auckland	Consultant chemometrician with Fonterra On-Farm R&D
Viji Sarojini University of Auckland	Philanthropic funding
Catherine Whitby Massey University	"Stabilisation of Fortified UHT Beverages" Fonterra Cooperative Group Limited funding for a PhD student

International Funding

Jack Chen Auckland University of Technology	"Dynamics of structure formation in stimuli-responsive amphiphilic catalysts (ID 8756)" Australian Centre for Neutron Scattering Neutron 2020-2 "Dynamic formation of a multifunctional catalyst (ID 9379)" Australian Centre for Neutron Scattering Neutron 2021-1
James Crowley University of Otago	"Metallosupramolecular Cages for Enantioselective Applications" with Dr. David Turner, Monash University
Laura Domigan University of Auckland	"Laying the groundwork for molluscan cellular agriculture" New Harvest, USA
Simon Granville Victoria University of Wellington	"Topotactic Control of Magnetism in Multiferroic and Skyrmion Materials" Australian Research Council Discovery Project
Carla Meledandri University of Otago	"Far-infrared spectroscopy for characterising metal-carboxylate coordination in MOF-type porous materials" Australia's Nuclear Science and Technology Organisation (ANSTO) Grant for use of the THz/Far-infrared beamline at the Australian Synchrotron in the 2021 cycle

2020 University Internal Funding

Martin Allen University of Canterbury	'Accelerator' PhD Scholarships (x2) for high achieving domestic PhD students working on MacDiarmid-relevant research areas - UC Aho Hinātore Scholarships
Matthew Cowan University of Canterbury	"Operational Process for Alkene/Alkane Separation" UC Aho Hinātore Scholarship
Petrik Galvosas Victoria University of Wellington	"Cellular Tissue Model for Magnetic Resonance" Faculty Strategic Research Grant
Simon Granville and Ben Ruck Victoria University of Wellington	"Cryogenic time-resolved MOKE system to measure magnetisation dynamics at GHz-THz" Faculty Strategic Research Grant
Erin Leitao University of Auckland	"Characterising polysulfides made by inverse vulcanisation of functional siloxanes" Performance Based Research Fund
Ben Mallett University of Auckland	"Understanding weird new states in superconductor sandwiches" Marsden Near-Miss
Jenny Malmström University of Auckland	Faculty Research Development Fund
Duncan McGillivray University of Auckland	"Atmospheric plasma jet printing of aerosol materials for tailored surfaces" Faculty Research Development Fund
Volker Nock University of Canterbury	"Gut-on-a-Chip" Strategic Grant
Viji Sarojini University of Auckland	"Self-cleaning Antimicrobial surface against Catheter-associated Urinary Tract Infections" Auckland Medical Research Foundation
Catherine Whitby Massey University	"Novel liposome vehicles for delivering pain relief to animals" Massey University Research Fund

Chapter 3.

INTO THE MARKET PLACE

Successful research translation relies on networks, connectedness and relationships. 2020 was therefore particularly challenging for NZ's research commercialisation sector, often labelled an 'ecosystem'. For most, the forced restrictions provided an opportunity to refocus and R&D was high on the agenda for many. The MacDiarmid Institute's commercialisation and industry engagement activities went online, a forced adaptation that will serve us well in a reduced-carbon future. We maintained high standards in our own activities – developing IP and spinouts, delivering an online Interface event alongside many industry engagements, and giving our researchers at all levels a step up towards research commercialisation. The cherry on the top for 2020 was provided by our affiliated spinout Zincovery, winners of the C-Prize.

Sustainable battery materials

Many of our researchers are making strides into new materials for energy storage. One project approaching the market is the development of an aluminium-ion battery material.

Dr Shalini Divya has recently completed her PhD working on new materials to replace lithium-ion batteries and is now forging her path as co-founder of the fresh spinout company, TasmanIon. The company aims to ensure the rapidly increasing global demand for batteries is met with a more sustainable alternative. Aluminium is a more abundant element than lithium and can be more easily recycled, leading to lower lifecycle impacts on our environment.

Like other deep tech opportunities, modern battery development and commercialisation is complex, time-consuming, and needs long-term support. Dr Divya has received MacDiarmid Institute support to take the technology to market and we are pleased to contribute alongside Wellington UniVentures and her academic supervisors (Professors Thomas Naan and Jim Johnston).

The coming year for TasmanIon will include finalising the seed investments and then pursuing technical milestones to develop a better battery prototype.

"The chance to translate my PhD project into a sustainable commercial product is a dream come true."

DR SHALINI DIVYA

Pulling microfluidics out of a hat

For Dr Rob Ward and MacDiarmid Institute Principal Investigator, Professor Bill Williams, commercialisation is the end point of a long learning process.

Together with recent engineering graduate Reuben Osborne, the pair are co-founders of White Rabbit which has a vision to provide plug and play scientific equipment for microworld experiments. They are initially focusing on developing easy-to-use reliable parts for microfluidics.

> **"White Rabbit was born out of the belief that the scientific community can do better. "**
> **PROFESSOR BILL WILLIAMS**

Microfluidics involves manipulation of liquids using micrometer-scale channels, valves, pumps and the like. This fast-growing technological field often goes by the label 'lab-on-a-chip', drawing an analogy with miniaturization of electronics in the second half of last century. Microfluidics has wide-ranging potential in areas such as sensing, diagnostics, genomics and proteomics, and even efficient industrial chemistry.

In the lab Dr Ward and Professor Williams found out the hard way that off-the-shelf microfluidics equipment is not easy to use. Turns out they're not alone and now they are in a position to leverage years of troubleshooting by developing and selling market-leading parts. Their first commercial product, the subject of a filed patent application, is a small 'Apple-esque' high-precision syringe pump.

Professor Williams thinks that experimental work to develop new equipment and methodologies is important and often underappreciated. "Research labs generally have cupboards full of gizmos that languish into obscurity, while other labs reinvent the wheel.

> **"Stepping from the lab into the commercial world feels a bit like shifting into a new universe."**
> **DR ROB WARD**

We want to produce devices that we would have loved to have had available when we started out and that could have saved us many hours and research dollars."

The MacDiarmid Institute has supported Dr Ward to scope opportunities, develop a commercial plan, and hone commercialisation skills. He says, "MacDiarmid has been a great source of ongoing training, support and advice, and we hope to draw more from their expertise over the coming years as we bring more products to market."

New companies affiliated with the MacDiarmid Institute between 2002 and 2020

MacDiarmid Institute affiliated start-ups:

Number of start-ups and spinouts preparing to raise capital	At least 4
Number of patent applications by researchers (2020)	10
Number of patents granted to researchers (2020)	5
Number of inventions disclosed to TTOs (2019)	6

Pathways to Industry

2020 certainly threw a few curveballs for Aotearoa New Zealand's research commercialisation ecosystem but true to our collaborative culture, the MacDiarmid Institute still managed to host and share a wide range of Commercial Skill Building and Industry Interface activities.

We would like to thank our many partners who have generously given advice, time and support for our efforts to grow the success of our research entrepreneurs - the likes of KiwiNet, Return on Science, each of our member University Technology Transfer Offices (TTOs), Callaghan Innovation, investors and deep tech entrepreneurs. Commercialising materials science requires not only leading edge scientific research, but also a diverse team of dedicated, well informed, ambitious founders and contributors along the journey.

A member of the Ligar team working on a natural products project.

Commercial Skill Building

We aim to ensure that our research community has access to all of the people, skills and support that they need on the challenging journey of deep tech commercialisation. With Covid-19 disrupting in-person activities, we jumped at the chance to initiate an online 'Commercial Skill Building' seminar series, in partnership with Auckland UniServices and Return on Science. Beyond the lockdowns, we are continuing to host monthly online seminars for research entrepreneurs interested in the intricacies of intellectual property, capital raising, investor dynamics, and accessing support from university technology transfer offices.

Industry Interface activities

We continue to develop long-term relationships with companies aimed at supporting any research needs they identify over time, while enabling researchers to plan long-term science portfolios that are relevant to these companies. These 'Interface' partners get to tap into our regular offerings (Industry Advisory Panels, internships, Commercial Skill Building, job postings and ongoing science outreach), and to advise us of future focused aspirations.

Our annual Industry Interface event, held within Techweek, was an online event but still managed to draw a highly engaged crowd. Entitled *Advanced materials – Science careers that improve our world*, the event featured a range of speakers alongside Zoom break-out room discussions:

- Jono Ring, CEO Zincovery, winner of the 2020 Callaghan C-Prize
- Veronica Harwood-Stevenson, CEO Humble Bee, developing advanced materials using biomimicry (from the nesting material of a solitary bee emerges a new chemical resistant, biodegradable fabric)
- Prof Jadranka Travas-Sejdic, Director of the Polymer Electronics Research Centre at The University of Auckland and a Principal Investigator at the MacDiarmid Institute
- Te Horipo Karaitiana, Ngati Kahungunu, Kurakura Kai Tahu, Kati Mamoe, Waitaha, Hawea. CEO Te Awanui Huka Pak

Our commercialisation and industry engagement activities continue to develop our next generation of start-up, commercial and R&D leaders so that our graduates emerge into the market, ready to improve Aotearoa New Zealand's R&D productivity. We continue to fund industry internships and are confident of the strong contribution our scientists are making (and will make) to local industry (see *Into the Future*).

Industry Advisory Panels

With Covid-19 requiring us to move to online formats, we also commenced an online platform for regular engagement between technology companies and our scientists in the form of an Industry Advisory Panel. Each panel session hosts a company that is interested in pursuing research to overcome a technical challenge with commercial relevance. The panel consists of a selection of our materials scientists (chemists, physicists, biologists, engineers) who provide advice on how to approach the company challenge. Companies such as CarbonScape and Ligar (see images) are able to learn about our research capability and facilities, and potentially build partnerships; while our scientists are able to identify new collaborations and gain exposure to industry perspectives and ways of operating.

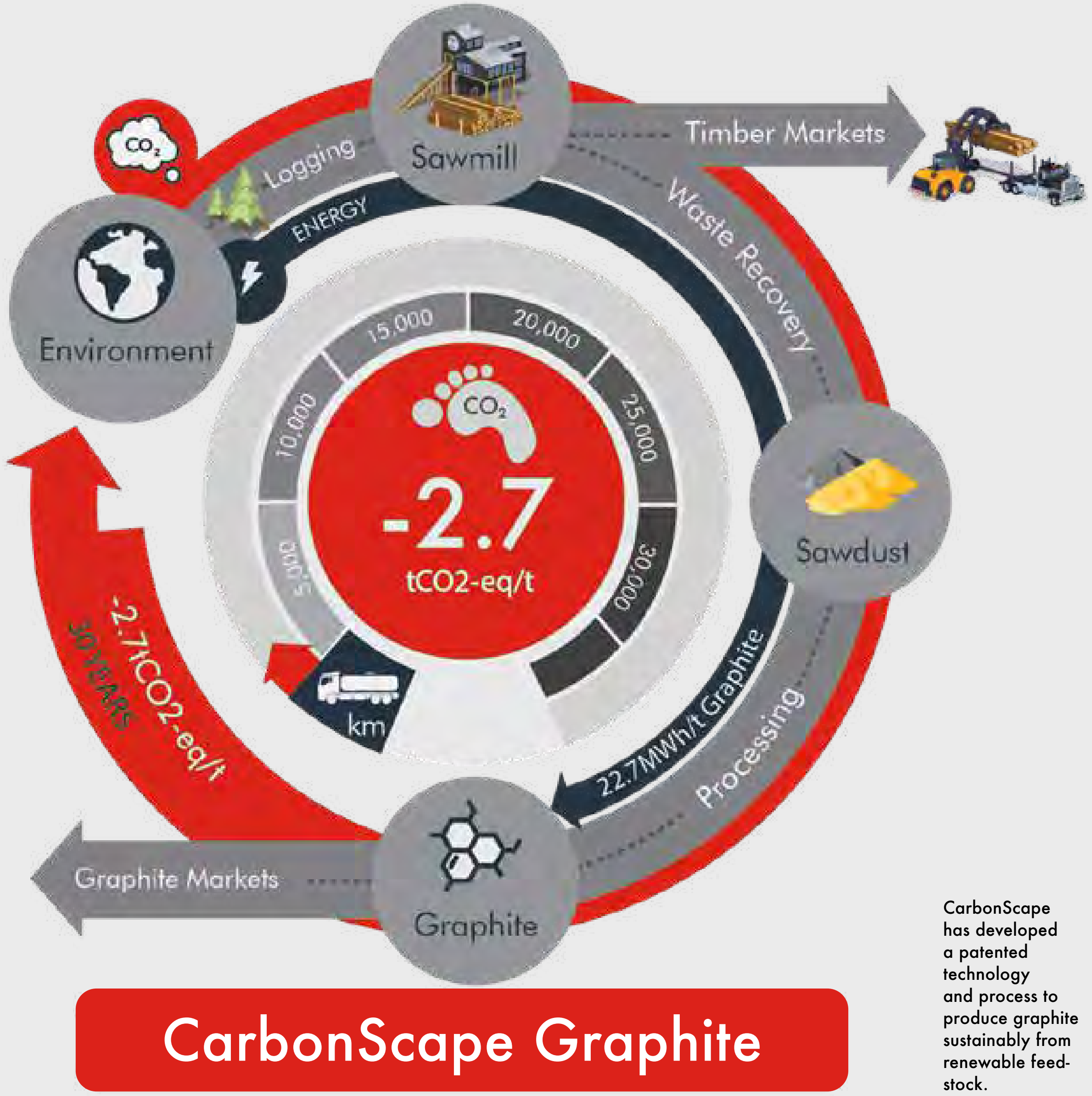
"Working on hi-tech science for industrial processes, we value the ability to access and consult with knowledgeable specialists in the field of materials science, chemistry and engineering through MacDiarmid."

HUMPHREY FELTHAM, PRODUCT DEVELOPMENT CHEMIST, LIGAR

"Via the Industry Advisory Panel, CarbonScape was able to connect with a wide range of enthusiastic scientists to further our materials understanding and enhance our product."

CARBONSCAPE CTO, HEINRICH BADENHORST

CarbonScape



Processing including pyrolysis, graphitisation and purification

CarbonScape has developed a patented technology and process to produce graphite sustainably from renewable feed-stock.

Zincovery wins the C-Prize

MacDiarmid Institute-affiliated start-up Zincovery was the winner of Callaghan Innovation's 2020 C-Prize, announced in September. The C-Prize, worth $100k, with access to ongoing support and mentoring, was this year looking for teams with 'world-leading innovative solutions to environmental problems'. Zincovery was judged the best of 140 entries.

"Science and entrepreneurship are our best chance to protect our planet's environment."

JONO RING, CEO, ZINCOVERY

Zincovery is a University of Canterbury (UC) start-up that recycles waste from the galvanizing industry for reuse as valuable raw materials. Associate Investigator and University of Canterbury Associate Professor, Aaron Marshall, and former UC student and MacDiarmid Institute alumnus, Jono Ring, have developed a process which recovers high purity zinc, iron and acid from material that would otherwise become expensive landfill. The team is developing an industry scale demonstration plant before launching in the international market.

Zincovery is an example of the type of high tech sustainability innovation that addresses not only environmental goals, but also Aotearoa New Zealand's opportunity to be a world leader in exporting sustainable-tech IP. Young entrepreneurs like Jono Ring are also an inspiration to other young people keen to see where science and engineering could lead them. The MacDiarmid Institute congratulates Zincovery on their 2020 achievements, and is proud to have supported the research and professional development underpinning their success.

The Zincovery team - MacDiarmid alumnus Jono Ring, and Associate Investigator, Aaron Marshall.

Alumni Business Scholarships

These scholarships will support the recipients to develop a more comprehensive commercial skillset to wrap around their existing scientific capabilities with the aim of enhancing New Zealand's deep tech commercial portfolio over time.

Four scholarships have been awarded for study in 2021.

Anna Farquhar

Anna Farquhar completed her PhD at the University of Canterbury and now works as a Senior Scientist in the R&D team at Aeroqual in Auckland as an electrochemist, focusing on electrochemical gas sensors, and ensuring their reliability in monitoring air pollution.

Anna will be starting a Master of Business Development at the University of Auckland in March. She intends to gain skills in business, product management and leadership to help develop New Zealand's reputation in the global air quality industry.

Stephen Lo

Prior to completing his PhD in Chemistry at the University of Auckland, Stephen Lo had partially completed a Postgraduate Diploma of Bioscience Enterprise. The MacDiarmid Institute Business Scholarship will allow him to complete this programme, which had always been a goal of his.

After the Postgraduate Diploma at the University of Auckland, Stephen intends to go further and also complete the Master of Bioscience Enterprise. He is really looking forward to developing the knowledge and skills required to bring valuable products from scientific research towards the commercial space, an area of work that is particularly exciting to Stephen.

Udbhav Ojha

After completing his PhD in condensed matter and materials physics at Victoria University of Wellington, Udbhav Ojha joined the financial technology services provider firm FNZ where he currently works as a senior analyst developer in the software development team.

The MacDiarmid Institute Business scholarship will enable Udbhav to undertake a Postgraduate Certificate in Business Administration at Victoria University of Wellington to develop skills in business accounting and finance that he plans to incorporate into his work from a fintech product development standpoint.

Davoud Zare

Davoud Zare completed his PhD at Victoria University of Wellington. He is currently working as a research scientist/engineer at the Fonterra Research and Development Centre in Palmerston North. The need for innovation in today's business environment and his ambition to commercialise academic knowledge motivated him to apply for this scholarship.

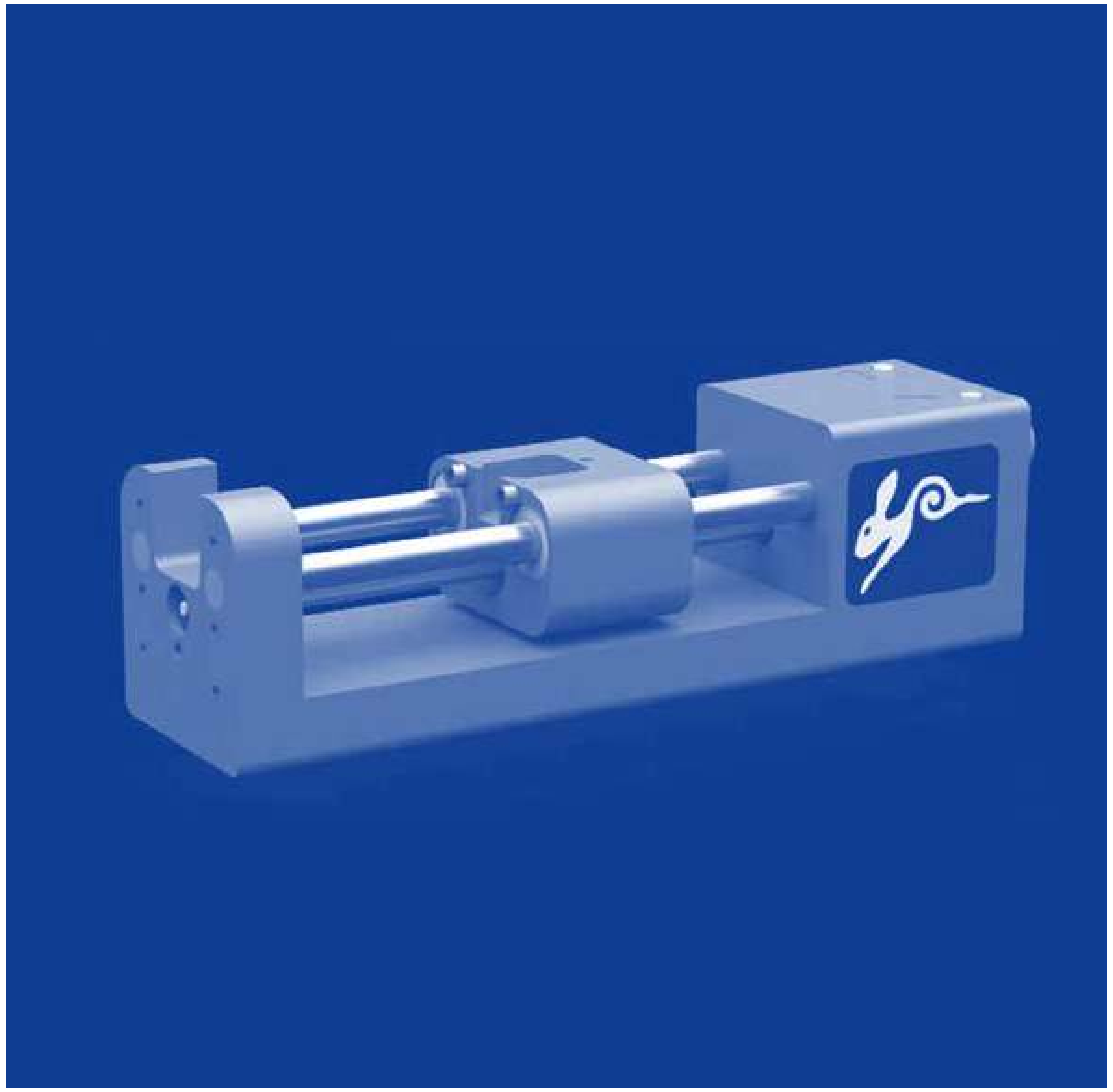
Davoud will be undertaking a Postgraduate Certificate in Business Administration with a specialisation in Technology Commercialisation at the University of Auckland to further develop his managerial abilities and business acumen and unify it with his existing scientific skillset.

Patenting to achieve market access

One of the early considerations on the path to market for materials science is what should be patented and why.

Our researchers are developing a deep pipeline of intellectual property (IP), including some that are best published, some that need to be patented in order to achieve their intended benefit, and some that demand a combined patent and publish strategy.

Our CIE team works closely with our researchers and member Technology Transfer Offices (TTOs) to explore the potential impact of scientific discoveries that could be commercialised. Early consideration of the IP strategy helps researchers plan their research to achieve optimal academic and commercial impact. Through our early 'seed funding' rounds we have financially supported five research projects this year to refine their market research or IP strategy and by doing so, increased their speed to market and likelihood of ultimate success. MacDiarmid Institute researchers have submitted ten patent applications in 2020 (see additional detail in following table).



The White Rabbit microfluidic syringe pump driver.

Patenting activity by MacDiarmid Researchers in 2020

Patent Applications

(only MacDiarmid Investigators named)

Volker Nock	Microfluidic sealing valve and microfluidic circuit
Margaret Brimble	Methanogen Inhibitors (1)
Margaret Brimble	Methanogen Inhibitors (2)
Rob Ward and Bill Williams	Syringe pump
Aaron Marshall	Process to extract dissolved metals and recover hydrochloric acid and apparatus thereof
Simon Brown	Nanoparticle networks
Simon Brown, Saurabh Bose	Percolating Switching Devices
Jerome Leveneur, John Kennedy	Ion beam sputtering apparatus and method
Chris Bumby	A superconducting switch
Laura Domigan	Biomaterials and Methods Related Thereto

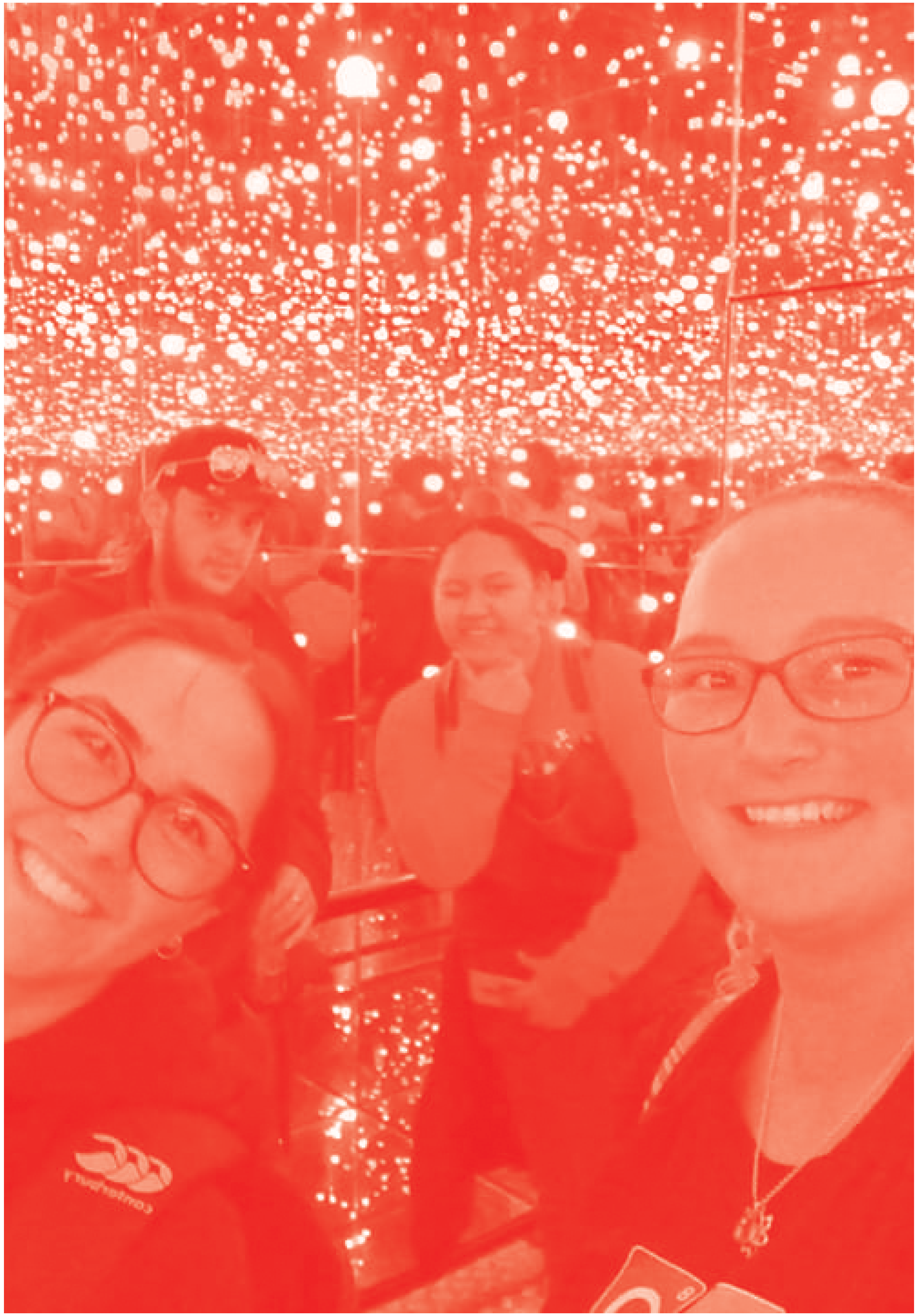
Patents Granted

(only MacDiarmid Investigators named)

Marcus Jones	Quantum Dot Light Emitting Devices
Marcus Jones	Methods and Compositions for Biosensing
Simon Granville, Eva Anton, Ben Ruck, Franck Natali, Joe Trodahl	Magnetic materials and devices comprising rare earth nitrides
Simon Granville, Ben Ruck, Franck Natali, Joe Trodahl	Doped rare earth nitride materials and devices comprising same
Eric Le Ru	Spectrometer apparatus for measuring spectra of a liquid sample using an integrating cavity

Affiliated start-ups formed

White Rabbit, led by Dr Rob Ward: microfluidic devices including syringe pump drivers and ultra-high temperature microfluidic chips.



Chapter 4.

INTO THE COMMUNITY

Into the community

What a huge year 2020 was for everyone, both in Aotearoa New Zealand and around the world. For organisations running educational outreach and engagement programmes, Covid-19 provided enormous challenges but also the proverbial opportunities. We took the chance to redevelop our resources and reconfigured what we do to reach our audiences via an online environment. We ran our annual Regional Lecture Series as online webinars, started a quirky podcast series and supported our students to make animated videos of both their own work and some of our 'Materials Fact or Fiction' episodes (our partnership series with RadioNZ Nights). While we were fortunate to be able to run some of our engagement (such as DiscoveryCamp and NanoCamp) in person, our pivot to an online environment added new strings to our bow, and we'll keep playing new tunes as we move forward.

Adapting to the online environment

As classes and meetings moved online in March as Aotearoa New Zealand entered Level 4 lockdown, we adapted our community outreach activities to the virtual environment.

Digital Regional Lecture Series

This year's annual Regional Lecture Series was based on our successful 'Materials: Fact or Fiction' collaboration with RadioNZ's Nights, running as a series of webinars tailored to each audience group. Audience members tuned into the events via Zoom, either in the comfort of their own home, or science societies.

Our researchers took their science fiction knowledge to the regions - Hawke's Bay, Tauranga, Wanaka and Nelson. These researchers were Dr Mike Price, Principal Investigators, Professor Penny Brothers, Professor Duncan McGillivray, Professor Bill Williams, and Associate Investigators, Dr Chris Bumby, Dr Michel Nieuwoudt, Dr Krista Steenbergen, and Dr Erin Leitao.

We also ran a couple of Zoom sessions with Year 7/8 school students – turning the 'Materials; Fact or Fiction' template into a interactive school session. The students had lots of questions and feedback was outstanding.

Supporting the teachers

We continued our partnership with NanoGirl Labs this year to deliver science videos for children learning at home during the Level 4 lockdown. The video series *Breaking it Down*, aired on TVNZ during the day, with episodes covering 'Materials', 'Energy and Electricity' and 'Mixtures', including interviews with Co-Directors, Professor Justin Hodgkiss, Associate Professor Nicola Gaston, and Principal Investigator, Professor Jadranka Travas-Sejdic.

Founder & CEO of Nanogirl Labs, Joe Davis, says NanoGirl Labs had a clear vision - to support the nation's teachers delivering science learning during a profoundly challenging time, and to take that opportunity to shift the conversation. "The MacDiarmid Institute - longtime partners in our STEM outreach mission - were the first to step up and get behind our vision for *Breaking it Down*, and as a result, hundreds of thousands of Kiwis have been exposed to STEM learning who would not otherwise. We are, as always, incredibly grateful for the MacDiarmid team's vision and support."

Showcasing futures

We supported high school students as they began to prepare for life and study after high school during a confusing and uncertain time. During the Level 4 lockdown, we launched #BetterWorkStories, a series of videos featuring our alumni discussing where their studies in materials science have taken them. Each video was repackaged with questions for students to reflect on while studying at home. The videos were shared widely, including by the House of Science which featured the videos on their website as a top link for activities especially suited to do at home during the Covid-19 lockdown.

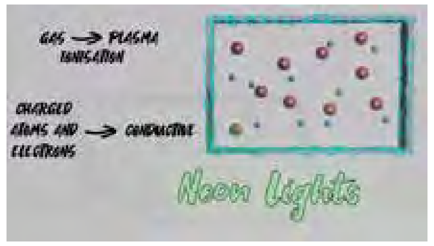
> **"We are, as always, incredibly grateful for the MacDiarmid team's vision and support."**
>
> **JOE DAVIS, FOUNDER & CEO, NANOGIRL LABS.**

We also hosted virtual lab visits with secondary school students who won places in the Innovative Young Minds programme. Students were able to connect with us online, dropping in 'virtually' on labs through Victoria University of Wellington, through livestreams on Facebook and Instagram, rechargeable batteries, to hear our researchers talk about solar cells and superconductors.

MacDiarmid Institute alumnus Dr Jonathan Falconer and Otago Museum Science Engagement Coordinator Dr Claire Concannon, co-hosts of the 15 Minutes Smarter podcast.

15 Minutes Smarter
2020 saw the launch of our new podcast - '15 Minutes Smarter', with MacDiarmid Institute alumnus, Dr Jonathan Falconer, and Otago Museum's Science Engagement Coordinator, Dr Claire Concannon, taking an irreverent but insightful look into the big important questions in materials science – "What has materials science ever done for the sport of skateboarding?" "What does being smart mean?" and "Is solar power really renewable if the sun is going to run out of hydrogen in 5 billion years?"

> **"What has materials science ever done for the sport of skateboarding?"**
> 15 MINUTES SMARTER PODCAST



Animated science videos
As part of our pivot to online delivery of outreach, we employed several of our students to script and animate short videos on the 'Materials: Fact or Fiction' theme, as well as on their own science.

Supporting science communication at The Spinoff

We continued our four-year partnership with award-winning online magazine The Spinoff, supporting high-quality science stories, which became especially crucial during the Covid-19 pandemic.

Covid-19 dominated the news, and the science news. This year, fewer stories on the Science page featured the work of MacDiarmid Institute researchers but these were viewed on average more than 4,460 times for longer than 4 and a half minutes.

Otago Museum Partnership

Our partnership with Otago Museum saw the development of 'The Future is Nano' workshops. These were run at the museum during school holidays, demonstrating how nanotechnology can be used to mitigate climate change through better photovoltaics, solar concentrators and metal organic frameworks.

New photovoltaics developed by researchers at the MacDiarmid Institute were also featured in the Otago Museum's Global Science Show – a Twitter-based collaborative project hosting regular shows to celebrate science communication around the world.

An Otago Museum curated exhibition created in collaboration with the MacDiarmid Institute, Unlocking Curious Minds and the Dodd Walls Centre, is dedicated to helping resolve the gender imbalance that exists in STEM by building relationships between female role models in STEM and young people. A significant aspect of this project is '100 women, 100 words... infinite possibilities', a digital portrait exhibition where people nominate women in their community who make science, technology, engineering and math meaningful to them.

As part of Otago Museum's Education weekly programme for the Gifted and Talented Education (GATE) group from Anderson's Bay Primary School, students have been learning about nanotechnology and how it can help combat climate change, including through better photovoltaics, solar concentrators and metal organic frameworks.

Otago Museum this year took our science to sports grounds around Dunedin with its Sideline Science Programme. Our cardboard push-out buckyballs (replicas of nano-sized buckyball structures of 60 carbon atoms), were a huge hit amongst the football players who could take a buckyball to hang from their ceiling at home, along with their end of season trophies. Footballs will never be seen the same way by the kids who discover the power of the buckyball shape, and know that tiny buckyballs are made from 60 carbon atoms.

Kids who discover the buckyball shape will never see footballs in the same way again.

Soccer players hold replicas of nanoscale buckyball structures as part of Otago Museum's Sideline Science Programme.

"A great kit that challenged the students' thinking and extended their knowledge of science."
GISBORNE INTERMEDIATE

"We had some amazing learning out of this kit and my students said this was the best one yet. They absolutely loved it."
ST PAT'S TAUPO

House of Science

This year we continued sponsoring the House of Science to provide teachers and children with resources and equipment to teach science with at least one 'NanoChem' box at every House of Science branch.

There are 14 copies of our NanoChem kit in circulation and it was booked by schools (for a week at at time) 221 times in 2020 - which is not a bad stat given the interruptions to classroom teaching in 2020.

"My 5 and 6 year old students absolutely LOVED the nano-chemistry kit!"
WHANGAMARINO PRIMARY

"The students really enjoyed the activities, went home and talked about them."
KILBIRNIE PRIMARY

RadioNZ Nights' Materials: Fact or Fiction

Following the successful 'Element of the Week' slot on RadioNZ Nights (for the Year of the Periodic Table in 2019), we continued our collaboration with RadioNZ, with a new series 'Materials: Fact of Fiction', where a MacDiarmid researcher or student discussed whether fictional or sci fi materials from books or movies could one day be a reality.

From Star Wars, Avatar, Doctor Who, Lord of the Rings, the Marvel Comics and more, 21 of our researchers and students dove into the science behind fictional materials.

From left to right: students making flubber, glow-in-the-dark polymers and crystals, all from the NanoChem kit.

"A big takeaway is how supported Pasifika students are at Otago University - it really feels like a home away from home."

"Coming from a small isolated town, it can tend to be hard to find opportunities for Māori females interested in science. I now realise that the University of Otago could be my future University and even though it is so far from home, the atmosphere and society is there to support students and create a home away from home."

"A personal favorite of mine was the micro-robotics."

DiscoveryCamp and NanoCamp

Every year, we invite a group of Aotearoa New Zealand's keenest year 12 and 13 science students to spend a week at NanoCamp and DiscoveryCamp. The long-running programmes are popular year after year and continue to attract more applications than places available, with 115 students applying for 11 places on DiscoveryCamp and 173 students applying for 11 places on NanoCamp. The programmes are a five day, all-expenses-paid camp designed to give students a hands-on experience in science under the guidance of Aotearoa New Zealand's top nanoscience and advanced materials researchers.

NanoCamp and DiscoveryCamp 2020 took place from 17-22 January 2021 in Christchurch, Palmerston North and Dunedin. There were 11 NanoCamp and 11 DiscoveryCamp students (22 in total).

"NanoCamp was like nothing I had ever experienced before."

Left and above: DiscoveryCampers and NanoCampers.

"This was mind-boggling - I had no idea that you could use blueberries to make power."

Chapter 5.

INTO THE FUTURE

Our graduates cite a 'MacDiarmid difference' of added soft skill training within the PhD and support for their next steps in their careers, as some of the most valuable aspects of their student experience. This year we continued our funded three-month graduate internships into the government, NGO and industry sectors. Covid-19 also gave us a nudge to look within the Institute for individuals and groups needing better support. This led us to establish a women's network and to give further impetus to our ongoing wellbeing work.

Internships

Past interns and their hosts repeatedly tell us how valuable the internship experience is in taking the first steps into the world of employment. With the vast technical skills and ability to self-manage a research workload, our graduates are well placed to plug in to company R&D projects or government policy making and data analysis.

This year we placed four graduate interns into MacDiarmid-funded or co-funded commercial R&D environments to undertake projects related to sustainability, biotech, market research and commercial R&D.

With Covid-19 disruptions, companies unfortunately had limited capacity to take on new R&D activities, so we anticipate a strong uptake of these internships in 2021. Two of the internships are currently in progress and we are able to advertise positions on an ongoing basis when companies identify a need.

2020 also saw eight of our graduates take up MacDiarmid Institute-funded three-month internships within the government and social enterprise sector.

Three joined the Office of the Prime Minister's Chief Science Advisor (OPMCSA), and three took the opportunity to experience science and energy policy development within government (MBIE Contestable Investments, and Energy Resource Markets); and the Energy Efficiency & Conservation Authority (ECCA). One interned at the Science Media Centre (SMC) and another at Ākina Foundation. All spoke positively of the opportunity to broaden their understanding of science, energy and science communication in policy, and review current regulatory frameworks via report writing, app design and protocol development in areas of energy resources, nanotechnology and funding processes.

OPMCSA Office
Stephen Lo: *Covid-19 and seasonality.*

Cherie Tollemache: *Covid-19 severity and vitamin D status.*

Shinji Kihara: *Nanotechnology regulation in Aotearoa New Zealand - comparison with overseas regulations and current developments.*

Ministry of Business, Innovation and Employment (MBIE)
Aubrey Dosado: *Science through the government lens with Contestable Investments.*

Samuel Martin Treceno: *Energy and Resource Markets.*

Ākina Foundation
Kannan Ridings: *Creating Outlines and a Framework for a Data Strategy.*

Energy Efficiency & Conservation Authority (ECCA)
Silvina Pugliese: *Thermal energy storage in New Zealand Evidence Insight and Innovation Team.*

Science Media Centre (SMC)
Cherie Tollemache: *Covid-19 related – improving skills for data journalists (0.3 FTE).*

Humble Bee
Ed Cozens: *Technical Analyst and Research Support - for developing a chemical resistant material using biomimicry.*

LPG Association
Praveen Vadakkedath: *Identify process for production of bioLPG or biopropane in New Zealand.*

Toha Foundry
Roan Vasdev: *Identifying viable low emissions manufacturing and construction materials and processes, focused on low carbon cement and concrete.*

Ligar
Maxime Savoie: *Removing smoke taint from wine using molecularly imprinted polymers.*

'What I wish I'd known before my internship'

Webinar
We ran a webinar for prospective interns titled 'What I wish I'd known before my internship'. Dr Kyle Webster, former intern at OPMCSA, and Dr Kannan Ridings, former intern with the Ākina Foundation, shared their knowledge and tips based on their own experiences. There were lots of great questions and enthusiasm to continue this type of connection between our previous and soon-to-be interns.

Interning for the PM's Chief Science Advisor

Cherie Tollemache

My internship at OPMCSA involved urgent research and reporting on Covid-19 topics. I looked at testing methods, Covid in animals, Covid and vitamin D status, vaccine development, mental health impacts, and mask use. Being a part of such a fascinating time for science policy and science communication was beyond my expectation.

"Being a part of such a fascinating time for science policy and science communication was beyond my expectation."

INTERN, CHERIE TOLLEMACHE

Humble Bee Bio internship helps grow career confidence

Ed Cozens

Having recently completed my PhD and looking at what direction to pursue a career in, I had a few different thoughts on options. One option that interested me was working within the biotech start up space. My internship with Humble Bee provided me invaluable experience of the workings and challenges associated with such 'deep tech' start ups. One of the highlights was that it confirmed to me that this is an area I want to get involved with in the future, something that I was previously uncertain on. It has given me the confidence that this is a career move I would enjoy and that my skills and personality are well suited to deliver what companies like Humble Bee Bio need. The internship has also presented a number of challenges, giving me opportunities for growth while working through them. In particular, I have had the chance to grow my communication skills, particularly within a virtual space, as a portion of the internship had to be completed back within my home country, the UK, as a result of the Coronavirus pandemic.

Humble Bee founder Veronica Harwood-Stevenson reports that "Ed helped prepare information for audiences from patent attorneys, to investors, through to colleagues and commercial partners. His work was of high quality and immediate value."

"Ed's deep research and science background meant that he was able to compile and interpret our data and compare it to the literature and our competitors' data."

VERONICA HARWOOD-STEVENSON, HUMBLE BEE FOUNDER

Alumni engagement

We continue to celebrate the achievements of our alumni – in academia, government and industry.

We keep in touch through newsletters, LinkedIn and other social media and through alumni-focused events. We're developing relations with our partner alumni offices which has meant we can support their alumni communications (newsletters and networks) to extend our reach and connect to our shared alumni. We're also increasingly inviting our alumni to join wider MacDiarmid Institute events and initiatives, including industry advisory connections and other networks.

In November, Deputy Director, Associate Professor Geoff Willmott, hosted our Auckland alumni event, 'The Future of Work: Sustainability.' The event, which was also livestreamed via Facebook, featured a talk by CEO of the Sustainable Business Network, Rachel Brown, and our very own alumna, Dr Lita Lee, now at start-up Mint Innovation. It was well-attended, equally in person and online via Facebook Live, with lots of engagement in the discussion of sustainability.

Speakers, Rachel Brown and Associate Professor, Geoff Willmott, at the alumni event.

Dr Lita Lee

Dr Lita Lee completed her PhD in Chemistry at the University of Canterbury under the supervision of MacDiarmid Principal Investigator, Professor Alison Downard. In 2019, Dr Lee was awarded a MacDiarmid Institute Alumni Business Scholarship which supported her to complete a Postgraduate Certificate in Commercialisation and Entrepreneurship at the University of Auckland. Her project involved designing an app that reveals a 'sustainability star rating' when products are scanned, enabling consumers to make better informed and sustainable purchasing decisions.

Dr Lee is now working as an R&D research scientist at Auckland start-up, Mint Innovation, where her focus is to recover copper from e-waste using electrochemistry.

Dr Ankita Gangotra

Engineer turned physicist Dr Ankita Gangotra graduated from the University of Auckland in 2020 with a physics PhD supervised by Principal Investigator Associate Professor Geoff Willmott. Dr Gangotra was one of the MacDiarmid's first funded interns, exploring equity, diversity and inclusion policy options for Aotearoa New Zealand, based at the Office of the Prime Minister's Chief Science Advisor. She then went on to Measurement Scientist roles at start-up company Toha under Professor Shaun Hendy, and with Calm the Farm, working with local farmers to develop science policy and measure environmental impact. She is now based in Washington DC as a Postdoctoral Fellow at Georgetown University Walsh School of Foreign Service and Department of Physics, researching low carbon construction materials from a science and policy perspective.

Covid-19 and the post-PhD workforce

Covid-19 presented a massive disruption to the academic workforce, particularly for PhD students and early career researchers, who face uncertainty about their future career prospects inside academia and options outside the university walls. To give some insight to our students and recent alumni, we arranged a joint webinar with our Australian partners FLEET, about career and post-PhD job market insights in our current pandemic times. The webinar was presented by Dr Inger Mewburn, Director of Researcher Development at The Australian National University.

Women in the MacDiarmid Institute

As a key part of our pivot during Covid-19, we set up a Women in MacDiarmid Institute/MESA Network.

The idea was to immediately support female and gender minority/non-binary students and early career researchers through lockdown. The Network started as a social hour once a week via Zoom during Aotearoa New Zealand's Covid Level 4 lockdown.

The Network provided a safe space for eligible members of the MacDiarmid Institute to connect via discussion of their research, experiences regarding being a gender minority in STEM and to informally present their research. The Network includes MacDiarmid Institute investigators, students, early career researchers and professional staff members. As the Network has grown, we have been able to host workshops around leadership, including strengths-based development and EQ facilitated by Associate Investigator, Dr Emilia Nowak, from Massey University. We also hosted an Institute-wide webinar with guest speaker, Catherine Fox, titled, 'Stop Fixing Women', which provided great foundational knowledge about building fairer workplaces.

In August 2020, we were fortunate enough to finally be able to host an in-person meet-up, with Network members gathering in person at each of the five universities, and streaming in via Zoom.

Our week-long writing bootcamp for PhD students and postdoctoral researchers, in December 2020, was also facilitated by Dr Nowak.

Our ambition is for this Network to grow and be self-sufficient so that all female, gender minority and non-binary MacDiarmid Institute members have a safe space for support and targeted development.

"Every postgrad student would benefit from taking the time to attend a workshop on strengths."

"I really enjoyed it and it was nice to meet a group of lovely women from within the MacDiarmid and across Aotearoa New Zealand."

Writing bootcamp: each ping-pong ball represents thousands of words that have been written in a flow of inspiration gathered from magnificent Ruapehu surroundings and supportive, strong women on the same quest.

MESA 2020

Now in its 10th year, the MacDiarmid Emerging Scientists Association (MESA) runs networking and training for all MacDiarmid Institute students and postdoctoral researchers.

In 2020, the MESA executive was Edoardo Galli (Chair), Sam Brooke (Secretary), Sriram Sundaresan (Treasurer), Tarek Kollmetz (Social Media Representative), David Uhrig, Charlie Ruffman, Aljo Anand, Benjamin Westberry, Caitlin Casey-Stevens, Tane Butler, Tehreema Nawaz, Hellen Nalumaga, Liam Carroll, Stephanie Lambie, Geoffrey Weal, Luca Bondí, and Sashikumar Ramamirtham.

From the MESA Chair

This year, we celebrated MESA's 10th anniversary. Unfortunately, 2020 was a very difficult year mainly due to the global pandemic of Covid-19. Nonetheless, our MESA committee managed to keep up the great work done in the last decade by organising multiple events. In particular, we started the year with one of the largest committees to date, showing how participation in and engagement with MESA has increased significantly throughout the years.

Our annual welcome events were not affected by Covid-19 since they took place at the beginning of the year. This was the perfect opportunity for new students to meet other MESA members through fun activities, such as bowling and go-karting and around a table for dinner. The lockdown significantly changed our mid-year plans. We managed to redirect part of the MESA international travel scholarship budget towards domestic events. We organised our first fully online MESA workshop, 'Science from the Supermarket', designed to help MacDiarmid researchers develop outreach skills that they could then use with young students and children. We also launched, during lockdown, a series of weekly social gatherings over Zoom to keep up the morale of the students.

Webinars also became the norm throughout the year. In particular, we organised a webinar with Australian researchers, Dr Inger Mewburn, about graduating during a pandemic and what the job market will look like.

We also managed to organise a MESA 3-Minute-Thesis competition, partially online, (at the time Auckland went back into Level 3) where students at each MacDiarmid partner university connected via Zoom to each other. The competition was a great success with more than 20 contestants.

In addition, this year we focused on developing coding skills for our students through a series of Python workshops in different centres (Massey, Otago, and Auckland).

Finally, the biggest event of the year was our annual Bootcamp 2020 which took place in Te Anau at the end of November. This was our largest Bootcamp to date with around 50 participants. The theme this year was 'Post-graduation pathways – where to next?' We had many speakers from industry, academia and the government sector. The feedback from the attendees and the speakers was very positive.

Wellbeing

Wellbeing has been firmly in our sights for some time, and 2020 brought it even more sharply into focus. Covid-19 disrupted many of our student and new graduate cohort, so much of our response this year has been to support our people though ongoing disruption and uncertainty.

Students and postdoctoral researchers attending the student-initiated Wellbeing Workshop in 2019 had identified five priorities for the Institute to act on. One of these these was to survey and develop, with all members of the MacDiarmid Institute, best practice supervision guidelines for our investigators.

We have drawn upon exit interviews with our graduating students and postdoctoral researchers, and also those exit interviews with graduates who participated in government and industry internships. The surveys, conducted online and in person, sought to understand the MacDiarmid Institute postgraduate student and early career researcher experience. Feedback will be implemented as part of our new CoRE contract.

From this, we pulled together a formal Wellbeing Report to better understand the wellbeing challenges identified that impact on the capacity of students, researchers and others to be well in all areas of their lives.

Throughout 2020, and especially in light of Covid-19 with lockdowns and the shift to working remotely, we have been able to implement some initiatives. This includes further equity, diversity, and inclusion by way of financial support for PhD students and Research Assistants, the organisation of online workshops and webinars for upskilling, and the development of the MacDiarmid Institute/MESA Women's Network.

The Wellbeing Report and all wellbeing initiatives undertaken have demonstrated to us that our people want to strengthen the sense of belonging for everyone in the Institute, now and into the future.

"In the constant habit of working on our weaknesses, we often forget about our strengths."

"I now see that I bring unique strengths to a team."

STRENGTHS DEVELOPMENT WORKSHOP PARTICIPANT

Chapter 6.

INTO THE METRICS

Financials

	2019	2020
CoRE funding	6,664,067	6,664,067
Surplus carried forward	2,182,948	1,699,129
Other funding (mainly interest income)	222,892	70,590
Total revenue	9,069,907	8,433,786
Salaries and salary related costs		
Director and Principal Investigators	814,090	1,216,070
Post-Doctoral Fellows	705,597	386,683
Research / Technical Assistants	222,852	89,802
Others	467,620	386,617
Total salaries and salary related costs	2,210,159	2,079,172
Other costs		
Overheads	2,407,636	1,969,133
Project Costs	2,789,634	3,241,519
Travel	462,915	92,158
Postgraduate Students	1,199,563	1,051,805
Total other costs	6,859,748	6,354,615
Total expenditure	9,069,907	8,433,786
Net surplus / (Deficit)	–	–

At a glance

Headcounts by category

Emeritus Investigators	20
Principal Investigators	32
Stakeholder Relations Partner Iwi	1
Associate Investigators	42
Postdoctoral Researchers	134
Students	350
Total	**579**

Peer reviewed research outputs by type

Journal articles	392
Book chapters	9
Conference papers	18
Books	0
Total	**419**

Board, executive, staff and students

Governance Representative Board

Mr Paul Atkins
Chair of the Board

Professor Richard Blaikie
Deputy Vice-Chancellor, Research & Enterprise
University of Otago

Mr Will Charles
Executive Director, Technology Development, UniServices
University of Auckland

Professor Don Cleland*
Professor of Process Engineering
Massey University

Professor Ray Geor*
Pro Vice-Chancellor, College of Sciences
Massey University

Professor David Harper*
Pro Vice-Chancellor Science, Engineering, Architecture & Design
Victoria University of Wellington

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

Mr Paul Linton
General Manager, Research and Technical Services, and Commercial Businesses
Callaghan Innovation

Mr Joe Manning
Head of Department – Materials and Air
GNS Science

Professor Ehsan Mesbahi*
Pro Vice-Chancellor, Wellington Faculties of Science, Health, Engineering, Architecture and Design Innovation (SHEADI)
Victoria University of Wellington

Mr Hēmi Rolleston
General Manager, Māori Forestry Futures
Scion

Mr Geoff Todd
Managing Director, Wellington UniVentures (formerly ViclLink Ltd)
Victoria University of Wellington

*Partial year

Ex-Officio

Associate Professor Nicola Gaston
Co-Director, MacDiarmid Institute
University of Auckland

Professor Justin Hodgkiss
Co-Director, MacDiarmid Institute
Victoria University of Wellington

Professor Paul Kruger
Deputy Director, Stakeholder Engagement, MacDiarmid Institute
University of Canterbury

Associate Professor Geoff Willmott
Deputy Director, Commercialisation and Industry Engagement, MacDiarmid Institute
University of Auckland

Associate Professor Carla Meledandri
Science Executive Representative, MacDiarmid Institute
University of Otago

Catherine Gibbs
Centre Manager, MacDiarmid Institute
Victoria University of Wellington

Rosie Wayte
Administrator, MacDiarmid Institute
Minute-taker
Victoria University of Wellington

International Science Advisory Board

Professor Sir Richard Friend
Cavendish Professor of Physics
University of Cambridge, UK
Physics of energy materials, condensed matter

Dr Anita Hill
Chief Research Scientist, Future Industries
CSIRO, Australia
Porous materials

Professor Wilhelm Huck
Professor of Chemistry, Institute for Molecules and Materials
Radboud University, Netherlands
Artificial cells

Professor Tomonobu Nakayama
Deputy Director, Administrative Director, Group Leader of WPI-MANA
Deputy Director of ICYS
Professor at the University of Tsukuba
National Institute for Materials Science | NIMS
International Center for Materials Nanoarchitectonics (MANA)
University of Tsukuba, Japan
Surface physics and chemistry, nanotechnology, nanobioscience

Professor Daniel Nocera
Patterson Rockwood Professor of Energy
Harvard University, USA
Chemistry of renewal energy

Professor Ivan Parkin
Dean of Mathematical and Physical Sciences Faculty
University College London, UK
Nanomaterials

Professor Annie Powell
Professor of Inorganic Chemistry, Institute of Chemistry and Institute of Nanotechnology
Karlsruhe Institute of Technology
Germany
Molecular materials

Dr Charles Royal
Independent researcher and consultant,
New Zealand, Mātauranga Māori

Professor Michelle Simmons
Director, Australian Research Council Centre of Excellence for Quantum Computation and Communication Technology
Laureate Fellow
Scientia Professor of Physics
University of New South Wales, Australia
Quantum computing, condensed matter physics

Professor Matt Trau
Professor of Chemistry, University of Queensland
Deputy Director and co-founder, Australian Institute for Bioengineering and Nanotechnology
University of Queensland, Australia
Nanoscience, nanotechnology, and molecular diagnostics

Dr David Williams
Chief Research Scientist and Laboratory Manager,
Hitachi Cambridge Laboratory
University of Cambridge, UK
Materials for computing

Science Executive

Associate Professor Nicola Gaston
Co-Director, MacDiarmid Institute
University of Auckland

Professor Justin Hodgkiss
Co-Director, MacDiarmid Institute
Victoria University of Wellington

Professor Paul Kruger
Deputy Director, Stakeholder Engagement
University of Canterbury

Associate Professor Geoff Willmott
Deputy Director, Commercialisation and Industry Engagement
University of Auckland

Dr Pauline Harris
Māori Research Representative
Victoria University of Wellington

Associate Professor Carla Meledandri
Principal Investigator Representative
University of Otago

Dr Natalie Plank
Principal Investigator Representative
Victoria University of Wellington

Dr James Storey
Science Leader: Tomorrow's Electronic Devices
Victoria University of Wellington

Associate Professor Geoffrey Waterhouse
Science Leader: Energy
University of Auckland

Dr Catherine Whitby
Associate Investigator Representative
Massey University

Professor Martin (Bill) Williams
Science Leader: Functional Nanostructures
Massey University

Edoardo Galli
MESA Chairperson
University of Canterbury

Ex-Officio

Catherine Gibbs
Centre Manager, MacDiarmid Institute
Victoria University of Wellington

Kevin Sheehy
Commercialisation Manager, MacDiarmid Institute
Victoria University of Wellington

Rosie Wayte
Administrator, MacDiarmid Institute
Minute-taker
Victoria University of Wellington

Vanessa Young
Strategic Engagement Manager, MacDiarmid Institute
Victoria University of Wellington

MacDiarmid Emerging Scientist Association (MESA) 2020

Edoardo Galli
Chair
PhD Student
University of Canterbury

Sam Brooke
Secretary
PhD Student
Massey University

Sriram Sundaresan
Treasurer
PhD Student
University of Otago

Tarek Kollmetz
Social Media Representative
PhD Student
University of Auckland

Aljo Anand
Centre Representative
PhD Student
University of Auckland

Luca Bondi
Centre Representative
PhD Student
University of Otago

Tane Butler
Centre Representative
MSc Student
Victoria University of Wellington

Liam Carroll
Centre Representative
PhD Student
University of Canterbury

Caitlin Casey-Stevens
Centre Representative
PhD Student
University of Otago

Stephanie Lambie
Centre Representative
PhD Student
University of Auckland

Hellen Nalumaga
Centre Representative
PhD Student
Victoria University of Wellington

Tehreema Nawaz
Centre Representative
PhD Student
Victoria University of Wellington

Sashikumar Ramamirtham
Centre Representative
PhD Student
Massey University

Charlie Ruffman
Centre Representative
PhD Student
University of Otago

David Uhrig
Centre Representative
PhD Student
Victoria University of Wellington

Geoffrey Weal
Centre Representative
PhD Student
University of Otago

Benjamin Westberry
Centre Representative
PhD Student
Massey University

Principal Investigators (32)

Maan Alkaisi
Martin Allen
Sally Brooker
Penny Brothers
Simon Brown
Alison Downard
Nicola Gaston
Keith Gordon
Michele Governale
Simon Granville
Pauline Harris
Justin Hodgkiss
Derek Kawiti
John Kennedy
Paul Kruger
Eric Le Ru
Nigel Lucas
Jenny Malmström
Duncan McGillivray
Carla Meledandri
Franck Natali
Volker Nock
Natalie Plank
Craig Rofe*
Ben Ruck
Shane Telfer
Jadranka Travas-Sejdic
Geoff Waterhouse
Grant Williams
Martin (Bill) Williams
Geoff Willmott
Ulrich Zuelicke

* Indicates shift in status from PI to EI

Stakeholder Relations Partner Iwi (1)

Diane Bradshaw

Associate Investigators (42)

Eva Anton
Baptiste Auguié
Ebubekir (Ebu) Avci
David Barker
Saurabh Bose
Margaret Brimble
Philip Brydon
Chris Bumby
Peng Cao
Damian Carder
Jack Chen
Shen Chong
Matthew Cowan
James Crowley
Nathaniel Davis
Renwick Dobson
Laura Domigan
Guy Dubuis
Christopher Fitchett
Robin Fulton
Petrik Galvosas
Anna Garden
Vladimir Golovko
Shaun Hendy
Geoff Jameson
Marcus Jones
Vedran Jovic
Erin Leitao
Jerome Leveneur
Ben Mallett
Aaron Marshall
Michel Nieuwoudt
Emilia Nowak
Elke Pahl
Viji Sarojini
Tilo Söhnel
Krista Steenbergen
James Storey
Charles Unsworth
Mark Waterland
Catherine Whitby
Stuart Wimbush

Emeritus Investigators (20)

Richard Blaikie
Ian Brown
Bob Buckley
Sally Davenport
Juliet Gerrard
Simon Hall
Jim Johnston
Alan Kaiser
Tim Kemmitt
Ken MacKenzie
Andreas Markwitz
Jim Metson
Roger Reeves
Mike Reid
Craig Rofe*
Cather Simpson
Jeff Tallon
Richard Tilley
Joe Trodahl
David Williams

*Partial year – shift in status from PI to EI

Administrative and Technical Staff

Catherine Gibbs
Centre Manager, MacDiarmid Institute
Victoria University of Wellington

Genevieve Fitzjames
Administrator, MacDiarmid Institute
University of Auckland

David Flynn
Electron Microscopy Technician
Victoria University of Wellington

Kevin Sheehy
Commercialisation Manager, MacDiarmid Institute
Victoria University of Wellington

Gary Turner
Research Engineer
University to Canterbury

Rosie Wayte
Administrator, MacDiarmid Institute
Victoria University of Wellington

Vanessa Young
Strategic Engagement Manager, MacDiarmid Institute
Victoria University of Wellington

MI Students in 2020 (350)

MSc (54)

Abdool Kader	Zain	University of Canterbury/GNS
Allan	Claudia	University of Canterbury
Bagley	Mark	Victoria University of Wellington
Berger	Amanda	Victoria University of Wellington
Bibin	Jose	University of Canterbury
Butler	Tane	Victoria University of Wellington
Buzas Stowers-Hull	André	Massey University
Clague	Lily	University of Otago
Cox	Matthew	University of Otago
Craig	Tim	Massey University
Data	Shailja	University of Auckland
Denys	Mathew	University of Otago
Ding	Qituo	University of Canterbury
Doonan	William	Victoria University of Wellington
Elashkar	Ahmed	University of Canterbury
Filatov	Yuri	University of Canterbury
Hamilton-Horne	Angus	Victoria University of Wellington
He	Jing	Massey University
Ingle	Max	Victoria University of Wellington
Kuang	Ze	University of Auckland
Kumar	Barath	Massey University
Lee	Keng Lung (Marcus)	University of Auckland
Lloyd	Hank	University of Auckland
Ly	Panharath (Ricky)	University of Auckland
Markwitz	Martin	Victoria University of Wellington
Matthews	Hannah	University of Auckland
McIntyre	Sam	University of Otago
Newport	Rebecca	University of Canterbury
Newton-Vesty	Michael	University of Canterbury
Otter	Sam	Massey University
Owen	Jessie	Massey University
Panjeta	Madhu	Auckland University of Technology
Park	Luke	University of Auckland
Patel	Hamesh	University of Auckland
Payet	Fabien	University of Canterbury
Pitman	Kira	Victoria University of Wellington
Prime	Helen	University of Otago
Said	Sultan	Auckland University of Technology
Scott	Hamish	University of Canterbury
Sharma	Vaibhav	Victoria University of Wellington
Smith	Anna	University of Canterbury
Sullivan	Matthew	University of Canterbury/GNS
Symon	Nicholas	Massey University
Tang	Pui Yan	University of Auckland
Thomas	Annabella	University of Canterbury
Tolentino	Winter	Auckland University of Technology
Wagner	Ford	University of Canterbury
Ward	Ciaran	University of Otago
Warren	Aran	University of Canterbury
Weaver	Nic	University of Canterbury
Whiting	John	University of Otago
Wild	Eleonore	University of Auckland
Xia	Bangwei	University of Auckland
Yu	Diana (Tiantian)	University of Auckland

PhD (296)

Abudayyeh	Abdullah	University of Otago
Acheson	Chris	Victoria University of Wellington
Adams	Ryan	University of Canterbury
Agnieray	Heiana	University of Auckland
Ahangarpour	Marzieh	University of Auckland
Akogun	Fola	University of Otago
Allam	Ravi Tej	Auckland University of Technology
Altenhuber	Nicola	University of Canterbury
Anand	Aljo	University of Auckland
Andrew	Phillippa-Kate (Kate)	Massey University
Anil	Anusree	University of Auckland
Arshad	Faiza	University of Otago
Ashraf	Jesna	University of Auckland
Auer	Bernhard	Massey University
Ayed	Zeineb	Victoria University of Wellington
Ayupova	Deanna	Victoria University of Wellington
Azad	Lal	University of Auckland
Bandara	Nisansala	Massey University
Bandi	Bhanumathi (Bhanu)	Auckland University of Technology
Beikzadeh Ghelejlou	Sara	University of Auckland
Bell-Tyler	Joseph	University of Auckland
Bernach	Michal	University of Canterbury
Bhugra	Vaibhav	Victoria University of Wellington
Bioletti	Gabriel	Victoria University of Wellington
Bjareborn	Oscar	Victoria University of Wellington
Board	Amanda	University of Canterbury
Bondi	Luca	University of Otago
Booth	Tony	Robinson Research Institute
Brant	Nicola	University of Auckland
Brett	Matthew	Victoria University of Wellington
Brooke	Sam	Massey University
Brooks	Justin (Gus)	Victoria University of Wellington
Burling	Sophie	Massey University
Camacho	Luis	University of Auckland
Carroll	Liam	University of Canterbury
Casey-Stevens	Caitlin	University of Otago
Cassie	Erica	Victoria University of Wellington
Chan	Andrew	University of Auckland
Chandrabose	Sreelakshmi	Victoria University of Wellington
Cheema	Jamal	University of Auckland
Chen	Xize	University of Auckland
Chen	Linda	University of Canterbury
Choudhury	Minati	University of Otago
Christopher	Tim	University of Auckland
Cleland	Josiah	Massey University
Clyde	Daniel	University of Auckland
Conroy	Francesca	University of Auckland
Coombes	David	University of Canterbury
Cornelio	Rani	Massey University
Currie	Michael	University of Canterbury
Davies	James	University of Canterbury
Deas	Robert	University of Auckland
Devese	Samuel	Victoria University of Wellington
Divya	Shalini	Victoria University of Wellington
Dong	Yusong	University of Auckland
Doran	Conor	University of Auckland
Drummond	Grace	University of Auckland
Durrani	Madeeha	University of Auckland
Earl	Andrew	University of Auckland

Edens	Samuel	University of Canterbury
Elahi	Asrar	University of Otago
Emeny	Chrissy	University of Canterbury
Evans	Matthew	Victoria University of Wellington
Fellner	Daniel	University of Auckland
Ferris	Shaun	University of Auckland
Ford	Kathryn	University of Canterbury
Francis	Adam	Victoria University of Wellington
Franke	Christine	University of Canterbury
Gaar	Jakob	University of Auckland
Galli	Edoardo	University of Canterbury
Geurts	Alisha	University of Auckland
Ghosh	Sunandita	University of Auckland
Giglio	Cannon	University of Auckland
Gilbertson	Fletcher	University of Canterbury
Gilkes	Jenna	University of Canterbury
Gonzales	Jofferson	Victoria University of Wellington
Gordon	Calum	Victoria University of Wellington
Grant	Philip	University of Auckland
Grant	Thomas	University of Auckland
Guna	Venkat	University of Auckland
Guo	Lun	University of Auckland
Gupta	Arka	Massey University
Hackett	Alissa	University of Auckland
Hamonnet	Johan	University of Canterbury
Happe	Erica	Victoria University of Wellington
Hardy	Jake	Victoria University of Wellington
Harris	Shikeale	Massey University
Harvey-Reid	Nathan	University of Canterbury
Haverkate	Natalie	University of Auckland
Hayali	Ahmed	University of Canterbury
Hedley	Gavin	University of Canterbury
Hermanspahn	Lily	University of Canterbury
Hermant	Yann	University of Auckland
Heywood	Zachary	University of Canterbury
Hindcapie Florez	Edison	Massey University
Holmes-Hewett	Will	Victoria University of Wellington
Horocek-Glading	Miriana	University of Auckland
Horrocks	Matthew	University of Auckland
Hosking	Peter	University of Auckland
Hou	Caixia	University of Canterbury
Howard	Ben	University of Canterbury
Howard	Georgina	University of Auckland
Hughson	Fraser	Victoria University of Wellington
Hung	Jenny	University of Auckland
Ilina	Aleksandra	Victoria University of Wellington
Itumoh	Emeka	University of Auckland
Jena	Kumar	University of Auckland
Ji	Junghun (William)	University of Auckland
Kanyan	Deepika	University of Auckland
Kariman	Asadollah	University of Canterbury
Kasim	Johanes	University of Auckland
Keemi	Lim	University of Auckland
Khalil	Bushra Anam	University of Auckland
Kihara	Shinji	University of Auckland
King-Hudson	Te-Rina	University of Canterbury
Kleinjan (nee Bakker)	Carline	University of Canterbury
Kollmetz	Tarek	University of Auckland
Kovalenko	Nadiia	University of Auckland
Kubitzky	Sascha	Victoria University of Wellington
Kumar	Saawan	University of Auckland
Kumar	Vipin	University of Auckland
Lacalendola	Nicola	University of Auckland
Lamba	Saurabh	University of Auckland
Lambie	Stephanie	University of Auckland
Landon-Lane	Leatham	University of Canterbury
Latif	Qaisar	University of Auckland
Lee	Subo	Massey University
Li	Sheung Yin (Tony)	University of Auckland
Li	Si	University of Auckland
Li	Yang	Massey University
Lisboa	Lynn	University of Otago
Lo	Stephen	University of Auckland
Lofroth	Matthew	Massey University
Lolohea	Taniela	University of Auckland
Love	Michael	University of Canterbury
Lu	Ziqi (Michael)	University of Auckland
Lucarelli	Valentina	University of Auckland
Luong	Tuan Minh	University of Auckland
Lya	Crystal	University of Auckland
Ma	Chao	University of Auckland
Mackerchar	Hannah	University of Canterbury
Mahendra	Anmol	Victoria University of Wellington
Majic	Matt	Victoria University of Wellington
Makinde	Zainab	University of Auckland
Mallinson	Joshua	University of Canterbury
Mandal	Ramkrishna	University of Otago
Mao	Yubing	University of Auckland
Mapley	Joseph	University of Otago
Marone-Hitz	Ombéline	University of Otago
Martin Treceno	Samuel	University of Canterbury
Mataira-Cole	Ratu	Victoria University of Wellington
Mautner	Ira	University of Auckland
McGowan	John	University of Auckland
Menke	Henri	University of Otago
Metin	Danielle	University of Auckland
Miller	Jackson	Victoria University of Wellington
Mirzakhani	Sara	University of Canterbury
Mohandas	Nimisha	Massey University
Mohd Darbi	Nur Maizura	University of Auckland
Molloy	Ellen Diana	Victoria University of Wellington
Monteiro	Isabela	University of Auckland
Mooney	Roisin	Auckland University of Technology
Murali	Sai	Victoria University of Wellington
Naiya	Mohinder	University of Auckland
Nally	Brianna	University of Otago
Nalumaga	Hellen	Victoria University of Wellington
Narasimhan	Badri Narayanan	University of Auckland
Nawaz	Tehreema	Victoria University of Wellington
Neiman	Alex	University of Canterbury
Nesbitt	Sam	University of Canterbury
Nguyen	Hong Phan (Jenna)	Victoria University of Wellington
Nieke	Philipp	University of Auckland
Nott	Thomas	Victoria University of Wellington
Onal	Sevgi	University of Canterbury
Onyema	Chikwzie	University of Canterbury
Ortega	Kenneth	University of Otago
Pandian	Santhosh Kumar	University of Auckland
Park	Kun Woo (Woo)	University of Auckland
Patel	Hamesh	University of Auckland
Patel	Sneh	University of Auckland
Paulin	Emily	University of Auckland
Pearl	Esperanza (Essie)	University of Auckland
Perl	David	Massey University
Phuong	Bui Thi	Victoria University of Wellington
Posa	Luka	University of Auckland
Prabowo	Sigit	Victoria University of Wellington
Pradhan	Susav	Massey University
Pu	Yuguang	University of Auckland
Pugliese	Silvina	Victoria University of Wellington
Pulickal Joseph	Delsa	University of Auckland
Rabanzo-Castillo	Kristel Mae	University of Auckland
Rajchakit	Urawadee	University of Auckland
Ramamirtham	Sashikumar	Massey University
Ramkrishna	Mandal	University of Otago
Randall	George	University of Auckland
Rani	Aakanksha	University of Auckland
Rees	Shaun	University of Auckland
Rehan	Muhammad	Massey University
Reis	Miguel	University of Canterbury
Ren	Zhijun (Chloe)	Auckland University of Technology
Ridings	Kannan	University of Auckland
Robb	Matt	University of Otago
Ross	Daniel	University of Otago
Rov	Rosanna	University of Auckland
Ruffman	Charlie	University of Otago
Sabet	Saman	University of Auckland
Safaei	Sina	University of Auckland
Sale	Sarah	University of Canterbury
Salehitaleghani	Sara	University of Canterbury
Sarkar	Debolina	University of Canterbury
Sarwar	Mian Makhdoom (Mak)	University of Otago
Savoie	Maxime	University of Canterbury
Schroeder	Kathryn	Victoria University of Wellington
Schuurman	Joel Chris	University of Canterbury
Schuyt	Joseph	Victoria University of Wellington
Schweig	Michael	Victoria University of Wellington
Sester	Clement	Victoria University of Wellington
Shaib	Ali	Victoria University of Wellington
Sharma	Shailendra	University of Canterbury
Shashidar	Vinay	University of Auckland
Sheikholeslami	Sina	University of Auckland
Shepperson	Oscar	University of Auckland
Shiraz	Fathumma	University of Auckland
Shojaei	Maryam	University of Canterbury
Siamaki	Mohammad	Victoria University of Wellington
Singh	Harshpreet	University of Auckland
Singh	Sandhya	University of Otago
Siu	Christy	University of Auckland
Smith	Jordan	University of Otago
Smith	Mark	University of Auckland
Solís Muñana	Pablo	Auckland University of Technology
Soman	Arya	Victoria University of Wellington
Song	Xin	University of Auckland
Spasovski	Martin	University of Auckland
Steel	Jamie	University of Canterbury
Steinmetz	Kai	University of Auckland
Stevenson	Sarah	Victoria University of Wellington
Sun	Yiling	University of Canterbury
Sundaresan	Sriram	University of Otago
Sutton	Joshua	University of Otago
Tamming	Ronnie	Victoria University of Wellington
Tan	Shi Min	University of Auckland
Tang	Chhayly	Victoria University of Wellington
Tang	Da	University of Auckland
Taylor	Ross	Victoria University of Wellington
Thompson	Kadin	Victoria University of Wellington
Thorn	Karen	Victoria University of Wellington
Tiban Arango	Bryan Andres (Andres)	Auckland University of Technology
Ting	Sheng Hao (Matthew)	University of Auckland
Tong	Juliana	University of Auckland
Tran	Loc	Victoria University of Wellington
Treacher	Eddyn (Ned)	Victoria University of Wellington
Truong	Diana	University of Auckland
Twidle	Andrew	University of Auckland
Uhrig	David	Robinson Research Institute
Vadakkedath	Praveen George	University of Auckland
Van Hilst	Quinn	University of Otago
Vargas	Matheus	University of Auckland
Vasdev	Roan	University of Otago
Vella	Joe	University of Auckland
Vyborna	Natalija	University of Auckland
Wagner	Isabella	Victoria University of Wellington
Wan	Ziyao	University of Auckland
Wang	Jie	Victoria University of Wellington
Wang	Min	University of Auckland
Wang	Qing	University of Auckland
Wang	Xindi (Andy)	University of Auckland
Wang	Yi	University of Auckland
Wang	Yuxin (Sunny)	University of Auckland
Wang	Zifei (Linna)	University of Auckland
Warren	Aran	University of Canterbury
Watkin	Serena	University of Canterbury
Weal	Geoffrey	University of Otago
Westberry	Benjamin	Massey University
Wildervanck	Martijn	University of Auckland
Williams	Elyse	University of Auckland
Wong	Andy (Chi Hung)	University of Auckland
Wong	Jin Xiang	Massey University
Wood	David	University of Canterbury
Wu	Jiazun	Victoria University of Wellington
Wu	Ting	University of Canterbury
Xu	Xiaoyi (Joy)	University of Auckland
Yang	Mingrui (Ray)	Massey University
Yang	Tingxuan	University of Auckland
Ye	Liu (Yasmin)	Victoria University of Wellington
Ye	Piao	University of Auckland
Yudhipratama	Indra	University of Auckland
Zhang	Ao	Robinson Research Institute
Zhang	Ethan	Victoria University of Wellington
Zhang	Hongzhou	University of Auckland
Zhoiu	Huihua	University of Auckland
Zhang	Karl	University of Auckland
Zhang	Wen	University of Auckland
Zhang	Yao	Victoria University of Wellington
Zhang	Yiming	Massey University
Zhu	Yufei	University of Otago

MI Postdoctoral Researchers & RAs 2020 (134)

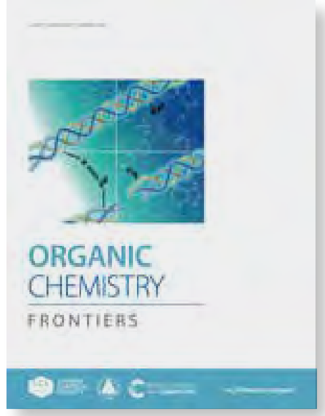
PDFs (78)

Abdollahi	Ayoub	University of Auckland
Acharya	Susant	University of Canterbury
Akbarinejad	Alireza	University of Auckland
Arif	Tanzeel	Victoria University of Wellington
Balzan	Miguel	University of Auckland
Bhattacharjee	Tanmoy	University of Otago
Bonesi	Marco	University of Auckland
Brooksby	Paula	University of Canterbury
Calvert	Matthew	University of Auckland
Cameron	Alan	University of Auckland
Cavanagh	David	University of Otago
Chalard	Anaïs	University of Auckland
Chen	Kai	Victoria University of Wellington
Chen	Wan-Ting	University of Auckland
Chen	Linda	University of Canterbury
Cink	Ruth	University of Auckland
Clarke	Daniel	Victoria University of Wellington
Clements	John	Massey University
Cotton	Gemma	University of Otago
Davison	Emma	University of Auckland
De Zoysa	Gayan Heruka	The University of Auckland
Ding	Xiaobo	University of Auckland
Dolamore	Fabian	University of Canterbury
Furkert	Daniel	University of Auckland
Gilkes	Jenna	University of Canterbury
Given	Fiona	University of Canterbury
Hayat	Muhammed	University of Auckland
Healy	Colm	University of Canterbury
Holmes-Hewett	William	Victoria University of Wellington
Holtkamp	Hannah	University of Auckland
Hume	Paul	Victoria University of Wellington
Kammermeier	Michael	Victoria University of Wellington
Kaur	Manmeet	University of Auckland
Kavianinia	Iman	University of Auckland
Kee	Mima	Victoria University of Wellington
Kee	Seyoung	University of Auckland
Kihara	Shinji	University of Auckland
Li	Fan (Freda)	University of Auckland
Li	Henry	University of Canterbury
Lolohea	Taniela	University of Auckland
Lowrey	Sam	University of Otago
Maerkl	Tobias	University of Canterbury
Martinez Gazoni	Rodrigo	University of Canterbury
Meffan	Claude	University of Canterbury
Menges	Julian	University of Canterbury
Minnee	Thomas	University of Auckland
North	Rachel	University of Canterbury
Novikova	Nina	University of Auckland
Ogilvie	Olivia	University of Canterbury
Preston	Dan	University of Canterbury
Price	Mike	Victoria University of Wellington
Raj (nee Patil)	Komal	University of Canterbury
Raudsepp	Allan	Massey University
Rennison	David	University of Auckland
Seal	Christopher	University of Auckland
Sikorska	Celina	University of Auckland
Soffe	Rebecca	University of Canterbury
Somerville	Walter	Victoria University of Wellington
Sparrow	Kevin	University of Auckland
Stubbing	Louise	University of Auckland
Sun	Yiling	University of Canterbury
Sun-Waterhouse	Dongxiao (James)	University of Auckland
Swain	Jonathan	University of Auckland
Tay	Aaron	University of Otago
Thorn	Karen	Victoria University of Wellington
Ullah	Rifat	Victoria University of Wellington
Venturumilli	Sriharsha	Victoria University of Wellington
Ward	Rob	Massey University
Weissert	Lena	University of Auckland
Wells	Frederick Steven (Steve)	University of Auckland
Williams	Geoffrey	University of Auckland
Wilson	Zoe	University of Auckland
Wright	Joshua	University of Canterbury
Wu	Ting	University of Canterbury
Xu	Sherry	University of Auckland
Yang	Sunghyun	University of Auckland
Zeng	Chunyan	Victoria University of Wellington
Zhu	Bicheng	University of Auckland

RAs (56)

Aguergaray	Claude	University of Auckland
Al-Ghaus	Zahraa	University of Auckland
Bennington	Michael	University of Otago
Chan	Eddie	University of Auckland
Chan	Jay	Victoria University of Wellington
Chen	Qun (Queenie)	University of Auckland
Cornelio	Rani (Joel)	Massey University
Cozens	Edward	Victoria University of Wellington
Deijs	Gerrit (Sjoerd)	University of Auckland
Divya	Shalini	Victoria University of Wellington
Falconer	Jonathan	MacDiarmid Institute/VUW
Fraser	Handayani (Putri)	Victoria University of Wellington
Gilmour	James (Tom)	Victoria University of Wellington
Glasson	Judith	University of Auckland
Goddard-Winchester	Max	Robinson Research Institute
Goodacre	Dana	University of Auckland
Hardy	Jake	Victoria University of Wellington
Hernandez	Pablo	Massey University
Huang	Saifang	University of Auckland
Huntington	Jacob	Victoria University of Wellington
Kerr-Philips	Thomas	University of Auckland
Kumar	Vishal	University of Auckland
Landon-Lane	Leatham	University of Canterbury
Laufersky	Geoffry	Victoria University of Wellington
Li	Si	University of Auckland
Lo	Stephen	AUT/Massey University
Lu	Benjamin	University of Auckland
Maity	Tanmay	Victoria University of Wellington
Majic	Matt	Victoria University of Wellington
Manners	Sarah	University of Canterbury
Maslova	Kate	Massey University
Matthews	Hannah	University of Auckland
McNulty	James	Victoria University of Wellington
Najafabadi	Atefeh Fazel	Victoria University of Wellington
Opiyo	George	University of Auckland
Pitman	Kira	Robinson Research Institute
Pugliese	Silvina	Victoria University of Wellington
Ridings	Kannan	University of Auckland
Robinson	John	Victoria University of Wellington
Sampath	Gayan	University of Canterbury
Schuster	Sebastian	Victoria University of Wellington
Schuyt	Joe	Victoria University of Wellington
Scott	Jonty	University of Canterbury
Shamailov	Sophie	University of Auckland
Siow	Andrew	University of Auckland
Sodavaram	Nireekshan (Nik) Kumar	Victoria University of Wellington
Taleshiahangari	Hani	University of Canterbury
Tayagui	Ayelen	University of Canterbury
Tesana	Siriluck	University of Canterbury
Tollemache	Cherie	University of Auckland
Treacher	Eddyn (Ned)	Victoria University of Wellington
Wang	Yi	University of Auckland
Woolly	Ethan	Victoria University of Wellington
Xu	Buzhe	University of Auckland
Zhang	Allan	University of Auckland
Zhang	Peikai	University of Auckland

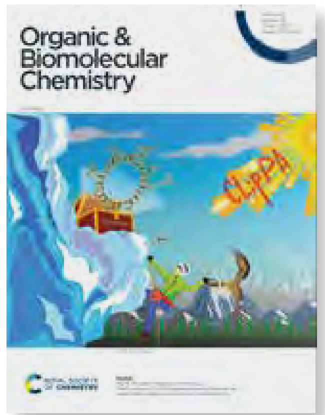
Journal covers



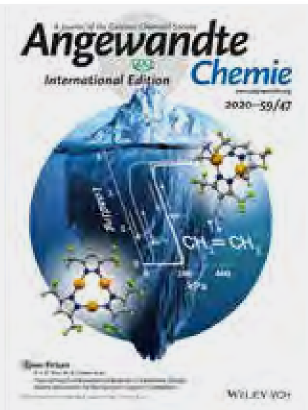
Margaret Brimble and co-workers
Enzymatic and Non-Enzymatic Crosslinks Found in Collagen and Elastin and Their Chemical Synthesis
Organic Chemistry Frontiers **7**, 2789-2814 (2020)

Margaret Brimble and co-workers
On-Resin Preparation of Allenamidyl Peptides: a Versatile Chemoselective Conjugation and Intramolecular Cyclisation Tool
Angewandte Chemie International Edition **59**, 18054-18061 (2020)

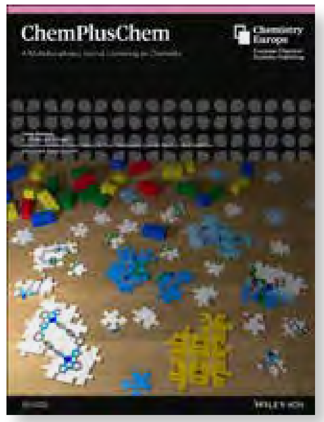
Margaret Brimble and co-workers
Rapid and Simultaneous Analysis of Advanced Glycation End Products on Silica Hydride Column: Comparison of UV, Fluorescence, and Mass Spectrometry Detectors
Separation Science Plus **3**, No. 11-12 (2020)



Margaret Brimble and co-workers
Direct Synthesis of Cyclic Lipopeptides using Intramolecular Native Chemical Ligation and Thiol-ene CLipPA Chemistry
Organic and Biomolecular Chemistry **18**, 2838-2844 (2020)



Matthew Cowan and co-workers
Overcoming Fundamental Limitations in Adsorbent Design: Alkene Adsorption by Non-porous Copper (I) Complexes
Angewandte Chemie International Edition **59**, 21001-21006 (2020)



Paul Kruger and Dan Preston
Using Complementary Ligand Denticity to Direct Metallosupramolecular Structure about Metal Ions with Square-Planar Geometry
ChemPlusChem **85**, 794-794 (2020)

Geoff Waterhouse and co-workers
Evolution of Zn(II) single atom catalyst sites during the pyrolysis-induced transformation of ZIF-8 to N-doped carbons
Science Bulletin **65**, 1743-1751 (2020)

Publications

AUTHORS	TITLE	JOURNAL
Twidle, A. M., **Barker, D.** & Suckling, D. M.	(7Z)-Tricosene Improves Pheromone Trap Catch of Raspberry Bud Moth, Heterocrossa rubophaga.	*Journal of Chemical Ecology* **46**, 830-834 (2020)
Gilmour, J. T. A. & **Gaston, N.**	5-Fold symmetry in superatomic scandium clusters: Exploiting favourable orbital overlap to sequester spin.	*Physical Chemistry Chemical Physics* **22**, 4051-4058 (2020)
Bai, S., Wang, Z., Tan, L., **Waterhouse, G. I. N.**, Zhao, Y. & Song, Y.-F.	600 nm Irradiation-Induced Efficient Photocatalytic CO_2 Reduction by Ultrathin Layered Double Hydroxide Nanosheets.	*Industrial and Engineering Chemistry Research* **59**, 5848-5857 (2020)
Wright, C. Y., du Preez, D. J., Martincigh, B. S., **Allen, M. W.**, Millar, D. A., Wernecke, B. & Blesic, S.	A Comparison of Solar Ultraviolet Radiation Exposure in Urban Canyons in Venice, Italy and Johannesburg, South Africa.	*Photochemistry and Photobiology* **96**,1148-1153 (2020)
Lotfian, N., Nourbakhsh, A., Mirsattari, S. N., Saberi, A. & **Mackenzie, K. D.**	A comparison of the effect of nanostructured $MgCr_2O_4$ and $FeCr_2O_4$ additions on the microstructure and mechanical properties of direct-bonded magnesia-chrome refractories.	*Ceramics International* **46**, 747–754 (2020)
Balabhadra, S., Reid, M. F., **Golovko, V.** & Wells, J.-P. R.	A comparison of the Yb^{3+} absorption and upconversion excitation spectra for both the cubic and hexagonal phases of $NaYF_4:Yb^{3+}/Er^{3+}$ nanoparticles.	*Optical Materials* **107,** 110050 (2020)
Li, S.-Y., Schon, B. S. & **Travas-Sejdic, J.**	A Conductive Microfiltration Membrane for In Situ Fouling Detection: Proof-of-Concept Using Model Wine Solutions.	*Macromolecular Rapid Communications* 20000303 (2020)
Jelley, R. E., Duhamel, N., **Barker, D.** & Fedrizzi, B.	A convenient synthesis of amino acid-derived precursors to the important wine aroma 3-sulfanylhexan-1-ol (3SH).	*Tetrahedron Letters* **61**, 151663 (2020)
Chong, S. V., Trompetter, W. J., **Leveneur, J.**, Robinson, F., Leuw, B., Rumsey, B., McCurdy, M., Turner, J., Uhrig, D. M., Spencer, S., **Kennedy, J. V.** & Long, N. J.	A facile route to insulate an Fe-based nanocrystalline alloy powder for magnetic composite cores.	*Materials Science and Engineering: B* **264**, 114928 (2021)
Zhang, Y., **Waterhouse, G. I. N.**, Xiang, Z.-P., Che, J., Chen, C. & Sun, W.	A highly sensitive electrochemical sensor containing nitrogen-doped ordered mesoporous carbon (NOMC) for voltammetric determination of L-tryptophan.	*Food Chemistry* **326** (2020)
Hanif, M., Arshad, J., Astin, J. W., Rana, Z., Zafar, A., Movassaghi, S., Leung, E., Patel, K., **Söhnel, T.**, Reynisson, J., **Sarojini, V.**, Rosengren, R. J., Jamieson, S. M. F. & Hartinger, C. G.	A Multitargeted Approach: Organorhodium Anticancer Agent Based on Vorinostat as a Potent Histone Deacetylase Inhibitor.	*Angewandte Chemie* **132**, 14717-14722 (2020)
Hanif, M., Arshad, J., Astin, J. W., Rana, Z., Zafar, A., Movassaghi, S., Leung, E., Patel, K., **Söhnel, T.**, Reynisson, J., **Sarojini, V.**, Rosengren, R. J., Jamieson, S. M. F. & Hartinger, C. G.	A Multitargeted Approach: Organorhodium Anticancer Agent Based on Vorinostat as a Potent Histone Deacetylase Inhibitor.	*Angewandte Chemie - International Edition* **59**, 14609-14614 (2020)
Ainslie, M., Grilli, F., Quéval, L., Pardo, E., Perez-Mendez, F., Mataira, R., Morandi, A., Ghabeli, A., **Bumby, C. W.** & Brambilla, R.	A new benchmark problem for electromagnetic modelling of superconductors: the high-T c superconducting dynamo.	*Superconductor Science and Technology* **33**, 105009 (2020)
Islah-u-din, **Chong, S. V.**, **Jameson, G. B.**, Raymond, S. G., Lee, G., Park, I. K., Wang, X., **Waterland, M. R.** & **Tallon, J. L.**	A new class of ferromagnetic semiconductor: Copper molybdate organic-inorganic compound with phenanthroline organic linkers.	*Magnetism and Magnetic Materials* **508** (2020)
van Leeuwen, K. A., Nardin, T., **Barker, D.**, Fedrizzi, B., Nicolini, G. & Larcher, R.	A novel LC-HRMS method reveals cysteinyl and glutathionyl polysulfides in wine.	*Talanta* **218** (2020)
Ablott, T. A., **Telfer, S. G.** & Richardson, C.	A post-synthetically reduced borane-functionalised metal-organic framework with oxidation-inhibiting reactivity.	*CrystEngComm* **22**, 5289-5295 (2020)
Hume, P. A. & **Hodgkiss, J. M.**	A Projective Method for the Calculation of Excited-State Electronic Coupling: Isolating Charge Transfer/Recombination Processes in Organic Photovoltaics.	*Journal of Physical Chemistry A* **124**, 591-600 (2020)
Lisboa, L. S., Findlay, J. A., Wright, L. J., Hartinger, C. G. & **Crowley, J. D.**	A Reduced-Symmetry Heterobimetallic $[PdPtL_4]^{4+}$ Cage: Assembly, Guest Binding, and Stimulus-Induced Switching.	*Angewandte Chemie - International Edition* **59**, 11101–11107 (2020)
Qazvini, O. T. & **Telfer, S. G.**	A robust metal-organic framework for post-combustion carbon dioxide capture.	*Journal of Materials Chemistry A* **8**, 12028-12034 (2020)

AUTHORS	TITLE	JOURNAL
Aqrawe, Z., Patel, N., Vyas, Y., Bansal, M., Montgomery, J., **Travas-Sejdic, J.** & Svirskis, D.	A simultaneous optical and electrical in-vitro neuronal recording system to evaluate microelectrode performance.	*PLoS ONE* **15**, e0237709 (2020)
Loho, T., **Leveneur, J.**, Davidson, R., Trompetter, M. M., Futter, J., Morel, J., Archer, R. & **Kennedy, J. V.**	A tensile technique for measuring frozen products adhesion strength: Application to stainless steel/frozen milk interaction.	*Journal of Food Engineering* **271**, 109772 (2020)
Raymond, O., Bühl, M., Lane, J. R., Henderson, W., **Brothers, P. J.** & Plieger, P. G.	*Ab Initio* Molecular Dynamics Investigation of Beryllium Complexes.	*Inorganic Chemistry* **59**, 2413-2425 (2020)
Balabhadra, S., **Reid, M. F.**, **Golovko, V.** & Wells, J.-P. R.	Absorption spectra, defect site distribution and upconversion excitation spectra of $CaF_2/SrF_2/BaF_2:Yb^{3+}:Er^{3+}$ nanoparticles.	*Journal of Alloys and Compounds* **834** (2020)
Song, W., Jiang, Z., Staines, M., **Wimbush, S. C.**, Badcock, R. & Fang, J.	AC Loss Calculation on a 6.5 MVA/25 kV HTS Traction Transformer with Hybrid Winding Structure.	*IEEE Transactions on Applied Superconductivity* **30**, 1–5 (2020)
Shillito, G. E., Bodman, S. E., Mapley, J. I., **Fitchett, C. M.** & **Gordon, K. C.**	Accessing a Long-Lived 3LC State in a Ruthenium(II) Phenanthroline Complex with Appended Aromatic Groups.	*Inorganic Chemistry* **59**,16967–16975 (2020)
Porter, G. C., Schwass, D. R., Tompkins, G. R., Bobbala, S. K. R., Medlicott, N. J. & **Meledandri, C. J.**	AgNP/Alginate Nanocomposite hydrogel for antimicrobial and antibiofilm applications.	*Carbohydrate Polymers* **251**, 117017 (2021)
Makinde, Z. O., van der Heijden, N. J., **Domigan, L. J.**, **McGillivray, D. J.** & **Williams, D. E.**	Aligned Assembly in a 2-D Gel of a Water-Soluble Peptide.	*Langmuir: The ACS Journal of Surfaces and Colloids* **36**, 11292-11302 (2020)
Zhao, Y., Zheng, L., Shi, R., Zhang, S., Bian, X., Wu, F., Cao, X., **Waterhouse, G. I. N.** & Zhang, T.	Alkali Etching of Layered Double Hydroxide Nanosheets for Enhanced Photocatalytic N_2 Reduction to NH_3.	*Advanced Energy Materials* **10**, 2002199 (2020)
Raymond, O., Henderson, W., Lane, J. R., **Brothers, P. J.** & Plieger, P. G.	An electrospray ionization mass spectrometric study of beryllium chloride solutions and complexes with crown ether and cryptand macrocyclic ligands.	*Journal of Coordination Chemistry* **73**, 1-16 (2020)
Wang, J., Zhang, H., Wang, H., Wang, J., Sun-Waterhouse, D., **Waterhouse, G. I. N.**, Ma, C. & Kang, W.	An immunomodulatory polysaccharide from blackberry seeds and its action on RAW 264.7 cells via activation of NF-κB/MAPK pathways.	*Food and Agricultural Immunology* **31**, 575-586 (2020)
Correddu, D., Sharma, N., Kaur, S., Varnava, K. G., Mbenza, N. M., **Sarojini, V.** & Leung, I. K. H.	An investigation into the effect of ribosomal protein S15 phosphorylation on its intermolecular interactions by using phosphomimetic mutant.	*Chemical Communications* **56**, 7857-7860 (2020)
Song, J., Ye, L., Li, C., Xu, J., Chandrabose, S., Weng, K., Cai, Y., Xie, Y., O'Reilly, P., Chen, K., Zhou, J., Zhou, Y., **Hodgkiss, J. M.**, Liu, F. & Sun, Y.	An Optimized Fibril Network Morphology Enables High-Efficiency and Ambient-Stable Polymer Solar Cells.	*Advanced Science* **7**, 2001986 (2020)
Burrows, A., Cooper, S., **Pahl, E.** & Schwerdtfeger, P.	Analytical Method for fast converging lattice sums for cubic and hexagonal closed-packed structures.	*Journal of Mathematical Physics* **61** (2020)
Khlebtsov, N. G. & **Le Ru, E. C.**	Analytical solutions for the surface- and orientation-averaged SERS enhancement factor of small plasmonic particles.	*Journal of Raman Spectroscopy* **52**, 285-295 (2020)
Dobson, R. C. J. & Patel, T. R.	Analytical ultracentrifugation: still the gold standard that offers multiple solutions.	*European Biophysics Journal* **49**, 673–676 (2020)
Zhang, Y., Mehta, M., Mansel, B. W., Ng, H. W., Liu, Y., Holmes, G., **Le Ru, E. C.** & Prabakar, S.	Anion-regulated binding selectivity of Cr(III) in collagen.	*Biopolymers* **111**, e23406 (2020)
Hu, J., Zhang, Y., Cabero, M. A. Z., Wei, B., Tu, S., Liu, S., Yu, D., Ansermet, J.-P., **Granville, S.** & Yu, H.	Anomalous Nernst effect in Co_2MnGa thin films with perpendicular magnetic anisotropy.	*Journal of Magnetism and Magnetic Materials* **500** (2020)
Porter, G. C., Tompkins, G. R., Schwass, D. R., Li, K. C., Waddell, J. N. & **Meledandri, C. J.**	Anti-biofilm activity of silver nanoparticle-containing glass ionomer cements.	*Dental Materials* **36**, 1096-1107 (2020)
Crlikova, H., Malina, J., Novohradsky, V., Kostrhunova, H., Vasdev, R. A. S., **Crowley, J. D.**, Kasparkova, J. & Brabec, V.	Antiproliferative Activity and Associated DNA Interactions of $[Co_2L_3]^{6+}$ Cylinders Derived from Bis(bidentate) 2-Pyridyl-1,2,3-triazole Ligands.	*Organometallics* **39**, 1448–1455 (2020)

AUTHORS	TITLE	JOURNAL
Abbasi, H. & **Unsworth, C.**	Applications of advanced signal processing and machine learning in the neonatal hypoxic-ischemic electroencephalogram.	*Neural Regeneration Research* **15**, 222-231 (2020)
Soffe, R., Mach, A. J., Onal, S., **Nock, V.**, Lee, L. P. & Nevill, J. T.	Art-on-a-Chip: Preserving Microfluidic Chips for Visualization and Permanent Display.	*Small* **16**, 2002035 (2020)
Pike, M. D., **Bose, S. K.**, Mallinson, J. B., Acharya, S. K., Shirai, S., Galli, E., Weddell, S. J., Bones, P. J., Arnold, M. D. & **Brown, S. A.**	Atomic Scale Dynamics Drive Brain-like Avalanches in Percolating Nanostructured Networks.	*Nano letters* **20**, 3935-3942 (2020)
Lyzwa, F., Chan, A., Khmaladze, J., Fürsich, K., Keimer, B., Bernhard, C., Minola, M. & **Mallett, B. P. P.**	Backfolded acoustic phonons as ultrasonic probes in metal-oxide superlattices.	*Physical Review Materials* **4** (2020)
Meng D., Xie J., **Waterhouse G.I.N.**, Zhang K., Zhao Q., Wang S., Qiu S., Chen K., Li J., Ma C., Pan Y., Xu J.	Biodegradable Poly(butylene adipate-co-terephthalate) composites reinforced with bio-based nanochitin: Preparation, enhanced mechanical and thermal properties.	*Journal of Applied Polymer Science* **137** (2020)
Rehan, M., Al-Bahadly, I., Thomas, D. G. & **Avci, E. A.**	Capsule robot for gut microbiota sampling using shape memory alloy spring.	*International Journal of Medical Robotics and Computer Assisted Surgery* **16**, e2140 (2020)
Fang, F., Rogers, J., **Leveneur, J.**, Rubanov, S., Koo, A. & **Kennedy, J. V.**	Catalyst-free synthesis of copper oxide composites as solar radiative filters.	*Nanotechnology* **31**, 504002 (2020)
Rabanzo-Castillo, K. M., Kumar, V. B., **Söhnel, T.** & **Leitao, E. M.**	Catalytic Synthesis of Oligosiloxanes Mediated by an Air Stable Catalyst, $(C_6F_5)_3B(OH_2)$.	*Frontiers in Chemistry* **8**, 477 (2020)
Beikzadeh, S., Akbarinejad, A., Swift, S., Perera, J., Kilmartin, P. A. & **Travas-Sejdic, J.**	Cellulose acetate electrospun nanofibers encapsulating Lemon Myrtle essential oil as active agent with potent and sustainable antimicrobial activity.	*Reactive and Functional Polymers* **157**, 104769 (2020)
Vadakkedath, P. G. & **McGillivray, D. J.**	Characterisation of pH dependent peptide nanostructures using small angle scattering.	*Journal of Physics: Conference Series* **1537**, 012014 (2020)
Blesić, S. M., du Preez, D. J., Stratimirović, D. I., Ajtić, J. V., Ramotsehoa, M. C., **Allen, M. W.** & Wright, C. Y.	Characterization of personal solar ultraviolet radiation exposure using detrended fluctuation analysis.	*Environmental Research* **182**, 108976 (2020)
Thompson, K., Brand, J. & **Zülicke, U.**	Chiral two-dimensional p -wave superfluid from s -wave pairing in the Bose-Einstein-condensate regime.	*Physical Review A* **101**, 013613 (2020)
Zhang, T., Wei, S., **Waterhouse, G. I. N.**, Fu, L., Liu, L., Shi, W., Sun, J. & Ai, S.	Chromium (VI) adsorption and reduction by humic acid coated nitrogen-doped magnetic porous carbon.	*Powder Technology* **360**, 55-64 (2020)
Yim, V., Kavianinia, I., Knottenbelt, M. K., Ferguson, S. A., Cook, G. M., Swift, S., Chakraborty, A., Allison, J. R., Cameron, A. J., Harris, P. W. R. & **Brimble, M. A.**	CLipP"ing on Lipids to Generate Antibacterial Lipopeptides.	*Chemical Science* **11**, 5759-5765 (2020)
Adhikari, B. R., Bērziņš, K., Fraser-Miller, S. J., **Gordon, K. C.** & Das, S. C.	Co-amorphization of Kanamycin with amino acids improves aerosolization.	*Pharmaceutics* **12** ,1-19 (2020)
Shaib, A., **Natali, F.**, Chan, J. R., Ullstad, F., Holmes-Hewett, W. F., Miller, J. D., **Ruck, B. J.** & **Trodahl, H. J.**	Coexisting structural phases in the catalytically driven growth of rock salt GdN.	*Materials Research Express* **7**, 46404 (2020)
Winkler, R. & **Zülicke, U.**	Collinear orbital antiferromagnetic order and magnetoelectricity in quasi-two-dimensional itinerant-electron paramagnets, ferromagnets, and antiferromagnets.	*Physical Review Research* **2**, 043060 (2020)
Solís-Muñana, P. & **Chen, J. L.-Y.**	Combining catalysis and replication.	*Nature Chemistry* **12**, 585-587 (2020)
Adams, L. E., Rynkiewicz, P., Babbitt, G. A., Mortensen, J. S., North, R. A., **Dobson, R. C. J.** & Hudson, A. O.	Comparative Molecular Dynamics Simulations Provide Insight Into Antibiotic Interactions: A Case Study Using the Enzyme L,L-Diaminopimelate Aminotransferase (DapL).	*Frontiers in Molecular Biosciences* **7** (2020)
Nouchikian, L., Lento, C., Donovan, K., **Dobson, R. C. J.** & Wilson, D. J.	Comparing the Conformational Stability of Pyruvate Kinase in the Gas Phase and in Solution.	*Journal of the American Society for Mass Spectrometry* **31**, 685-692 (2020)
Jia, C., Wu, P., Sun, Y., **Waterhouse, G. I. N.** & Sun-Waterhouse, D.	Comparison of fruit traits for Chinese cherry cultivars.	*Acta Horticulturae* **1281**, 81 (2020)

AUTHORS	TITLE	JOURNAL
Jaskólska, D. E., Brougham, D. F., Warring, S. L., McQuillan, A. J., Rooney, J. S., **Gordon, K. C.** & **Meledandri, C. J.**	Competition-Driven Ligand Exchange for Functionalizing Nanoparticles and Nanoparticle Clusters without Colloidal Destabilization.	*ACS Applied Nano Materials* **2**, 2230-2240 (2019)
Liu, J., Zhang, T., & **Waterhouse, G.I.N.**	Complex alloy nanostructures as advanced catalysts for oxygen electrocatalysis: From materials design to applications.	*Journal of Materials Chemistry A* **8**, 23142-23161 (2020)
Zadeh, H. N., Huber, T., **Nock, V.**, Fee, C. & Clucas, D.	Complex geometry cellulose hydrogels using a direct casting method.	*Bioengineering* **7**, 1-13 (2020)
Whitby, C.P. & Hermant, A.	Concentration of deposit patterns by nanoparticles modified with short amphiphiles.	*Colloids and Surfaces A: Physicochemical and Engineering Aspects* **594**, 124648 (2020)
Alinezhad, A., Benedetti, T. M., Gloag, L., Cheong, S., Watt, J., Chen, H.-S., Gooding, J. J. & **Tilley, R. D.**	Controlling Pt Crystal Defects on the Surface of Ni-Pt Core-Shell Nanoparticles for Active and Stable Electrocatalysts for Oxygen Reduction.	*ACS Applied Nano Materials* **3**, 5995-6000 (2020)
Myekhlai, M., Benedetti, T. M., Gloag, L., Poerwoprajitno, A. R., Cheong, S., Schuhmann, W., Gooding, J. J. & **Tilley, R. D.**	Controlling the Number of Branches and Surface Facets of Pd-Core Ru-Branched Nanoparticles to Make Highly Active Oxygen Evolution Reaction Electrocatalysts.	*Chemistry - A European Journal* **26**, 15501-15504 (2020)
Raymond, O., Henderson, W., **Brothers, P. J.** & Plieger, P. G.	Coordination chemistry of Be^{2+} ions with chelating oxygen donor ligands: Further insights using electrospray mass spectrometry.	*Zeitschrift fur Naturforschung - Section B Journal of Chemical Sciences* **75**, 473-482 (2020)
Lee, S., Hwang, H., Lee, W., Schebarchov, D., Wy, Y., Grand, J., **Auguié, B.**, Wi, D. H., Cortés, E. & Han, S. W.	Core–Shell Bimetallic Nanoparticle Trimers for Efficient Light-to-Chemical Energy Conversion.	*ACS Energy Letters* **5**, 3881-3890 (2020)
Abbaspour, S., Nourbakhsh, A., Ebrahimi Kahrizsangi, R., Ghayour, H. & **MacKenzie, K. J. D.**	Corrigendum to "The effect of nanoparticle and mesoporous TiO_2 additions on the electronic characteristics of reduced graphene oxide nanocomposites with zinc oxide under UV irradiation".	*Materials Science and Engineering B: Solid-State Materials for Advanced Technology* **263** (2021)
Bhugra, V. S., Hughson, F. R., **Williams, G. V. M.**, **Chong, S. V.** & Nann, T.	Corrigendum: Electrospun, Oriented, Ferromagnetic $Ni_{1-x}Fe_x$ Nanofibers.	*Frontiers in Chemistry* **8**, 809 (2020)
De Zoysa, G.H., Wang, K., Lu, J., Hemar, Y. & **Sarojini, V.**	Covalently Immobilized Battacin Lipopeptide Gels with Activity against Bacterial Biofilms.	*Molecules* **25**, 945 (2020)
Yousuf, M. U., Al-Bahadly, I. & **Avci, E. A.**	Current Perspective on the Accuracy of Deterministic Wind Speed and Power Forecasting.	*IEEE Access* **7**, 159547-159564 (2019)
He, Z., Zhang, S., Yin, L., Hayat, M. D. & **Cao, P.**	Cu-TiO_2 nanocomposite coatings prepared from sol-enhanced electrodeposition.	*International Journal of Modern Physics B* **34**, 2040038 (2019)
Slyusarchuk, V. D., **Kruger, P. E.** & Hawes, C. S.	Cyclic Aliphatic Hydrocarbons as Linkers in Metal-Organic Frameworks: New Frontiers for Ligand Design.	*ChemPlusChem* **85**, 845-854 (2020)
Weng Y., Guan S., Wang L., Lu H., Meng X., **Waterhouse G.I.N.** & Zhou S.	Defective Porous Carbon Polyhedra Decorated with Copper Nanoparticles for Enhanced NIR-Driven Photothermal Cancer Therapy.	*Small* **16** (2020)
Sabet, S., Seal, C. K., Swedlund, P. J. & **McGillivray, D. J.**	Depositing alginate on the surface of bilayer emulsions.	*Food Hydrocolloids* **100**, 105385 (2020)
Ruckstuhl, K., Costa Camoes Rabello, R. & **Davenport, S.**	Design and responsible research innovation in the additive manufacturing industry.	*Design Studies* **71** (2020)
Song, W., Jiang, Z., Staines, M., Badcock, R. A., **Wimbush, S. C.**, Fang, J. & Zhang, J.	Design of a single-phase 6.5 MVA/25 kV superconducting traction transformer for the Chinese Fuxing high-speed train.	*International Journal of Electrical Power and Energy Systems* **119** (2020)
Gilmour, J. T. A. & **Gaston, N.**	Design of superatomic systems: exploiting favourable conditions for the delocalisation of d-electron density in transition metal doped clusters.	*Physical Chemistry Chemical Physics* **22**, 18585–18594 (2020)
De Leon-Rodriguez, L. M., Park, Y.-E., Naot, D., Musson, D. S., Cornish, J. & **Brimble, M. A.**	Design, Characterization and Evaluation of β-Hairpin Peptide Hydrogels as Support for Osteoblast Cell Growth and Bovine Lactoferrin Delivery.	*RSC Advances* **10**, 18222-18230 (2020)
Li, R., Wang, M., Li, Z., **Cao, P.**, Yuan, T. & Zhu, H.	Developing a high-strength Al-Mg-Si-Sc-Zr alloy for selective laser melting: Crack-inhibiting and multiple strengthening mechanisms.	*Acta Materialia* **193**, 83-98 (2020)

AUTHORS	TITLE	JOURNAL
Singh, H., Yu, T., Hayat, M., Bokhari, S. W., He, Z. & **Cao, P.**	Development of titanium metal matrix composites reinforced with coated powders.	*International Journal of Modern Physics B* **34**, 2040049 (2019)
Pilkington, L. I., Sparrow, K., Rees, S. W. P., Paulin, E. K., van Rensburg, M., Xu, C. S., Langley, R. J., Leung, I. K. H., Reynisson, J., Leung, E. & **Barker, D.**	Development, synthesis and biological investigation of a novel class of potent PC-PLC inhibitors.	*European Journal of Medicinal Chemistry* **191**, 112162 (2020)
Rinck, J., Kitchen, J. A., Carter, A. B., Lan, Y., Anson, C. E., Fink, K., **Brooker, S. A.** & Powell, A. K.	Di- and Tri-nuclear VIII and CrIII Complexes of Dipyridyltriazoles: Ligand Rearrangements, Mixed Valency and Ferromagnetic Coupling.	*Frontiers in Chemistry* **8**, 540 (2020)
Kvach, M. V., Barzak, F. M., Harjes, S., Schares, H. A. M., Kurup, H. M., Jones, K. F., Sutton, L., Donahue, J., D'Aquila, R. T., **Jameson, G. B.**, Harki, D. A., Krause, K. L., Harjes, E. & Filichev, V. V.	Differential Inhibition of APOBEC3 DNA-Mutator Isozymes by Fluoro- and Non-Fluoro-Substituted 2′-Deoxyzebularine Embedded in Single-Stranded DNA.	*ChemBioChem* **21**, 1028-1035 (2020)
Miller, R. G., Warren, M. R., Allan, D. R. & **Brooker, S. A.**	Direct Crystallographic Observation of CO_2 Captured in Zig Zag Channels of a Copper(I) Metal-Organic Framework.	*Inorganic Chemistry* **59**, 6376-6381 (2020)
Güttler, J., Kennedy, S.-J., Luimstra, V. M., Wood, S. A., **Williams, D. E.** & Packer, M. A.	Direct electron transport as a possible mechanism of electrogenic activity across a range of benthic cyanobacteria in a photosynthetic microbial fuel cell.	*New Zealand Journal of Botany* **58**, 378–388 (2020)
Kee, S., Zhang, P. & **Travas-Sejdic, J.**	Direct writing of 3D conjugated polymer micro/nanostructures for organic electronics and bioelectronics.	*Polymer Chemistry* **11**, 4530–4541 (2020)
Rani, A., Kavianinia, I., **Hume, P. A.**, De Leon-Rodriguez, L. M., Kihara, S., **Williams, D. E.**, **McGillivray, D. J.**, **Plank, N. O. V.**, **Gerrard, J.**, **Hodgkiss, J. M.** & **Brimble, M. A.**	Directed self-assembly of peptide–diketopyrrolopyrrole conjugates – a platform for bio-organic thin film preparation.	*Soft Matter* **16**, 6563-6571 (2020)
Ren, C. Z.-J., Solís-Muñana, P., Warr, G. G. & **Chen, J. L.-Y.**	Dynamic and Modular Formation of a Synergistic Transphosphorylation Catalyst.	*ACS Catalysis* **10**, 8395-8401 (2020)
Chen, W.-T., Dong, Y., Yadav, P., Aughterson, R. D., Sun-Waterhouse, D. & **Waterhouse, G. I. N.**	Effect of alcohol sacrificial agent on the performance of Cu/TiO_2 photocatalysts for UV-driven hydrogen production.	*Applied Catalysis A: General* **602**, 117703 (2020)
Qazvini, O. T., Macreadie, L. K. & **Telfer, S. G.**	Effect of Ligand Functionalization on the Separation of Small Hydrocarbons and CO_2 by a Series of MUF-15 Analogues.	*Chemistry of Materials* **32**, 6744-6752 (2020)
Xie, S., Li, R., Yuan, T., Zhang, M., Wang, M., Yin, L. & **Cao, P.**	Effect of phase transformation on densification kinetics and properties of spark plasma sintered $Al_{0.7}CoCrFeNi$ high-entropy alloy.	*Materials Characterization* **160** (2020)
Pan, Y., Lu, X., Hayat, M. D., Yang, F., Liu, C., Li, Y., Li, X., Xu, W., Qu, X. & **Cao, P.**	Effect of Sn addition on the high-temperature oxidation behavior of high Nb-containing TiAl alloys.	*Corrosion Science* **166**, 108449 (2020)
Murmu, P. P., **Leveneur, J.**, **Storey, J. G.** & **Kennedy, J. V.**	Effect of surface nanopatterning on the thermoelectric properties of bismuth antimony telluride films.	*Materials Today: Proceedings* **36**, 416–420 (2021)
Rashidian, H., Broom, M., **Willmott, G. R.** & Sellier, M.	Effects of a microscale ridge on dynamic wetting during drop impact.	*Journal of the Royal Society of New Zealand* **50**, 523-537 (2019)
Lao, J., Li, D., Jiang, C., Luo, R., Peng, H., Qi, R., Lin, H., Huang, R., **Waterhouse, G.I.N.**, & Luo, C.	Efficient overall water splitting using nickel boride-based electrocatalysts.	*International Journal of Hydrogen Energy* **45**, 28616-28625 (2020)
Zhang, S., Zhao, Y., Shi, R., Zhou, C., **Waterhouse, G. I. N.**, Wu, L.-Z., Tung, C.-H. & Zhang, T.	Efficient Photocatalytic Nitrogen Fixation over $Cu^{\delta+}$-Modified Defective ZnAl-Layered Double Hydroxide Nanosheets.	*Advanced Energy Materials* **10**, 1901973 (2020)
Li, Y., Zhou, M., **Waterhouse, G. I. N.**, Sun, J., Shi, W. & Ai, S.	Efficient removal of cadmium ions from water by adsorption on a magnetic carbon aerogel.	*Environmental Science and Pollution Research* (2020)
Shi, R., Guo, J., Zhang, X., **Waterhouse, G. I. N.**, Han, Z., Zhao, Y., Shang, L., Zhou, C., Jiang, L. & Zhang, T.	Efficient wettability-controlled electroreduction of CO_2 to CO at Au/C interfaces.	*Nature Communications* **11**, 3028 (2020)
Ramalingam, G., Vignesh, R., Ragupathi, C., Magdalane, C. M., Kaviyarasu, K. & **Kennedy, J.V.**	Electrical and chemical stability of CuS nanofluids for conductivity of water soluble based nanocomposites.	*Surfaces and Interfaces* **19** (2020)

AUTHORS	TITLE	JOURNAL
Martin-Treceno, S., Weaver, N., Allanore, A., Bishop, C. M., **Marshall, A. T.** & Watson, M. J.	Electrochemical behaviour of titanium-bearing slag relevant for molten oxide electrolysis.	*Electrochimica Acta* **354**, 136619 (2020)
Vajhadin, F., Ahadian, S., **Travas-Sejdic, J.,** Lee, J., Mazloum-Ardakani, M., Salvador, J., Aninwene, G. E., Bandaru, P., Sun, W. & Khademhossieni, A.	Electrochemical cytosensors for detection of breast cancer cells.	*Biosensors and Bioelectronics* **151**, 111984 (2020)
Williams, D. E.	Electrochemical sensors for environmental gas analysis.	*Current Opinion in Electrochemistry* **22**, 145-153 (2020)
Motshakeri, M., Phillips, A. R. J., **Travas-Sejdic, J.** & Kilmartin, P. A.	Electrochemical Study of Gold Microelectrodes Modified with PEDOT to Quantify Uric Acid in Milk Samples.	*Electroanalysis* **32**, 2101-2111 (2020)
Abbasi, H. & **Unsworth, C. P.**	Electroencephalography studies of hypoxic ischemia in fetal and neonatal animal models.	*Neural Regeneration Research* **15**, 828-837 (2020)
Bollinger, A. T., **Dubuis, G.**, Leng, X., He, X. & Božović, I.	Electrolyte-Gated Oxides.	*Journal of Superconductivity and Novel Magnetism* **33**, 223-228 (2020)
Bhugra, V. S., **Williams, G. V. M.**, **Chong, S. V.** & Nann, T.	Electrospun, Oriented, Ferromagnetic Ni1-xFex Nanofibers.	*Frontiers in Chemistry* **8** (2020)
Mashhadi Moghaddam, S., O'Sullivan, M., Walker, C., Fotuhi Piraghaj, S. & **Unsworth, C. P.**	Embedding individualized machine learning prediction models for energy efficient VM consolidation within Cloud data centers.	*Future Generation Computer Systems* **106**, 221-233 (2020)
Hobbs, C. J., Roach, N., Wagner, P., van der Salm, H., Barnsley, J. E., **Gordon, K. C.**, Kodali, G., Moser, C. C., Dutton, P. L., Wagner, K. & Officer, D. L.	Emulating photosynthetic processes with light harvesting synthetic protein (maquette) assemblies on titanium dioxide.	*Advanced Materials* **1**, 1877–1885 (2020)
Rossi, A., Price, M. B., Hardy, J., Gorman, J., Schmidt, T. W. & **Davis, N. J. L. K.**	Energy Transfer between Perylene Diimide Based Ligands and Cesium Lead Bromide Perovskite Nanocrystals.	*Journal of Physical Chemistry C* **124**, 3306-3313 (2020)
Jobbitt, N. L., Wells, J.-P. R. & **Reid, M. F.**	Energy transfer between Sm3+ ions in Y2SiO5 crystals.	*Journal of Luminescence* **224** (2020)
Iizasa, D., Kohda, M., **Zülicke, U.**, Nitta, J. & Kammermeier, M.	Enhanced longevity of the spin helix in low-symmetry quantum wells.	*Physical Review B* **101**, 245417 (2020)
Liu, S., Wen, B., Jiang, X., **Waterhouse, G. I. N.**, Zhang, Z.-M. & Yu, L.-M.	Enhanced photocathodic antifouling/antibacterial properties of polyaniline–Ag–N-doped TiO2 coatings.	*Journal of Materials Science* **55**, 16255-16272 (2020)
Macreadie, L. K., Babarao, R., Setter, C. J., Lee, S. J., Qazvini, O. T., Seeber, A. J., Tsanaktsidis, J., **Telfer, S. G.**, Batten, S. R. & Hill, M. R.	Enhancing Multicomponent Metal–Organic Frameworks for Low Pressure Liquid Organic Hydrogen Carrier Separations.	*Angewandte Chemie - International Edition* **59**, 6090-6098 (2020)
Gaar, J. M., Naffa, R. & **Brimble, M. A.**	Enzymatic and Non-Enzymatic Crosslinks Found in Collagen and Elastin and Their Chemical Synthesis.	*Organic Chemistry Frontiers* **7**, 2789-2814 (2020)
Hume, P. A. & **Hodgkiss, J. M.**	Erratum: A Projective Method for the Calculation of Excited-State Electronic Coupling: Isolating Charge Transfer/Recombination Processes in Organic Photovoltaics.	*Journal of Physical Chemistry A* **124**, 1464 (2020)
Grand, J., **Auguié, B.** & **Le Ru, E. C.**	Erratum: Combined extinction and absorption UV-visible spectroscopy as a method for revealing shape imperfections of metallic nanoparticles.	*Analytical Chemistry* **92**, 4164 (2020)
Liu, C., Zhang, X., Han X., Fang, Y., Liu, X., Wang, X., **Waterhouse G.I.N.**, Xu, C., Yin H., Gao, X.	Erratum: Polypeptide-templated au nanoclusters with red and blue fluorescence emissions for multimodal imaging of cell nuclei	*ACS Applied Bio Materials* **3** (2020)
Steyn, N., Binny, R. N., Hannah, K., **Hendy, S. C.**, James, A., Kukutai, T., Lustig, A., McLeod, M., Plank, M. J., Ridings, K. & Sporle, A.	Estimated inequities in COVID-19 infection fatality rates by ethnicity for Aotearoa New Zealand.	*The New Zealand Medical Journal* **133**, 28-39 (2020)
Longworth, L, Post, S., Jermy, M., Hendrickson, H., Steel, J., Cannon, E., Gleadow, J. & **Brown, S. A.**	Evaluating capacitive wetness sensors for measuring deposition in electrostatically charged spraying operations.	*Computers & Electronics in Agriculture* **179**, 105829 (2020)

AUTHORS	TITLE	JOURNAL
Murugathas, T., Hamiaux, C., Colbert, D., Kralicek, A. V. & **Plank, N. O. V.**	Evaluating Insect Odorant Receptor Display Formats for Biosensing Using Graphene Field Effect Transistors.	*ACS Applied Electronic Materials* **2**, 3610-3617 (2020)
Wang, Q., Ina, T., Chen, W.-T., Shang, L., Sun, F., Wei, S., Sun-Waterhouse, D., **Telfer, S. G.**, Zhang, T. & **Waterhouse, G. I. N.**	Evolution of Zn(II) single atom catalyst sites during the pyrolysis-induced transformation of ZIF-8 to N-doped carbons.	*Science Bulletin* **65**, 1743-1751 (2020)
Shillito, G. E., Preston, D., Traber, P., Steinmetzer, J., McAdam, C. J., **Crowley, J. D.**, Wagner, P., Kupfer, S. & **Gordon, K. C.**	Excited-State Switching Frustrates the Tuning of Properties in Triphenylamine-Donor-Ligand Rhenium(I) and Platinum(II) Complexes.	*Inorganic Chemistry* **59**, 6736-6746 (2020)
Borgersen, J., Vines, L., Frodason, Y.K., Kuznetsov, A., von Wenckstern, H., Grundmann, M., **Allen, M. W.**, Zúñiga-Pérez, J. & Johansen, K.M.	Experimental exploration of the amphoteric defect model by cryogenic ion irradiation of a range of wide band gap oxide materials.	*Journal of Physics Condensed Matter* **32**, 415704 (2020)
Kolien, J., Inglis, A. R., Vasdev, R. A. S., Howard, B. I., **Kruger, P. E.** & Preston, D.	Exploiting the labile site in dinuclear [Pd2L2]n+ metallo-cycles: multi-step control over binding affinity without alteration of core host structure.	*Inorganic Chemistry Frontiers* **7**, 3895–3908 (2020)
Singh, S. & **Brooker, S. A.**	Extension of Azine-Triazole Synthesis to Azole-Triazoles Reduces Ligand Field, Leading to Spin Crossover in Tris-L Fe(II).	*Inorganic Chemistry* **59**, 1265-1273 (2020)
Djorović, A., Oldenburg, S. J., Grand, J. & **Le Ru, E. C.**	Extinction-to-Absorption Ratio for Sensitive Determination of the Size and Dielectric Function of Gold Nanoparticles.	*ACS Nano* **14**, 17597–17605 (2020)
Hayat, M. D., Singh, H., Miodowski, A., Bokhari, S. W., He, Z. & **Cao, P.**	Fabrication, microstructure and mechanical properties of in situ formed particle reinforced titanium matrix composite.	*International Journal of Refractory Metals and Hard Materials* **92** (2020)
Poerwoprajitno, A. R., Gloag, L., Watt, J., Cychy, S., Cheong, S., Kumar, P. V., Benedetti, T. M., Deng, C., Wu, K.-H., Marjo, C. E., Huber, D. L., Muhler, M., Gooding, J. J., Schuhmann, W., Wang, D.-W. & **Tilley, R. D.**	Faceted Branched Nickel Nanoparticles with Tunable Branch Length for High-Activity Electrocatalytic Oxidation of Biomass.	*Angewandte Chemie - International Edition* **59**, 15487-15491 (2020)
Chan, J., Lambie, S., **Trodahl, H. J.**, Lefebvre, D., Le Ster, M., Shaib, A., Ullstad, F., **Brown, S. A.**, **Ruck, B.**, **Garden, A.** & **Natali, F.**	Facile dissociation of molecular nitrogen using lanthanide surfaces: towards ambient temperature ammonia synthesis.	*Physical Review Materials* **4**, 115003 (2020)
Xu, Y., Al-Salim, N., Lim, T. H., **Bumby, C. W.**, Cheong, S. & **Tilley, R. D.**	Facile synthesis of Ge1-xSnx nanowires.	*Materials Research Express* **7** (2020)
Bjareborn, O., Arif, T., Monaghan, B. & **Bumby, C. W.**	Fate of titanium in alkaline electro-reduction of sintered titanomagnetite.	*Materials Research Express* **7** (2020)
Ashforth, S. A., Oosterbeek, R. N., Bodley, O. L. C., Mohr, C., Aguergaray, C. & **Simpson, M. C.**	Femtosecond lasers for high-precision orthopedic surgery.	*Lasers in Medical Science* **35**, 1263–1270 (2020)
Zhao, J., Yang, Q., Shi, R., **Waterhouse, G. I. N.**, Zhang, X., Wu, L.-Z., Tung, C.-H. & Zhang, T.	FeO–CeO2 nanocomposites: an efficient and highly selective catalyst system for photothermal CO2 reduction to CO.	*NPG Asia Materials* **12** (2020)
Jelley, R. E., Deed, R. C., **Barker, D.**, Parish-Virtue, K. & Fedrizzi, B.	Fermentation of Sauvignon blanc grape marc extract yields important wine aroma 3-sulfanylhexan-1-ol (3SH).	*LWT* **131**, 109653 (2020)
Tallon, J. L. & Loram, J. W.	Field-dependent specific heat of the canonical underdoped cuprate superconductor YBa 2Cu 4O 8.	*Scientific Reports* **10** (2020)
Mataira, R. C., Ainslie, M. D., Badcock, R. A. & **Bumby, C. W.**	Finite-element modelling of no-insulation HTS coils using rotated anisotropic resistivity.	*Superconductor Science and Technology* **33**, 08LT01 (2020)
Governale, M., Bhandari, B., Taddei, F., Imura, K.-I. & **Zülicke, U.**	Finite-size effects in cylindrical topological insulators.	*New Journal of Physics* **22**, 063042 (2020)
Wang, Y., Graham, E. S. & **Unsworth, C. P.**	First observations of spontaneous bursting in human hNT neurons with a customised neural chip platform.	*Biomedical Physics and Engineering Express* **5** (2019)
Smits, O. R., Jerabek, P., **Pahl, E.** & Schwerdtfeger, P.	First-principles melting of krypton and xenon based on many-body relativistic coupled-cluster interaction potentials.	*Physical Review B* **101** (2020)

AUTHORS	TITLE	JOURNAL
Sutton, J. J., Li, Y., Ryu, H. S., Tay, E. J., Woo, H. Y. & **Gordon, K. C.**	Fluorination Position: A Study of the Optoelectronic Properties of Two Regioisomers Using Spectroscopic and Computational Techniques.	*Journal of Physical Chemistry A* **124**, 7685–7691 (2020)
Guo, M., Chi, J., Li, Y., **Waterhouse, G. I. N.**, Ai, S., Hou, J. & Li, X.	Fluorometric determination of mercury(II) based on dual-emission metal-organic frameworks incorporating carbon dots and gold nanoclusters.	*Microchimica Acta* **187**, 534 (2020)
Gonçales, V. R., Lian, J., Gautam, S., **Tilley, R. D.** & Gooding, J. J.	Functionalized Silicon Electrodes in Electrochemistry.	*Annual Review of Analytical Chemistry (Palo Alto, Calif.)* **13**, 135-158 (2020)
Alzahrani, H. A. H., Buckingham, M. A., Wardley, W. P., **Tilley, R. D.**, Ariotti, N. & Aldous, L.	Gold nanoparticles immobilised in a superabsorbent hydrogel matrix: Facile synthesis and application for the catalytic reduction of toxic compounds.	*Chemical Communications* **56**, 1263-1266 (2020)
Cree, S. L., Chua, E. W., Crowther, J., **Dobson, R. C. J.** & Kennedy, M. A.	G-quadruplex structures bind to EZ-Tn5 transposase.	*Biochimie* **177**, 190-197 (2020)
Golim, O. P., Huang, S., Yang, T., Yin, L., Zhang, K. S., Gao, W. & **Cao, P.**	Greenish-yellow emitting $Ca_9MgLi(PO_4)_7:Dy^{3+}$ phosphors – Photoluminescence and thermal stability.	*Journal of Luminescence* **229**, 117675 (2021)
Cho, C. A. H., Liang, C., Perera, J., **Brimble, M. A.**, Swift, S. & Jin, J.	Guanidinylated Amphiphilic Polycarbonates with Enhanced Antimicrobial Activity by Extending the Length of the Spacer Arm and Micelle Self-Assembly.	*Macromolecular Bioscience* **20** (2020)
Shen, J., Zheng, X., Peng, L., **Waterhouse, G.I.N.**, Tan, L., Yang, J., Li, L., Wei, Z.	Heteroatom Modification of Nanoporous Nickel Surfaces for Electrocatalytic Water Splitting.	*ACS Applied Nano Materials* **3**, 11298-11306 (2020)
Roach, R. J., Garavís, M., González, C., **Jameson, G. B.**, Filichev, V. V. & Hale, T. K.	Heterochromatin protein 1α interacts with parallel RNA and DNA G-quadruplexes.	*Nucleic Acids Research* **48**, 682-693 (2020)
Deas, R., Pearce, S., Goss, K., Wang, Q., Chen, W.-T. & **Waterhouse, G. I. N.**	Hierarchical Au/TiO_2 nanoflower photocatalysts with outstanding performance for alcohol photoreforming under UV irradiation.	*Applied Catalysis A: General* **602**, 117706 (2020)
Weissert, L., Miles, E., Miskell, G., Alberti, K., Feenstra, B., Henshaw, G. S., Papapostolou, V., Patel, H., Polidori, A., Salmond, J. A. & **Williams, D. E.**	Hierarchical network design for nitrogen dioxide measurement in urban environments.	*Atmospheric Environment* **228** (2020)
Harris, J., Silk, R., Smith, M., Dong, Y., Chen, W.-T. & **Waterhouse, G. I. N.**	Hierarchical TiO_2 Nanoflower Photocatalysts with Remarkable Activity for Aqueous Methylene Blue Photo-Oxidation.	*ACS Omega* **5**, 18919-18934 (2020)
Kaviyarasu, K., Maria Magdalane, C., Jayakumar, D., Samson, Y., Bashir, A. K. H., Maaza, M., Letsholathebe, D., Mahmoud, A. H. & **Kennedy, J.V.**	High performance of pyrochlore like $Sm_2Ti_2O_7$ heterojunction photocatalyst for efficient degradation of rhodamine-B dye with waste water under visible light irradiation.	*Journal of King Saud University - Science* **32**, 1516-1522 (2019)
Hou, C., York, K.R., Makin, R.A., Durbin, S.M., Gazoni, R.M., **Reeves, R.J.** & **Allen, M.W.**	High temperature (500 °c) operating limits of oxidized platinum group metal (PtO_x, IrO_x, PdO_x, RuO_x) Schottky contacts on β-Ga_2O_3.	*Applied Physics Letters* **117**, 203502 (2020)
Broom, M. A. J. & **Willmott, G. R.**	High throughput analysis of liquid droplet impacts.	*Journal of Visualized Experiments* **2020** (2020)
Wang, Y., Shi, R., Shang, L., **Waterhouse, G. I. N.**, Zhao, J., Zhang, Q., Gu, L. & Zhang, T.	High-Efficiency Oxygen Reduction to Hydrogen Peroxide Catalyzed by Nickel Single-Atom Catalysts with Tetradentate N_2O_2 Coordination in a Three-Phase Flow Cell.	*Angewandte Chemie* **132**, 13157-13162 (2020)
Wang, Y., Shi, R., Shang, L., **Waterhouse, G. I. N.**, Zhao, J., Zhang, Q., Gu, L. & Zhang, T.	High-Efficiency Oxygen Reduction to Hydrogen Peroxide Catalyzed by Nickel Single-Atom Catalysts with Tetradentate N_2O_2 Coordination in a Three-Phase Flow Cell.	*Angewandte Chemie - International Edition* **59**, 13057-13062 (2020)
Ma, S., Yang, H., Chen, X., Hu, G., Chen, W.-T., Bradley, S. J., Zhang, W., Verma, G., Nann, T., Jiang, D.-E., **Kruger, P. E.**, Wang, X., Tian, H., **Waterhouse, G. I. N.** & **Telfer, S. G.**	Highly efficient electrocatalytic hydrogen evolution promoted by O-Mo-C interfaces of ultrafine β-Mo_2C nanostructures.	*Chemical Science* **11**, 3523-3530 (2020)
Pan, Z., Han, E., Zheng, J., Lu, J., Wang, X., Yin, Y., **Waterhouse, G.I.N.**, Wang, X. & Li, P.	Highly Efficient Photoelectrocatalytic Reduction of CO_2 to Methanol by a p–n Heterojunction $CeO_2/CuO/Cu$ Catalyst.	*Nano-Micro Letters* **12** (2020)

AUTHORS	TITLE	JOURNAL
Wang, L., Xu, S.-M., Guan, S., Qu, X., **Waterhouse, G.I.N.**, He, S. & Zhou, S.	Highly efficient photothermal heating: Via distorted edge-defects in boron quantum dots.	*Journal of Materials Chemistry B* **8**, 9881-9887 (2020)
Wang, S., Li F., Dai, X., Wang, C., Lv, X., **Waterhouse, G.I.N.**, Fan, H. & Ai, S.	Highly flexible and stable carbon nitride/cellulose acetate porous films with enhanced photocatalytic activity for contaminants removal from wastewater.	*Journal of Hazardous Materials* **384** (2020)
Ma, N., Song, Y., Han, F., **Waterhouse, G. I. N.**, Li, Y. & Ai, S.	Highly selective hydrogenation of 5-hydroxymethylfurfural to 2,5-dimethylfuran at low temperature over a Co-N-C/NiAl-MMO catalyst.	*Catalysis Science and Technology* **10**, 4010-4018 (2020)
Wang, M., Kee, S., **Barker, D.** & **Travas-Sejdic, J.**	Highly stretchable, solution-processable, and crosslinkable poly(3,4-ethylenedioxithiophene)-based conjugated polymers.	*European Polymer Journal* **125** (2020)
Dai, S., Zhou, J., Chandrabose, S., Shi, Y., Han, G., Chen, K., Xin, J., Liu, K., Chen, Z., Xie, Z., Ma, W., Yi, Y., Jiang, L., **Hodgkiss, J. M.** & Zhan, X.	High-Performance Fluorinated Fused-Ring Electron Acceptor with 3D Stacking and Exciton/Charge Transport.	*Advanced Materials* **32**, 2000645 (2020)
Lu, X., Pan, Y., Li, W., Hayat, M. D., Yang, F., Singh, H., Song, W., Qu, X., Xu, Y. & **Cao, P.**	High-performance Ti composites reinforced with in-situ TiC derived from pyrolysis of polycarbosilane.	*Materials Science and Engineering A* **795** (2020)
Gautam, S., Gonçales, V. R., Colombo, R. N. P., Tang, W., Córdoba De Torresi, S. I., Reece, P. J., **Tilley, R. D.** & Gooding, J. J.	High-resolution light-activated electrochemistry on amorphous silicon-based photoelectrodes.	*Chemical Communications* **56**, 7435-7438 (2020)
Yang, Z., Shang, L., Xiong, X., Shi, R., **Waterhouse, G. I. N.** & Zhang, T.	Hollow PtFe Alloy Nanoparticles Derived from Pt-Fe_3O_4 Dimers through a Silica-Protection Reduction Strategy as Efficient Oxygen Reduction Electrocatalysts.	*Chemistry - A European Journal* **26**, 4090-4096 (2020)
Kalsi, S., Badcock, R. A., Hamilton, K. & **Storey, J. G.**	Homopolar superconducting AC machines, with HTS dynamo driven field coils, for aerospace applications.	*IOP Conference Series: Materials Science and Engineering* **756**, 12028 (2020)
Bagshaw, S., **Kemmitt, T.**, Brooke, S., **Waterland, M. R.** & Fertel, L.	Hydrophobic chemical treatment of aggregate surfaces to re-engineer the mineral/bitumen interface and improve bitumen adhesion.	*Road Materials and Pavement Design* 1-22 (2020)
Sundaresan, S., Kitchen, J. A. & **Brooker, S. A.**	Hydrophobic tail length in spin crossover active iron(ii) complexes predictably tunes: T ½ in solution and enables surface immobilisation.	*Inorganic Chemistry Frontiers* **7**, 2050-2059 (2020)
Dissanayake, S. S. M., Ekambaram, M., Li, K. C., Harris, P. W. R. & **Brimble, M. A.**	Identification of Key Functional Motifs of Native Amelogenin Protein for Dental Enamel Remineralisation.	*Molecules* **25**, 4214-4223 (2020)
Chitara, M. K., Keswani, C., Varnava, K. G., Birla, H., Dilnashin, H., Singh, S. P., **Sarojini, V.**, Sperry, J. & Singh, H. B.	Impact of the alkaloid colletotrichumine A on the pathogenicity of Colletotrichum capsici in Capsicum annum L.	*Rhizosphere* **16**, 100247 (2020)
Yang, M., **Pahl, E.** & Brand, J.	Improved walker population control for full configuration interaction quantum Monte Carlo.	*Journal of Chemical Physics* **153** (2020)
Kesküla, A., Heinmaa, I., Tamm, T., Aydemir, N., **Travas-Sejdic, J.**, Peikolainen, A.-L. & Kiefer, R.	Improving the electrochemical performance and stability of polypyrrole by polymerizing ionic liquids.	*Polymers* **12** (2020)
Willmott, G. R., Briole, A. & Szczepaniak, F.	Inertial capillary uptake of drops.	*Physical Review E* **101** (2020)
Kennedy, J. V., Murmu, P. P., Karthik, V., Liu, Z., **Jovic, V.**, Mori, T., Yang, W. L. & Smith, K. E.	Influence of carrier density and energy barrier scattering on a high Seebeck coefficient and power factor in transparent thermoelectric copper iodide.	*ACS Applied Energy Materials* **3**, 10037–10044 (2020)
Danczyk, M., Meaclem, T., Mehdizad, M., Clarke, D., **Galvosas, P.**, Fullard, L. & Holland, D.	Influence of contact parameters on Discrete Element method (DEM) simulations of flow from a hopper: Comparison with magnetic resonance imaging (MRI) measurements.	*Powder Technology* **372**, 671-684 (2020)
George, A., Raj, A. D., Irudayaraj, A. A., Raj, D. M. A., Arumugam, J., Sundaram, S. J., **Kennedy, J. V.** & Kaviyarasu, K.	Influence of solvent and precursor concentration on the properties of NiV_2O_6 nanoparticles.	*Surfaces and Interfaces* **21** (2020)
Su, G., Zheng, X., Zou, J., **Waterhouse, G. I. N.** & Sun-Waterhouse, D.	Insight into the advantages of premixing yeast-wheat gluten and combining ultrasound and transglutaminase pretreatments in producing umami enzymatic protein hydrolysates.	*Food Chemistry* **342**, 128317 (2020)

AUTHORS	TITLE	JOURNAL
Vella, J., Hemar, Y., Gu, Q., Wu, Z. R., Li, N. & **Söhnel, T.**	In-situ SAXS investigation of high-pressure triglyceride polymorphism in milk cream and anhydrous milk fat.	*LWT* **135**, 110174 (2020)
Choi, H., Shirley, H. J., Aitken, H. R. M., Schulte, T., **Söhnel, T.**, **Hume, P. A.**, **Brimble, M. A.** & Furkert, D. P.	Intermolecular Diels-Alder Cycloaddition/ Cross-Coupling Sequences of 2-Bromo-1,3-butadienes.	*Organic Letters* **22**, 1022-1027 (2020)
Salkeld, A. J., **Reid, M. F.** & Wells, J.-P. R.	Interpreting *ab initio* energy level calculations for the trivalent praseodymium ion using a parametrized crystal-field Hamiltonian.	*Optical Materials* **106,** 109998 (2020)
Mapley, J. I., Hayes, P., Officer, D. L., Wagner, P. & **Gordon, K. C.**	Investigation of Ferrocene Linkers in β-Substituted Porphyrins.	*Journal of Physical Chemistry A* **124**, 5513-5522 (2020)
Elamathi, R., Ramesh, R., Aravinthraj, M., Manivannan, M., Liakath Ali Khan, F., Mphale, K., Letsholathebe, D., Kaviyarasu, K., **Kennedy, J. V.** & Maaza, M.	Investigation of structural and electrical properties of lithium cobalt oxide nanoparticles for optoelectronic applications.	*Surfaces and Interfaces* **20**, 100590 (2020)
Devendra, R., Edmonds, N. R. & **Söhnel, T.**	Investigations of catalysis of urethane formation using organotin dicarboxylate.	*Heliyon* **6** (2020)
Elayaperumal, M., Vedachalam, Y., Loganathan, D., Kumaravelu, T. A., Anusuya, G. S. & **Kennedy, J. V.**	Ion Beam Analysis of Proton-Induced X-ray Emission (PIXE) Techniques for Elemental Investigation of Young Stage Neem Leaf of Southern India, Tamil Nadu.	*Biological Trace Element Research* (2020)
Elashkar, A. H., Parasar, D., Muñoz-Castro, A., Doherty, C. M., **Cowan, M. G.** & Dias, H. V. R.	Isolable 1-Butene Copper(I) Complexes and 1-Butene/Butane Separation Using Structurally Adaptable Copper Pyrazolates.	*ChemPlusChem* (2020)
Cryer, M. E., Browning, L. A., **Plank, N. O. V.** & Halpert, J. E.	Large Photogain in Multicolor Nanocrystal Photodetector Arrays Enabling Room-Temperature Detection of Targets above 100 °c.	*ACS Photonics* (2020)
Abbasi, H., Gunn, A. J., Bennet, L. & **Unsworth, C. P.**	Latent phase identification of high-frequency micro-scale gamma spike transients in the hypoxic ischemic eeg of preterm fetal sheep using spectral analysis and fuzzy classifiers.	*Sensors (Switzerland)* **20** (2020)
Li, Y., Wang, T., Camps-Arbestain, M., Suárez-Abelenda, M. & **Whitby, C. P.**	Lime and/or Phosphate Application Affects the Stability of Soil Organic Carbon: Evidence from Changes in Quantity and Chemistry of the Soil Water-Extractable Organic Matter.	*Environental Science & Technology* **54**, 13908–13916 (2020)
Novis, P. M., Sales, R. E., **Gordon, K. C.**, Manning, N., Duleba, M., Ács, É., Dressler, M. & Schallenberg, M.	Lindavia intermedia (Bacillariophyceae) and Nuisance lake Snow in New Zealand: Chitin Content and Quantitative PCR Methods to Estimate Cell Concentrations and Expression of Chitin Synthase1.	*Journal of Phycology* **56**, 1232-1244 (2020)
Tallon, J. L., **Storey, J. G.**, Cooper, J. R. & Loram, J. W.	Locating the pseudogap closing point in cuprate superconductors: Absence of entrant or reentrant behavior.	*Physical Review B* **101**, 174512 (2020)
Preston, D., **Patil, K. M.**, O'Neil, A. T., Vasdev, R. A. S., Kitchen, J. A. & **Kruger, P. E.**	Long-cavity $[Pd_2L_4]^{4+}$cages and designer 1,8-naphthalimide sulfonate guests: Rich variation in affinity and differentiated binding stoichiometry.	*Inorganic Chemistry Frontiers* **7**, 2990-3001 (2020)
Shirai, S., Acharya, S. K., **Bose, S. K.**, Mallinson, J. B., Galli, E., Pike, M. D., Arnold, M. D. & **Brown, S. A.**	Long-range temporal correlations in scale-free neuromorphic networks.	*Network Neuroscience* **4**, 432-447 (2020)
Weissert, L., Alberti, K., Miles, E., Miskell, G., Feenstra, B., Henshaw, G. S., Papapostolou, V., Patel, H., Polidori, A., Salmond, J. A. & **Williams, D. E.**	Low-cost sensor networks and land-use regression: Interpolating nitrogen dioxide concentration at high temporal and spatial resolution in Southern California.	*Atmospheric Environment* **223** (2020)
Salim, M., Fraser-Miller, S. J., Rziņš, K. B., Sutton, J. J., Ramirez, G., Clulow, A. J., Hawley, A., Beilles, S., **Gordon, K. C.** & Boyd, B. J.	Low-frequency raman scattering spectroscopy as an accessible approach to understand drug solubilization in milk-based formulations during digestion.	*Molecular Pharmaceutics* **17**, 885-899 (2020)
Bērziņš, K., Sales, R. E., Barnsley, J. E., Walker, G., Fraser-Miller, S. J. & **Gordon, K. C.**	Low-wavenumber Raman spectral database of pharmaceutical excipients.	*Vibrational Spectroscopy* **107** (2020)
Gupta, P., Fiedler, H., Rubanov, S. & **Kennedy, J. V.**	Magnetisation and magnetic anisotropy of ion beam synthesised iron nitride.	*Journal of Magnetism and Magnetic Materials* **517**, 167388 (2021)

AUTHORS	TITLE	JOURNAL
Maity, T., **Trodahl, H. J.**, **Granville, S.**, Vézian, S., **Natali, F.** & **Ruck, B. J.**	Magnetoresistance of epitaxial GdN films.	*Journal of Applied Physics* **128**, 213901 (2020)
Han, K., Zhao, W., Yu, Q., Liu, Z., Li, P., Wang, W. A., Song, L., An, F., **Cao, P.** & Qu, X.	Marcasite-FeS_2@carbon nanodots anchored on 3D cell-like graphenic matrix for high-rate and ultrastable potassium ion storage.	*Journal of Power Sources* **469** (2020)
Geng, J., **Bumby, C. W.** & Badcock, R. A.	Maximising the current output from a self-switching kA-class rectifier flux pump.	*Superconductor Science and Technology* **33** (2020)
Narasimhan, B. N., Ting, M. S., Kollmetz, T., Horrocks, M. S., Chalard, A. E. & **Malmström, J.**	Mechanical Characterization for Cellular Mechanobiology: Current Trends and Future Prospects.	*Frontiers in Bioengineering and Biotechnology* **8**, 1333 (2020)
Mataira, R., Ainslie, M., Pantoja, A., Badcock, R. & **Bumby, C. W.**	Mechanism of the High-T_c Superconducting Dynamo: Models and Experiment.	*Physical Review Applied* **14** (2020)
Ruffman, C., Gordon, C. K., Skúlason, E. & **Garden, A. L.**	Mechanisms and Potential-Dependent Energy Barriers for Hydrogen Evolution on Supported MoS_2 Catalysts.	*Journal of Physical Chemistry C* **124**, 17015-17026 (2020)
Lewis, J. E. M. & **Crowley, J. D.**	Metallo-Supramolecular Self-Assembly with Reduced-Symmetry Ligands.	*ChemPlusChem* **85**, 815-827 (2020)
Sun, Y., Tayagui, A., Garrill, A. & **Nock, V.**	Microfluidic platform for integrated compartmentalization of single zoospores, germination and measurement of protrusive force generated by germ tubes.	*Lab on a Chip* **20**, 4141-4151 (2020)
Penny, H., Hayman, D. T. S. & **Avci, E. A.**	Micromanipulation system for isolating a single cryptosporidium oocyst.	*Micromachines* **11** (2020)
Zhang, C. J., Guo, C. X., Zhang, S. Z., Feng, H., Chen, C. Y., Zhang, H. Z. & **Cao, P.**	Microstructural manipulation and improved mechanical properties of a near α titanium alloy.	*Materials Science and Engineering A* **771** (2020)
Yin, H., Alkaş, A., Zhang, Y., Zhang, Y. & **Telfer, S. G.**	Mixed matrix membranes (MMMs) using an emerging metal-organic framework (MUF-15) for CO_2 separation.	*Journal of Membrane Science* **609** (2020)
Mataira, R., Ainslie, M. D., Badcock, R. & **Bumby, C. W.**	Modeling of stator versus magnet width effects in High-T_c superconducting dynamos.	*IEEE Transactions on Applied Superconductivity* **30** (2020)
Sikorska, C. & **Gaston, N.**	Modified Lennard-Jones potentials for nanoscale atoms.	*Journal of Computational Chemistry* **41**, 1985-2000 (2020)
Lambie, S., **Steenbergen, K. G.** & **Gaston, N.**	Modulating the thermal and structural stability of gallenene via variation of atomistic thickness.	*Nanoscale Advances* **3**, 499–507 (2021)
Wilson, B. H. & **Kruger, P. E.**	Modulation of Crystal Packing via the Tuning of Peripheral Functionality for a Family of Dinuclear Mesocates.	*Chemistry - An Asian Journal* **1**, 2716-2723(2020)
Le Ster, M., Märkl, T. & **Brown, S. A.**	Moiré patterns: A simple analytical model.	*2D Materials* **7**, 011005 (2020)
Chakraborty, A., Kobzev, A., Chan, J., de Zoysa, G.H., **Sarojini, V.**, Piggot,T.J. & Allison, J.R.	Molecular Dynamics Simulation of the Interaction of Two Linear Battacin Analogs with Model Gram-Positive and Gram-Negative Bacterial Cell Membranes.	*ACS Omega* **6**, 388 (2020)
Divya, S., **Johnston, J. H.** & Nann, T.	Molybdenum Dichalcogenide Cathodes for Aluminum-Ion Batteries.	*Energy Technology* **8**, 2000038 (2020)
Ma, N., Song, Y., Han, F., **Waterhouse, G. I. N.**, Li, Y. & Ai, S.	Multifunctional NiCoTi Catalyst Derived from Layered Double Hydroxides for Selective Hydrogenation of 5-Hydroxymethylfurfural to 2,5-Dimethylfuran.	*Catalysis Letters* (2020)
Horne, C. R., Henrickson, A., Demeler, B. & **Dobson, R. C. J.**	Multi-wavelength analytical ultracentrifugation as a tool to characterise protein–DNA interactions in solution.	*European Biophysics Journal* **49**, 819–827 (2020)
Sheveleva, E., Xu, B., Marsik, P., Lyzwa, F., **Mallett, B. P. P.**, Willa, K., Meingast, C., Wolf, T., Shevtsova, T., Pashkevich, Y. G. & Bernhard, C.	Muon spin rotation and infrared spectroscopy study of $Ba_{1-x}Na_xFe_2As_2$.	*Physical Review B* **101** (2020)
Sikorska, C. & **Gaston, N.**	N_4Mg_6M (M = Li, Na, K) superalkalis for CO_2 activation.	*Journal of Chemical Physics* **153** (2020)
Holleran, I., Masad, E., Holleran, G., Wubulikasimu, Y., **Malmström, J.** & Wilson, D. J.	Nanomechanical mapping of rejuvenated asphalt binders.	*Road Materials and Pavement Design*, **Jan-20** (2020)

AUTHORS	TITLE	JOURNAL
Ulanova, M., Poljak, A., Wen, W., Bongers, A., Gloag, L., Gooding, J., **Tilley, R. D.**, Sachdev, P. & Braidy, N.	Nanoparticles as contrast agents for the diagnosis of Alzheimer's disease: A systematic review.	*Nanomedicine* **15**, 725-743 (2020)
Rani, A., Kavianinia, I., De Leon-Rodriguez, L. M., **McGillivray, D. J.**, **Williams, D. E.** & **Brimble, M. A.**	Nanoribbon self-assembly and hydrogel formation from an N[sbnd]Octanoyl octapeptide derived from the antiparallel β-Interface of a protein homotetramer.	*Acta Biomaterialia* **114**, 233-243 (2020)
Maksakova, O. V., Webster, R. F., **Tilley, R. D.**, Ivashchenko, V. I., Postolnyi, B. O., Bondar, O. V., Takeda, Y., Rogoz, V. M., Sakenova, R. E., Zukowski, P. V., Opielak, M., Beresnev, V. M. & Pogrebnjak, A. D.	Nanoscale architecture of (CrN/ZrN)/(Cr/Zr) nanocomposite coatings: Microstructure, composition, mechanical properties and first-principles calculations.	*Journal of Alloys and Compounds* **831** (2020)
Saadeldeen, F.S.A, Niu, Y., Wang, H., Zhou, L., Meng, L., Chen, S., Sun-Waterhouse, D., **Waterhouse, G.I.N.**, Liu, Z., & Kang, W.	Natural products: Regulating glucose metabolism and improving insulin resistance.	*Food Science and Human Wellness* **9**, 214-228 (2020)
Holmes-Hewett, W. F., Pot, C., **Buckley, R. G.**, Koo, A., **Ruck, B. J.**, **Natali, F.**, Shaib, A., Miller, J. D. & **Trodahl, H. J.**	Nitrogen vacancies and carrier-concentration control in rare-earth nitrides.	*Applied Physics Letters* **117**, 222409 (2020)
Patel, K. D., De Zoysa, G. H., Kanamala, M., Patel, K., Pilkington, L. I., **Barker, D.**, Reynisson, J., Wu, Z. & **Sarojini, V.**	Novel Cell-Penetrating Peptide Conjugated Proteasome Inhibitors: Anticancer and Antifungal Investigations.	*Journal of Medicinal Chemistry* **63**, 334-348 (2020)
Akbarinejad, A., Hisey, C. L., Brewster, D., Ashraf, J., Chang, V., Sabet, S., Nursalim, Y., Lucarelli, V., Blenkiron, C., Chamley, L., **Barker, D.**, **Williams, D. E.**, Evans, C. W. & **Travas-Sejdic, J.**	Novel Electrochemically Switchable, Flexible, Microporous Cloth that Selectively Captures, Releases, and Concentrates Intact Extracellular Vesicles.	*ACS Applied Materials & Interfaces* **12**, 39005-39013 (2020)
Liu, F., Li, C., Jiang, X., **Waterhouse, G. I. N.**, Xing, C., Zhang, Z. & Yu, L.	Novel three-dimensional TiO2-Fe3O4@ polypyrrole composites with tunable microwave absorption in the 2–40 GHz frequency range.	*Journal of Materials Science* **55**, 15493-15509 (2020)
Brooks, J. M., Ainslie, M. D., Jiang, Z., **Wimbush, S. C.**, Badcock, R. A. & **Bumby, C. W.**	Numerical Modelling of Dynamic Resistance in a Parallel-Connected Stack of HTS Coated-Conductor Tapes.	*IEEE Transactions on Applied Superconductivity* **30** (2020)
Majic, M. & **Le Ru, E. C.**	Numerically stable formulation of Mie theory for an emitter close to a sphere.	*Applied Optics* **59**, 1293-1300 (2020)
Borah, R., Hughson, F. R., **Johnston, J. H.** & Nann, T.	On battery materials and methods.	*Materials Today Advances* **6** (2020)
Love, M. J., Abeysekera, G. S., Muscroft-Taylor, A. C., Billington, C. & **Dobson, R. C. J.**	On the catalytic mechanism of bacteriophage endolysins: Opportunities for engineering.	*Biochimica et Biophysica Acta - Proteins and Proteomics* **1868** (2020)
Gilmour, J. T. A. & **Gaston, N.**	On the influence of exact exchange on transition metal superatoms.	*Physical Chemistry Chemical Physics* **22**, 772-780 (2020)
Schmid, G., Kingan, M. J., Panton, L., **Willmott, G. R.**, Yang, Y., Decraene, C., Reynders, E. & Hall, A.	On the measurement and prediction of rainfall noise.	*Applied Acoustics* **171**, 107636 (2021)
Horne, C., Kind, L., Davies, J. & **Dobson, R. C. J.**	On the structure and function of Escherichia coli YjhC: An oxidoreductase involved in bacterial sialic acid metabolism.	*Proteins: Structure, Function, and Bioinformatics* **88** (2019)
Crowther, J. M., Broadhurst, M., Laue, T. M., **Jameson, G. B.**, Hodgkinson, A. J. & **Dobson, R. C. J.**	On the utility of fluorescence-detection analytical ultracentrifugation in probing biomolecular interactions in complex solutions: a case study in milk.	*European Biophysics Journal* **49**, 677-685 (2020)
Dhers, S., Wilson, R. K., Rouzières, M., Clérac, R. & **Brooker, S. A.**	One-Dimensional Coordination Polymer Assembled from a Macrocyclic Mn(III) Single-Molecule Magnet and Terephthalate.	*Crystal Growth and Design* **20**, 1538-1542 (2020)
Smith, J. N., Brind, T. K., Petrie, S. B., Grant, M. S. & **Lucas, N. T.**	One-Step Synthesis of C2v-Symmetric Resorcin[4]arene Tetraethers.	*Journal of Organic Chemistry* **85**, 4574-4580 (2020)
Itumoh, E. J., Data, S. & **Leitao, E. M.**	Opening up the toolbox: Synthesis and mechanisms of phosphoramidates.	*Molecules* **25**, 3684 (2020)
Andrew, P.-K., **Williams, M. A. K.** & **Avci, E. A.**	Optical micromachines for biological studies.	*Micromachines* **11** (2020)

AUTHORS	TITLE	JOURNAL
Han, F., Armstrong, T., Andres-Arroyo, A., Bennett, D., Soeriyadi, A., Alinezhad Chamazketi, A., Bakthavathsalam, P., **Tilley, R. D.**, Gooding, J. J. & Reece, P. J.	Optical tweezers-based characterisation of gold core-satellite plasmonic nano-assemblies incorporating thermo-responsive polymers.	*Nanoscale* **12**, 1680-1687 (2020)
Jiao, S., Li, Y., Wang, Z., Sun-Waterhouse, D., **Waterhouse, G. I. N.**, Liu, C. & Wang, X.	Optimization of enzyme-assisted extraction of bioactive-rich juice from *Chaenomeles sinensis* (Thouin) Koehne by response surface methodology.	*Journal of Food Processing and Preservation* **44**. e14638 (2020)
Qiu, S., Zhou, Y., **Waterhouse, G. I. N.**, Gong, R., Xie, J., Zhang, K. & Xu, J.	Optimizing interfacial adhesion in PBAT/PLA nanocomposite for biodegradable packaging films.	*Food Chemistry* **334**, 127487 (2021)
Petit, N., Dyer, J. M., Clerens, S., **Gerrard, J. A.** & **Domigan, L. J.**	Oral delivery of self-assembling bioactive peptides to target gastrointestinal tract disease.	*Food and Function* **11**, 9468–9488 (2020)
Parasar, D., Elashkar, A. H., Yakovenko, A. A., Jayaratna, N. B., Edwards, B. L., **Telfer, S. G.**, Dias, H. V. R. & **Cowan, M. G.**	Overcoming Fundamental Limitations in Adsorbent Design: Alkene Adsorption by Non-porous Copper(I) Complexes.	*Angewandte Chemie* **132**, 21187-21192 (2020)
Parasar, D., Elashkar, A. H., Yakovenko, A. A., Jayaratna, N. B., Edwards, B. L., **Telfer, S. G.**, Dias, H. V. R. & **Cowan, M. G.**	Overcoming Fundamental Limitations in Adsorbent Design: Alkene Adsorption by Non-porous Copper(I) Complexes.	*Angewandte Chemie - International Edition* **59**, 21001–21006 (2020)
Xiang, H., Waterhouse, D.-S., Liu, P., **Waterhouse, G. I. N.**, Li, J. & Cui, C.	Pancreatic lipase-inhibiting protein hydrolysate and peptides from seabuckthorn seed meal: Preparation optimization and inhibitory mechanism.	*LWT* **134**, 109870 (2020)
Wu, Y., Lian, J., Gonca,les, V. R., Pardehkhorram, R., Tang, W., **Tilley, R. D.** & Gooding, J. J.	Patterned Molecular Films of Alkanethiol and PLL-PEG on Gold-Silicate Interfaces: How to Add Functionalities while Retaining Effective Antifouling.	*Langmuir* **36**, 5243-5250 (2020)
Du Le, H., Loveday, S. M., **Nowak, E.**, Niu, Z. & Singh, H.	Pectin emulsions for colon-targeted release of propionic acid.	*Food Hydrocolloids* **103** (2020)
Doak, D. G., Denyer, G. S., **Gerrard, J. A.**, Mackay, J. P. & Allison, J. R.	Peppy: A virtual reality environment for exploring the principles of polypeptide structure.	*Protein Science* **29**, 157–168 (2020)
Liu, X., Zhang, Y., Wang, S., Liu, C., Wang, T., Qiu, Z., Wang, X., **Waterhouse, G. I. N.**, Xu, C. & Yin, H.	Performance comparison of surface plasmon resonance biosensors based on ultrasmall noble metal nanoparticles templated using bovine serum albumin.	*Microchemical Journal* **155** (2020)
Boehme, S. C., Brinck, S. T., Maes, J., Yazdani, N., Zapata, F., Chen, K., Wood, V., **Hodgkiss, J. M.**, Hens, Z., Geiregat, P. & Infante, I.	Phonon-Mediated and Weakly Size-Dependent Electron and Hole Cooling in CsPbBr3 Nanocrystals Revealed by Atomistic Simulations and Ultrafast Spectroscopy.	*Nano Letters* **20**, 1819-1829 (2020)
Xiong, X., Mao, C., Yang, Z., Zhang, Q., **Waterhouse, G.I.N.**, Gu, L., Zhang, T.	Photocatalytic CO2 Reduction to CO over Ni Single Atoms Supported on Defect-Rich Zirconia.	*Advanced Energy Materials* **10**, 2002928 (2020)
Falah, M. & **MacKenzie, K. J. D.**	Photocatalytic nanocomposite materials based on inorganic polymers (Geopolymers): A review.	*Catalysts* **10**, 1-20 (2020)
Gholizadeh, E. M., Prasad, S. K. K., Teh, Z. L., Ishwara, T., Norman, S., Petty, A. J., II, Cole, J. H., Cheong, S., **Tilley, R. D.**, Anthony, J. E., Huang, S. & Schmidt, T. W.	Photochemical upconversion of near-infrared light from below the silicon bandgap.	*Nature Photonics* **14**, 585-590 (2020)
Lagesse, N. R., Tan, K. Y. L., **Crowley, J. D.** & Findlay, J. A.	Planar 2-Pyridyl-1,2,3-triazole Derived Metallo-ligands: Self-assembly with PdCl2 and Photocatalysis.	*Chemistry - An Asian Journal* **15**, 1567-1573 (2020)
Zhang, Z., Wang, S., **Waterhouse, G.I.N.**, Zhang, Q. & Li, L.	Poly(N-isopropylacrylamide)/mesoporous silica thermosensitive composite hydrogels for drug loading and release.	*Journal of Applied Polymer Science* **137** (2020)
Kavuri, H. A., Kihara, S., **McGillivray, D. J.** & **Willmott, G. R.**	Poly(vinyl pyrrolidone)-modified metal oxide anode interlayers for stable organic solar cells.	*Journal of Photonics for Energy* **10**, 1-15 (2020)
Srinivas, A. R. G., Hilali, R., Damavandi, M., **Malmström, J.**, **Barker, D.**, Weatherall, E., **Willmott, G. R.** & **Travas-Sejdic, J.**	Polymer Brush Functionalization of Polyurethane Tunable Nanopores for Resistive Pulse Sensing.	*ACS Applied Polymer Materials* **3**, 279–289 (2021)

AUTHORS	TITLE	JOURNAL
Liu, C., Zhang, X., Han, X., Fang, Y., Liu, X., Wang, X., **Waterhouse, G. I. N.**, Xu, C., Yin, H. & Gao, X.	Polypeptide-Templated Au Nanoclusters with Red and Blue Fluorescence Emissions for Multimodal Imaging of Cell Nuclei.	*ACS Applied Bio Materials* **3**, 1934-1943 (2020)
Mansel, B. W., Ryan, T. M., Chen, H. L., Lundin, L. & **Williams, M. A. K.**	Polysaccharide conformations measured by solution state X-ray scattering.	*Chemical Physics Letters* **739**, 136951 (2020)
Williams, M. A. K., Cornuault, V., Irani, A. H., Symonds, V. V., **Malmström, J.**, An, Y., Sims, I. M., Carnachan, S. M., Sallé, C. & North, H. M.	Polysaccharide Structures in the Outer Mucilage of Arabidopsis Seeds Visualized by AFM.	*Biomacromolecules* **21**, 1450-1459 (2020)
Kollmetz, T., Monteiro A, I., **Gerrard, J. A.** & **Malmström, J.**	Polystyrene- block-poly(ethylene oxide) Thin Films Fabricated from a Solvent Mixture for the Co-Assembly of Polymers and Proteins.	*ACS Omega* **5**, 26365–26373 (2020)
Monteiro A., I., Kollmetz, T., Musson, D. S., McGlashan, S. R. & **Malmström, J.**	Polystyrene-block-polyethylene oxide thin films: In vitro cytocompatibility and protein adsorption testing.	*Biointerphases* **15** (2020)
Wagner, M., Wagner, K., Barnsley, J. E., Veksha, A., Wagner, P., **Gordon, K. C.**, Bobacka, J., Wallace, G. G., Ivaska, A., Officer, D. L. & Lisak, G.	Polyterthiophenes Cross-Linked with Terpyridyl Metal Complexes for Molecular Architecture of Optically and Electrochemically Tunable Materials.	*ChemElectroChem* **7**, 4453–4459 (2020)
Sabet, S., Seal, C. K., Akbarinejad, A., Rashidinejad, A. & **McGillivray, D. J.**	"Positive-negative-negative": a colloidal delivery system for bioactive compounds.	*Food Hydrocolloids* **107** (2020)
Hamilton, K., Mataira, R., Geng, J., **Bumby, C. W.**, Carnegie, D. & Badcock, R.	Practical Estimation of HTS Dynamo Losses.	*IEEE Transactions on Applied Superconductivity* **30** (2020)
Grand, J. & **Le Ru, E. C.**	Practical Implementation of Accurate Finite-Element Calculations for Electromagnetic Scattering by Nanoparticles.	*Plasmonics* **15**, 109–121 (2020)
Dumoulin, F., Nyokong, T. & **Brothers, P. J.**	Preface	*Journal of Porphyrins and Phthalocyanines* **23**, I (2019)
Li, Y., Zhang, K., Zhang, M., Wu, T., **Cao, P.** & Gao, W.	Preparation of electroless Ni-P alloy coating with medium temperature and low phosphorus content.	*International Journal of Modern Physics B* **34**, 2040044 (2019)
Qin, M., Yang, J., Chen, Z., Chen, P., Zhao, S., Cheng, J., **Cao, P.**, Jia, B., Chen, G., Zhang, L. & Qu, X.	Preparation of intragranular-oxide-strengthened ultrafine-grained tungsten via low-temperature pressureless sintering.	*Materials Science and Engineering A* **774** (2020)
Langer, J., Jimenez de Aberasturi, D., Aizpurua, J., Alvarez-Puebla, R. A., **Auguié, B.**, Baumberg, J. J., Bazan, G. C., Bell, S. E. J., Boisen, A., Brolo, A. G., Choo, J., Cialla-May, D., Deckert, V., Fabris, L., Faulds, K., García de Abajo, F. J., Goodacre, R., Graham, D., Haes, A. J., Haynes, C. L., Huck, C., Itoh, T., Käll, M., Kneipp, J., Kotov, N. A., Kuang, H., **Le Ru, E. C.**, Lee, H. K., Li, J.-F., Ling, X. Y., Maier, S. A., Mayerhöfer, T., Moskovits, M., Murakoshi, K., Nam, J.-M., Nie, S., Ozaki, Y., Pastoriza-Santos, I., Perez-Juste, J., Popp, J., Pucci, A., Reich, S., Ren, B., Schatz, G. C., Shegai, T., Schlücker, S., Tay, L.-L., Thomas, K. G., Tian, Z.-Q., Van Duyne, R. P., Vo-Dinh, T., Wang, Y., Willets, K. A., Xu, C., Xu, H., Xu, Y., Yamamoto, Y. S., Zhao, B. & Liz-Marzán, L. M.	Present and Future of Surface-Enhanced Raman Scattering.	*ACS Nano* **14**, 28–117 (2020)
Chen, H.-S., Benedetti, T. M., Goncales, V. R., Bedford, N. M., Scott, R. W. J., Webster, R. F., Cheong, S., Gooding, J. J. & **Tilley, R. D.**	Preserving the Exposed Facets of Pt_3Sn Intermetallic Nanocubes during an Order to Disorder Transition Allows the Elucidation of the Effect of the Degree of Alloy Ordering on Electrocatalysis.	*Journal of the American Chemical Society* **142**, 3231-3239(2020)
Guan, H., Li, J., Zhou, T., Pang, Z., Fu, Y., Cornelio, J., Wang, Q., **Telfer, S. G.** & Kong, X.	Probing Nonuniform Adsorption in Multicomponent Metal-Organic Frameworks via Segmental Dynamics by Solid-State Nuclear Magnetic Resonance.	*The Journal of Physical Chemistry Letters* **11**, 7167-7176 (2020)
Raudsepp, A., **Hall, S. B.** & **Williams, M. A. K.**	Probing start-up electroosmotic forces and flows in a microfluidic channel using laser tweezer force spectroscopy.	*Microfluidics and Nanofluidics* **24** (2020)
Kumar, V. B. & **Leitao, E. M.**	Properties and applications of polysilanes.	*Applied Organometallic Chemistry* **34** (2020)

AUTHORS	TITLE	JOURNAL
Ogilvie, O., Roberts, S., Sutton, K., **Domigan, L. J.**, Larsen, N., **Gerrard, J. A.** & Demarais, N.	Proteomic modelling of gluten digestion from a physiologically relevant food system: A focus on the digestion of immunogenic peptides from wheat implicated in celiac disease.	*Food Chemistry* **333**, 127466 (2020)
Mcneill, S. M., Giles, N. M., Preston, D., Jones, P. P., **Crowley, J. D.** & Giles, G. I.	Quadruply Stranded Metallo-Supramolecular Helicate $[Pd_2(hextrz)_4]^{4+}$Acts as a Molecular Mimic of Cytolytic Peptides.	*Chemical Research in Toxicology* **33**, 1822-1834 (2020)
Bondì, L., **Garden, A. L.**, Jerabek, P., Totti, F. & **Brooker, S. A.**	Quantitative and Chemically Intuitive Evaluation of the Nature of M–L Bonds in Paramagnetic Compounds: Application of EDA-NOCV Theory to Spin Crossover Complexes.	*Chemistry - A European Journal* **26**, 13677-13685 (2020)
Manjunath, L., Coombes, D., Davies, J., Dhurandhar, M., Tiwari, V. R., **Dobson, R. C. J.**, Sowdhamini, R., Ramaswamy, S. & **Bose, S. K.**	Quaternary variations in the structural assembly of N-acetylglucosamine-6-phosphate deacetylase from Pasteurella multocida.	*Proteins: Structure, Function and Bioinformatics* **89**, 81-93 (2020)
Mehta, M., Naffa, R., Zhang, W., Schreurs, N. M., Martin, N. P., Hickson, R. E., **Waterland, M. R.** & Holmes, G.	Raman spectroscopic detection of carotenoids in cattle skin.	*RSC Advances* **10**, 22758–22765 (2020)
Nieuwoudt, M. K., Shahlori, R., Naot, D., Patel, R., Holtkamp, H., Aguergaray, C., Watson, M., Musson, D., Brown, C., Dalbeth, N., Cornish, J. & **Simpson, M. C.**	Raman spectroscopy reveals age- and sex-related differences in cortical bone from people with osteoarthritis.	*Scientific Reports* **10**, 19443 (2021)
Naffa, R., Gaar, J., Durrani, M., Zhang, W., Maidment, C., Shehadi, I., Etxabide, A., Holmes, G., Kavianinia, I. & **Brimble, M. A.**	Rapid and Simultaneous Analysis of Advanced Glycation End Products on Silica Hydride Column: Comparison of UV, Fluorescence, and Mass Spectrometry Detectors.	*Separation Science Plus* **3**, 540-552 (2020)
Kowalczyk, P. J., **Brown, S. A.**, Maerkl, T., Lu, Q., Chiu, C.-K., Liu, Y., Yang, S. A., Wang, X., Zasada, I., Genuzio, F., Menteş, T. O., Locatelli, A., Chiang, T.-C. & Bian, G.	Realization of Symmetry-Enforced Two-Dimensional Dirac Fermions in Nonsymmorphic α-Bismuthene.	*ACS Nano* **14**,1888-1894 (2020)
Zhou, C., Shi, R., **Waterhouse, G. I. N.** & Zhang, T.	Recent advances in niobium-based semiconductors for solar hydrogen production.	*Coordination Chemistry Reviews* **419** (2020)
Peng, L., Shang, L., Zhang, T. & **Waterhouse, G.I.N.**	Recent Advances in the Development of Single-Atom Catalysts for Oxygen Electrocatalysis and Zinc–Air Batteries	*Advanced Energy Materials* **10**, 2003018 (2020)
Kong, C., Cheong, S. & **Tilley, R. D.**	Recent development in focused ion beam nanofabrication.	*Comprehensive Nanoscience and Nanotechnology* **1-5**, 327-356 (2019)
Zhang, A., Monaghan, B. J., Longbottom, R. J., Nusheh, M. & **Bumby, C. W.**	Reduction Kinetics of Oxidized New Zealand Ironsand Pellets in H_2 at Temperatures up to 1443 K.	*Metallurgical and Materials Transactions B: Process Metallurgy and Materials Processing Science* **51**, 492-504 (2020)
Khlebtsov, B. N., Khanadeev, V. A., Burov, A. M., **Le Ru, E. C.** & Khlebtsov, N. G.	Reexamination of Surface-Enhanced Raman Scattering from Gold Nanorods as a Function of Aspect Ratio and Shape.	*Journal of Physical Chemistry C* **124**, 10647–10658 (2020)
Hu, J., Butler, T., Cabero Z., M. A., Wang, H., Wei, B., Tu, S., Guo, C., Wan, C., Han, X., Liu, S., Zhao, W., Ansermet, J.-P., **Granville, S.** & Yu, H.	Regulating the anomalous Hall and Nernst effects in Heusler-based trilayers.	*Applied Physics Letters* **117**, 62405 (2020)
Gazoni, R. M., Carroll, L., Scott, J. I., Astley, S., Evans, D. A., **Downard, A. J.**, **Reeves, R. J.** & **Allen, M. W.**	Relationship between the hydroxyl termination and band bending at $(\bar{2}01)$β-G α2 O3 surface.	*Physical Review B* **102**, 35304 (2020)
Mbambo, M. C., Khamlich, S., Khamliche, T., Moodley, M. K., Kaviyarasu, K., Madiba, I. G., Madito, M. J., Khenfouch, M., **Kennedy, J. V.**, Henini, M., Manikandan, E. & Maaza, M.	Remarkable thermal conductivity enhancement in Ag—decorated graphene nanocomposites based nanofluid by laser liquid solid interaction in ethylene glycol.	*Scientific Reports* **10**, 10982 (2020)
Le Ster, M., Chan, J. R., **Ruck, B. J.**, **Brown, S. A.** & **Natali, F.**	Removable capping layer for air-sensitive GdN.	*Nanotechnology* **31**, 275709 (2020)
Uhrig, D. M., **Williams, G. V. M.**, Bioletti, G. & **Chong, S. V.**	Residual oxygen responsible for universal superconducting phase diagram in annealed $FeSe_{1-x}Te_x$.	*Superconductor Science and Technology* **33** (2020)
Qin, J., Chen, Y.-H., Zhang, Z., Zhang, Y., **Blaikie, R. J.**, Ding, B. & Qiu, M.	Revealing Strong Plasmon-Exciton Coupling between Nanogap Resonators and Two-Dimensional Semiconductors at Ambient Conditions.	*Physical Review Letters* **124** (2020)

AUTHORS	TITLE	JOURNAL
Makin, R. A., York, K., Durbin, S. M. & **Reeves, R. J.**	Revisiting semiconductor band gaps through structural motifs: An Ising model perspective.	*Physical Review B* **102** (2020)
Cavanagh, D. C. & **Brydon, P. M. R.**	Robustness of unconventional s -wave superconducting states against disorder.	*Physical Review B* **101** (2020)
Khadka, R., Zhang, P., Tuan Nguyen, N., Tamm, T., **Travas-Sejdic, J.**, Otero, T. F. & Kiefer, R.	Role of polyethylene oxide content in polypyrrole linear actuators.	*Materials Today Communications* **23** (2020)
Mosaferi, S., Jelley, R. E., Fedrizzi, B. & **Barker, D.**	Scalable synthesis of the aroma compounds d6-β-ionone and d6-β-cyclocitral for use as internal standards in stable isotope dilution assays.	*Tetrahedron Letters* **61**, 152642 (2020)
Han, M.-G., Garlow, J. A., Kharkov, Y., Camacho, L., Rov, R., Sauceda, J., Vats, G., Kisslinger, K., Kato, T., Sushkov, O., Zhu, Y., Ulrich, C., **Söhnel, T.** & Seidel, J.	Scaling, rotation, and channeling behavior of helical and skyrmion spin textures in thin films of Te-doped Cu2OSeO3.	*Science Advances* **6** (2020)
Fishburn, M. G., Skelton, D. R., **Telfer, S. G.**, Wagner, P. & Richardson, C.	Second-order programming the synthesis of metal–organic frameworks.	*Chemical Communications* **56**, 12355–12358 (2020)
Xiong, X., Zhao, Y., Shi, R., Yin, W., Zhao, Y., **Waterhouse, G. I. N.** & Zhang, T.	Selective photocatalytic CO2 reduction over Zn-based layered double hydroxides containing tri or tetravalent metals.	*Science Bulletin* **65**, 987-994 (2020)
Vasdev, R. A. S., Findlay, J. A., Turner, D. R. & **Crowley, J. D.**	Self-Assembly of a Redox Active, Metallosupramolecular [Pd3L6]6+ Complex Using a Rotationally Flexible Ferrocene Ligand.	*Chemistry - An Asian Journal* **16**, 39-43 (2020)
Harwell, J. R., Glackin, J. M. E., **Davis, N. J. L. K.**, Gillanders, R. N., Credgington, D., Turnbull, G. A. & Samuel, I. D. W.	Sensing of explosive vapor by hybrid perovskites: Effect of dimensionality.	*APL Materials* **8**, 71106 (2020)
Tang, G., Belzig, W., **Zülicke, U.** & Bruder, C.	Signatures of the Higgs mode in transport through a normal-metal–superconductor junction.	*Physical Review Research* **2**, 022068 (2020)
Cho, I., Zhao, L., Mapley, J. I., Shahshahan, S., Wagner, P., **Gordon, K. C.**, Innis, P. C., Kimura, M., Mori, S. & Mozer, A. J.	Significant Effect of Electronic Coupling on Electron Transfer between Surface-Bound Porphyrins and Co2+/3+ Complex Electrolytes.	*Journal of Physical Chemistry C* **124**, 9178-9190 (2020)
Joon, N. K., Barnsley, J. E., Ding, R., Lee, S., Latonen, R.-M., Bobacka, J., **Gordon, K. C.**, Ogawa, T. & Lisak, G.	Silver(I)-selective electrodes based on rare earth element double-decker porphyrins.	*Sensors and Actuators B: Chemical* **305**, 127311 (2020)
Landon-Lane, L., **Downard, A. J.** & **Marshall, A. T.**	Single fibre electrode measurements – A versatile strategy for assessing the non-uniform kinetics at carbon felt electrodes.	*Electrochimica Acta* **354**, 136709 (2020)
Markhali, B. P., Sriram, M., Bennett, D. T., Khiabani, P. S., Hoque, S., **Tilley, R. D.**, Bakhtavathsalam, P. & Gooding, J. J.	Single particle detection of protein molecules using dark-field microscopy to avoid signals from nonspecific adsorption.	*Biosensors and Bioelectronics* **169** (2020)
Katančić, Z., Chen, W.-T., **Waterhouse, G. I. N.**, Kušić, H., Lončarić Božić, A., Hrnjak-Murgić, Z. & **Travas-Sejdic, J.**	Solar-active photocatalysts based on TiO2 and conductive polymer PEDOT for the removal of bisphenol A.	*Journal of Photochemistry and Photobiology A: Chemistry* **396** (2020)
Bērziņš, K., Sutton, J. J., Fraser-Miller, S. J., Rades, T., Korter, T. M. & **Gordon, K. C.**	Solving the Computational Puzzle: Toward a Pragmatic Pathway for Modeling Low-Energy Vibrational Modes of Pharmaceutical Crystals.	*Crystal Growth & Design* **20**, 6947–6955 (2020)
Chen, C., Sun-Waterhouse, D., Zhao, J., Zhao, M., **Waterhouse, G. I. N.** & Sun, W.	Soybean protein isolate hydrolysates-liposomes interactions under oxidation: Mechanistic insights into system stability.	*Food Hydrocolloids* **112** (2021)
Colombo, R. N. P., Gonçales, V. R., Gautam, S., **Tilley, R. D.**, Gooding, J. J. & Córdoba de Torresi, S. I.	Spatially localized electrodeposition of multiple metalsvialight-activated electrochemistry for surface enhanced Raman spectroscopy applications.	*Chemical Communications* **56**, 5831-5834 (2020)
Hu, J., **Granville, S.** & Yu, H.	Spin-Dependent Thermoelectric Transport in Cobalt-Based Heusler Alloys.	*Annalen der Physik* **532**, 1900456 (2020)
Safaei, S., **Hendy, S. C.** & **Willmott, G. R.**	Stability of amphiphilic Janus dimers in shear flow: a molecular dynamics study.	*Soft Matter* **16**, 7116-7125 (2020)
Suh, H. G.,Menke, H., **Brydon, P. M. R.**, Timm, C., Ramires, A. & Agterberg, D. F.	Stabilizing Even-Parity Chiral Superconductivity in Sr2 RuO4.	*Physical Review Research* **2** (2020)
Zeng, X., Jiang, W., Jiang, X., **Waterhouse, G.I.N.**, Zhang, Z. & Yu, L.	Stable Pb 2+ ion-selective electrodes based on polyaniline-TiO 2 solid contacts.	*Analytica Chimica Acta* **1094**, 26-33 (2020)

AUTHORS	TITLE	JOURNAL
Love, M. J., **Dobson, R. C. J.** & Billington, C.	Stemming the tide of antibiotic resistance by exploiting bacteriophages.	*The Biochemist* **42**, 6-11 (2020)
Storey, J. G., Szmigiel, M., Robinson, F., **Wimbush, S. C.** & Badcock, R. A.	Stiffness Enhancement of a Superconducting Magnetic Bearing Using Shaped YBCO Bulks.	*IEEE Transactions on Applied Superconductivity* **30**, 600706 (2020)
Mabakachaba, B. M., Madiba, I. G., **Kennedy, J. V.**, Kaviyarasu, K., Ngoupe, P., Khanyile, B. S., Van Rensburg, J. J., Ezema, F., Arendse, C. J. & Maaza, M.	Structural and electrical properties of Mg-doped vanadium dioxide thin films via room-temperature ion implantation.	*Surfaces and Interfaces* **20**, 100590 (2020)
Gangi Setty, T., Sarkar, A., Coombes, D., **Dobson, R. C. J.** & Subramanian, R.	Structure and Function of N-Acetylmannosamine Kinases from Pathogenic Bacteria.	*ACS Omega* **5**, 30923–30936 (2020)
Kihara, S., Ghosh, S., McDougall, D. R., Whitten, A. E., Mata, J. P., Köper, I. & **McGillivray, D. J.**	Structure of soft and hard protein corona around polystyrene nanoplastics—Particle size and protein types.	*Biointerphases* **15** (2020)
Trevelyan, S. J., Brewster, J. L., Burgess, A. E., Crowther, J. M., Cadell, A. L., Parker, B. L., Croucher, D. R., **Dobson, R. C. J.**, Murphy, J. M. & Mace, P. D.	Structure-based mechanism of preferential complex formation by apoptosis signal-regulating kinases.	*Science Signaling* **13** (2020)
Meng, Y., Sheen, C. R., Magon, N. J., Hampton, M. B. & **Dobson, R. C. J.**	Structure-function analyses of alkylhydroperoxidase D from Streptococcus pneumoniae reveal an unusual three-cysteine active site architecture.	*Journal of Biological Chemistry* **295**, 2984-2999 (2020)
Whitby, C. P.	Structuring Edible Oils With Fumed Silica Particles.	*Frontiers in Sustainable Food Systems* **4**, 585160 (2020)
Panimalar, S., Uthrakumar, R., Selvi, E. T., Gomathy, P., Inmozhi, C., Kaviyarasu, K. & **Kennedy, J. V.**	Studies of MnO2/g-C3N4 hetrostructure efficient of visible light photocatalyst for pollutants degradation by sol-gel technique.	*Surfaces and Interface* **20** (2020)
Zhang, S., Zhao, Y., Shi, R., Zhou, C., **Waterhouse, G.I.N.**, Wang, Z., Weng, Y. & Zhang, T.	Sub-3 nm Ultrafine Cu2O for Visible Light Driven Nitrogen Fixation.	*Angewandte Chemie - International Edition* (2020)
Suzuki, H., Mahapatra, D., Board, A. J., Steel, P. J., Dyer, J. M., **Gerrard, J. A.**, **Dobson, R. C. J.** & Valéry, C.	Sub-Ångstrom structure of collagen model peptide (GPO)10 shows a hydrated triple helix with pitch variation and two proline ring conformations.	*Food Chemistry* **319** (2020)
Wilson, B. H. & **Kruger, P. E.**	Supramolecular interactions in a family of dinuclear helicates in the solid-state.	*Supramolecular Chemistry*, 1-10 (2020)
Gautam, S., Lian, J., R. Gonçales, V., Vogel, Y. B., Ciampi, S., **Tilley, R. D.** & Gooding, J. J.	Surface Patterning of Biomolecules Using Click Chemistry and Light-Activated Electrochemistry to Locally Generate Cu(I).	*ChemElectroChem* **7**, 4245-4250 (2020)
Zhang, T., Ye, J., Arul, R., Yang, T., Wang, Y., Yue, X., Schaeffer, M., **Simpson, M.C.**, **Nieuwoudt, M.K.**, Huang, S., Wei, S. & Gao, W.	Surface-enhanced Raman scattering (SERS) by Ag nanoparticles on anodized TiO2-X nanotubes.	*International Journal of Modern Physics B.*, **34**, 2040009 (2020)
Lao, J., Li, D., Jiang, C., Luo, C., Qi, R., Lin, H., Huang, R., **Waterhouse, G. I. N.** & Peng, H.	Synergistic effect of cobalt boride nanoparticles on MoS2 nanoflowers for a highly efficient hydrogen evolution reaction in alkaline media.	*Nanoscale* **12**, 10158-10165 (2020)
Khadka, R., Carraher, C., Hamiaux, C., **Travas-Sejdic, J.** & Kralicek, A.	Synergistic improvement in the performance of insect odorant receptor based biosensors in the presence of Orco.	*Biosensors and Bioelectronics* **153** (2020)
Barker, D., Lee, S., Varnava, K. G., Sparrow, K., van Rensburg, M., Deed, R. C., Cadelis, M. M., Li, S. A., Copp, B. R., **Sarojini, V.** & Pilkington, L. I.	Synthesis and Antibacterial Analysis of Analogues of the Marine Alkaloid Pseudoceratidine.	*Molecules (Basel, Switzerland)* **25** (2020)
Twidle, A. M., Suckling, D. M., Chhagan, A., Pilkington, L. I., Park, K. C. & **Barker, D.**	Synthesis and Biological Testing of Ester Pheromone Analogues for Two Fruitworm Moths (Carposinidae).	*Journal of Agricultural and Food Chemistry* **68**, 9557–9567 (2020)
Parish-Virtue, K., Johannisson-Wallman, M., Pilkington, L. I., Hsieh, S., **Barker, D.** & Fedrizzi, B.	Synthesis and Use of Ethyl 6-Acetyloxyhexanoate as an Internal Standard: An Interdisciplinary Experiment for an Undergraduate Chemistry Laboratory.	*Journal of Chemical Education* **97**, 3847–3851 (2020)
Golim, O. P., Huang, S., Yin, L., Yang, T., Zhou, H., Gao, W., **Söhnel, T.** & **Cao, P.**	Synthesis, neutron diffraction and photoluminescence properties of a whitlockite structured Ca9MgLi(PO4)7:Pr3+ phosphor.	*Ceramics International* **46**, 27476-27483 (2020)

AUTHORS	TITLE	JOURNAL
Ako, A. M., Kathalikkattil, A. C., Elliott, R., Soriano-López, J., Mckeogh, I. M., Zubair, M., Zhu, N., García-Melchor, M., **Kruger, P. E.** & Schmitt, W.	Synthetic Approaches to Metallo-Supramolecular CoIIPolygons and Potential Use for H2O Oxidation.	*Inorganic Chemistry* **59**, 14432-14438 (2020)
Pariary, R., Ghosh, B., Bednarikova, Z., Varnava, K. G., Ratha, B. N., Raha, S., Bhattacharyya, D., Gazova, Z., **Sarojini, V.**, Mandal, A. K. & Bhunia, A.	Targeted inhibition of amyloidogenesis using a non-toxic, serum stable strategically designed cyclic peptide with therapeutic implications.	*Biochimica et Biophysica Acta - Proteins and Proteomics* **1868** (2020)
Tran, H.N., Le, P.Y., Murdoch, B.J., **Allen, M.W.**, McConville, C.F., & Partridge, J.G.	Temperature-Dependent Electrical Properties of Graphitic Carbon Schottky Contacts to B-Ga2O3.	*IEEE Transactions on Electron Devices* **67**, 5669-5675 (2020)
Cairns, M. J., Mesic, B., **Johnston, J. H.**, Hill, S. J. & Kirby, N.	Tetraethylorthosilicate-containing barrier dispersion coatings—Mechanism of action.	*Progress in Organic Coatings* **139** (2020)
Evans, M. J., Anker, M. D., Mouchfiq, A., Lein, M. & **Fulton, J. R.**	The "Metallo"-Diels–Alder Reactions: Examining the Metalloid Behavior of Germanimines.	*Chemistry - A European Journal* **26**, 2606-2609 (2020)
Zujovic, Z., Kilmartin, P. A. & **Travas-Sejdic, J.**	The applications of solid-state NMR to conducting polymers. The special case on polyaniline.	*Molecules* **25** (2020)
Coombes, D., Davies, J. S., Newton-Vesty, M. C., Horne, C. R., Setty, T. G., Subramanian, R., Moir, J. W. B., Rosmarie Friemann, X., Panjikar, S., Griffin, M. D. W., North, R. A. & **Dobson, R. C. J.**	The basis for non-canonical ROK family function in the N-acetylmannosamine kinase from the pathogen Staphylococcus aureus.	*Journal of Biological Chemistry* **295**, 3301-3315 (2020)
Abdelbassit, M. S., Curnow, O. J., Brooke, S. J. & **Waterland, M. R.**	The Bromine-Chlorine Interhalides [Br3Cl5]2–, [Br4Cl4]2– and [Br6.56Cl1.44]2–.	*European Journal of Inorganic Chemistry* **2020**, 3302–3310 (2020)
Nalumaga, H., Schuyt, J. J., **Williams, G. V. M.**, Clarke, D. J. & **Chong, S. V.**	The effect of ionising radiation on the photoluminescence and radioluminescence properties of nanoparticle and bulk NaMgF3:Ce,Sm.	*Journal of Luminescence* **228** (2020)
Zhang, T., Liu, Y., Christopher, T. D., Huang, S., **Söhnel, T.** , Song, X., Gao, W., & **Cao, P.**	The effect of water vapour on structure and electrochemical performance of an aluminium-free niobium-doped garnet electrolyte.	*Ceramics International* **46**, 3889-3895 (2020)
Mallett, B. P. P., **Chong, S. V.,** Guehne, R., Chan, A., Murmu, P., **Kennedy, J. V.** & **Buckley, R. G.**	The electronic properties and defect chemistry of Bi2-xSe3, −0.05<x<0.15.	*Journal of Physics and Chemistry of Solids* **148** (2021)
Mayer, A., **Barker, D.**, Copp, B. R. & Miskelly, G. M.	The HONO-methamphetamine adduct – An unexpected derivative.	*Forensic Chemistry* **20**, 100276 (2020)
Wordsworth, J., Benedetti, T. M., Alinezhad, A., **Tilley, R. D.**, Edwards, M. A., Schuhmann, W. & Gooding, J. J.	The importance of nanoscale confinement to electrocatalytic performance.	*Chemical Science* **11**, 1233-1240 (2020)
Zhang, T., Liu, Y., Christopher, T. D., Huang, S., Yang, T., Huang, Z., Gao, W., **Söhnel, T.** & **Cao, P.**	The influence of co-doping strontium and zirconium on structure and ionic conductivities of Li6+y La3-y Sry NbZrO12 solid electrolytes.	*International Journal of Modern Physics B* **34**, 2040006 (2019)
Sabet, S.,Rashidinejad, A. Melton, L.D., Zujovic, Z., Akbarinejad, A., **Nieuwoudt, M.K.**, Seal, C.K. & **McGillivray, D.J.**	The interactions between the two negatively charged polysaccharides: Gum Arabic and alginate.	*Food Hydrocolloids* **112**, 106343 (2021)
Jovic, V., Moser, S., Papadogianni, A., Koch, R. J., Rossi, A., Jozwiak, C., Bostwick, A., Rotenberg, E., **Kennedy, J. V.**, Bierwagen, O. & Smith, K. E.	The Itinerant 2D Electron Gas of the Indium Oxide (111) Surface: Implications for Carbon- and Energy-Conversion Applications.	*Small* **16** (2020)
Shi, R., Zhang, X., **Waterhouse, G.I.N.**, Zhao, Y. & Zhang, T.	The Journey toward Low Temperature, Low Pressure Catalytic Nitrogen Fixation.	*Advanced Energy Materials* **10** (2020)
Sugrue, E., Coombes, D., Wood, D., Zhu, T., Donovan, K. A. & **Dobson, R. C. J.**	The lid domain is important, but not essential, for catalysis of Escherichia coli pyruvate kinase.	*European Biophysics Journal* **49**, 761-772 (2020)
Weir, G., Chisholm, G. & **Leveneur, J.**	The magnetic field about a three-dimensional block neodymium magnet.	*The ANZIAM Journal*, 1–20 (2020)
Lo, S.N., Smit, A.K., Espinoza, D., Cust, A.E., Newson, A.J., Morton, R.L., Kimlin, M., Keogh, L., Law, M.H., Kirk, J., Dobbinson, S.J., Kanetsky, P.A., Mann, G.J., Dawkins, H., Savard, J., Dunlop, K., Trevena, L., Jenkins, M., **Allen, M. W.**, Butow, P., Wordsworth, S., Lo, S.N., Low, C., Smit, A. & Espinoza, D.	The Melanoma Genomics Managing Your Risk Study randomised controlled trial: statistical analysis plan.	*Trials* **21**, 594 (2020)

AUTHORS	TITLE	JOURNAL
Kumar, R., Akbarinejad, A., Jasemizad, T., Fucina, R., **Travas-Sejdic, J.** & Padhye, L. P.	The removal of metformin and other selected PPCPs from water by poly(3,4-ethylenedioxythiophene) photocatalyst.	*Science of the Total Environment* **751**, 142302 (2021)
Whaanga, H., **Harris, P.** & Matamua, R.	The science and practice of Māori astronomy and Matariki.	*New Zealand Science Review* **76**, 13-19 (2020)
Metcalfe, R. D., Aizel, K., Zlatic, C. O., Nguyen, P. M., Morton, C. J., Lio, D. S.-S., Cheng, H.-C., **Dobson, R. C. J.**, Parker, M. W., Gooley, P. R., Putoczki, T. L. & Griffin, M. D. W.	The structure of the extracellular domains of human interleukin 11α receptor reveals mechanisms of cytokine engagement.	*The Journal of Biological Chemistry* **295**, 8285-8301 (2020)
Swaney, B., Luxenburger, A., **Lucas, N. T.**, Hawkins, B. C. & Hinkley, S. F. R.	The synthesis of 3-azabicyclo[4.3.0]nonane scaffolds from brefeldin A.	*Tetrahedron Letters* **61**, 152006 (2020)
Healy, C., **Patil, K. M.**, Wilson, B. H., Hermanspahn, L., Harvey-Reid, N. C., Howard, B. I., Kleinjan, C., Kolien, J., Payet, F., **Telfer, S. G.**, **Kruger, P. E.** & Bennett, T. D.	The thermal stability of metal-organic frameworks.	*Coordination Chemistry Reviews* **419** (2020)
Brooks, J. M., Ainslie, M. D., Jiang, Z., Pantoja, A. E., Badcock, R. A. & **Bumby, C. W.**	The transient voltage response of ReBCO coated conductors exhibiting dynamic resistance.	*Superconductor Science and Technology* **33** (2020)
Thammasangwan, W., Harding, P., **Telfer, S. G.**, Alkaş, A., Phonsri, W., Murray, K. S., Clérac, R., Rouzières, M., Chastanet, G. & Harding, D. J.	Thermal and Light-Activated Spin Crossover in Iron(III) qnal Complexes.	*European Journal of Inorganic Chemistry* **2020**, 1325-1330 (2020)
Healy, C., Harvey-Reid, N. C., Howard, B. I. & **Kruger, P. E.**	Thermal decomposition of hybrid ultramicroporous materials (HUMs).	*Dalton Transactions* **49**, 17433–17439 (2020)
Alkaş, A., Friche, L. E. S., Harris, S. N. & **Telfer, S. G.**	Thermal Elimination of Ethylene from Cyclobutyl Groups Characterized by X-ray Crystallography in a Metal–Organic Framework Matrix.	*Chemistry - A European Journal* **26**, 10321-10329 (2020)
Sun, Y., **Waterhouse, G. I. N.**, Xu, L., Qiao, X. & Xu, Z.	Three-dimensional electrochemical sensor with covalent organic framework decorated carbon nanotubes signal amplification for the detection of furazolidone.	*Sensors and Actuators, B: Chemical* **321**, 128501 (2020)
Nguyen, H. T. D., **Granville, S.** & Seidel, J.	Topotactic Phase Transformation in Epitaxial SrCo1- xFexO3− δ Thin Films.	*Advanced Electronic Materials* **6**, 1901204 (2020)
Xie, X., Shang, L., Shi, R., **Waterhouse, G. I. N.**, Zhao, J. & Zhang, T.	Tubular assemblies of N-doped carbon nanotubes loaded with NiFe alloy nanoparticles as efficient bifunctional catalysts for rechargeable zinc-air batteries.	*Nanoscale* **12**, 13129-13136 (2020)
Khalil, B. A. & **Gaston, N.**	Two-dimensional aluminium, gallium, and indium metallic crystals by first-principles design.	*Journal of Physics: Condensed Matter* **33**, 125901 (2021)
Zhao, Y., Zhang, S., Shi, R., **Waterhouse, G.I.N.**, Tang, J. & Zhang, T.	Two-dimensional photocatalyst design: A critical review of recent experimental and computational advances.	*Materials Today* **34** (2020)
Steenbergen, K. G. & **Gaston, N.**	Ultra stable superatomic structure of doubly magic Ga13 and Ga13Li electrolyte.	*Nanoscale* **12**, 289-295 (2020)
Sun, Y., Gao, H., Xu, L., **Waterhouse, G. I. N.**, Zhang, H., Qiao, X. & Xu, Z.	Ultrasensitive determination of sulfathiazole using a molecularly imprinted electrochemical sensor with CuS microflowers as an electron transfer probe and Au@COF for signal amplification.	*Food Chemistry* **332**, 127376 (2020)
Zhou, M., Ning, S., Liu, J., **Waterhouse, G.I.N.**, Li, L., Dong, J. & Ai, S.	Ultrasensitive Electrochemiluminescence Immunosensor Based on a Three-Dimensional Flower-Like Manganese Dioxide–Polyethyleneimine–Palladium Nanocomposite as the Signal Label for Detection of Avian Leukosis Virus Subgroup J.	*Analytical Letters*, 1-14 (2020)
Mehta, M. & **Waterland, M. R.**	Ultrasensitive surface-enhanced Raman scattering detection of biological pollutants by controlled evaporation on omniphobic substrates.	*Heliyon* **6**, e04317 (2020)

AUTHORS	TITLE	JOURNAL
Samanali, G. A. P., Paasi, I., Lowe, B. J., Smith, C. A., Fraser-Miller, S. J. & **Gordon, K. C.**	Understanding consolidants on harakeke fibres using Raman microscopy: Implications for conservation.	*Journal of Cultural Heritage* **45**, *41-47* (2020)
Shang, L., Zhao, Y., Kong, X.-Y., Shi, R., **Waterhouse, G. I. N.**, Wen, L. & Zhang, T.	Underwater superaerophobic Ni nanoparticle-decorated nickel–molybdenum nitride nanowire arrays for hydrogen evolution in neutral media.	*Nano Energy* **78**, 117017 (2020)
Allen, M. W., Swift, N., Nield, K. M., Liley, B. & McKenzie, R. L.	Use of electronic UV dosimeters in measuring personal UV exposures and public health education.	*Atmosphere* **11**, 744 (2020)
Preston, D. & **Kruger, P. E.**	Using Complementary Ligand Denticity to Direct Metallosupramolecular Structure about Metal Ions with Square-Planar Geometry.	*ChemPlusChem* **85**, 454-465 (2020)
Sandupatla, A., Arulkumaran, S., Ing, N. G., Nitta, S., **Kennedy, J. V.** & Amano, H.	Vertical GaN-on-GaN schottky diodes as α-particle radiation sensors.	*Micromachines* **11** (2020)
Miller, J. D., Ullstad, F. H., **Trodahl, H. J.**, **Ruck, B. J.** & **Natali, F.**	Vertical transport and tunnelling in rare-earth nitride heterostructures.	*Nanotechnology* **31**, 235202 (2020)
McIntyre, S. M., Ma, Q., Burritt, D. J., Oey, I., **Gordon, K. C.** & Fraser-Miller, S. J.	Vibrational spectroscopy and chemometrics for quantifying key bioactive components of various plum cultivars grown in New Zealand.	*Journal of Raman Spectroscopy* **51**, 1138-1152 (2020)
Tsai, H., Shaya, J., Tesana, S., **Golovko, V. B.**, Wang, S.-Y., Liao, Y.-Y., Lu, C.-S. & Chen, C.-C.	Visible-light driven photocatalytic degradation of pirimicarb by pt-doped agins2 nanoparticles.	*Catalysts* **10**, 1-20 (2020)
Goodacre, D., Blum, M., Buechner, C., Hoek, H., Gericke, S. M., **Jovic, V.**, Franklin, J. B., Kittiwatanakul, S., **Söhnel, T.**, Bluhm, H. & Smith, K. E.	Water adsorption on vanadium oxide thin films in ambient relative humidity.	*Journal of Chemical Physics* **152** (2020)
Luo, C., Huang, S., Zhang, T., Jiang, C., Qi, R., Liu, M., Lin, H., **Travas-Sejdic, J.** & Peng, H.	Water driven photoluminescence enhancement and recovery of CH3NH3PbBr3/Silicon oil/PDMS-urea composite.	*Journal of Alloys and Compounds* **834** (2020)
Raoufi, F., Ranjbar, Z., Rategar, S., **Nowak, E.** & Nazari, B.	Wettability study of super-hydrophobic silica aerogel powders.	*Progress in Color, Colorants and Coatings* **13**, 75-83 (2020)
Price, M. B., Lewellen, K., Hardy, J., Lockwood, S. M., Zemke-Smith, C., Wagner, I., Gao, M., Grand, J., Chen, K., **Hodgkiss, J. M.**, **Le Ru, E. C.** & **Davis, N. J. L. K.**	Whispering-Gallery Mode Lasing in Perovskite Nanocrystals Chemically Bound to Silicon Dioxide Microspheres.	*The Journal of Physical Chemistry Letters* **11,** 709-7014 (2020)
Gloag, L., Mehdipour, M., Ulanova, M., Mariandry, K., Nichol, M. A., Hernández-Castillo, D. J., Gaudet, J., Qiao, R., Zhang, J., Nelson, M., Thierry, B., Alvarez-Lemus, M. A., Tan, T. T., Gooding, J. J., Braidy, N., Sachdev, P. S. & **Tilley, R. D.**	Zero valent iron core-iron oxide shell nanoparticles as small magnetic particle imaging tracers.	*Chemical Communications* **56,** 3504-3507 (2020)
Ge, Y., Li, C., **Waterhouse, G.I.N.**, Zhang, Z., & Yu, L.	ZnFe2O4@SiO2@Polypyrrole nanocomposites with efficient electromagnetic wave absorption properties in the K and Ka band regions.	*Ceramics International* **47,** 1728-1739 (2021)
Raos, B. J., Maddah, M., Graham, E. S., **Plank, N. O. V.** & **Unsworth, C. P.**	ZnO nanowire florets promote the growth of human neurons.	*Materialia* **9** (2020)

Chapters

AUTHORS	CHAPTER TITLE	BOOK TITLE	PUBLISHER
James, B. & **Malmström, J.**	Chapter 14: Applications of Scanning Electron Microscopy and Atomic Force Microscopy to Food Structure Characterisation	*Food Chemistry, Function and Analysis*	RSC Publishing
Waterhouse, G. I. N., Wang, L. & Sun-Waterhouse, D.	Chapter 11 - Porous three-dimensional polymer composites for tailored delivery of bioactives and drugs	*Materials for Biomedical Engineering: Nanomaterials-based Drug Delivery*	Elsevier
Webster, K., Sasso, L. & **Domigan, L. J.**	Adding Function to Protein Scaffolds	*Methods in Molecular Biology*	Springer Nature, Humana Press, New York
An, Y., Manuguri, S. S. & **Malmström, J.**	Atomic Force Microscopy of Proteins	*Methods in Molecular Biology*	Springer Nature, Humana Press, New York
Domigan, L. J. & **Gerrard, J. A.**	Introduction to Protein Nanotechnology	*Methods in Molecular Biology*	Springer Nature, Humana Press, New York
Domigan, L. J. & **Gerrard, J. A.**	Preface	*Methods in Molecular Biology*	Springer Nature, Humana Press, New York
Hermant, Y. O., Cameron, A. J., Harris, P. W. R. & **Brimble, M. A.**	Synthesis of antimicrobial lipopeptides using the "CLipPA" thiol-ene reaction	*Methods in Molecular Biology*	Springer Nature, Humana Press, New York
Anand, A., Rajchakit, U. & **Sarojini, V.**	Detection and removal of biological contaminants in water: the role of nanotechnology	*Nanomaterials for the Detection and Removal of Wastewater Pollutants*	Elsevier
Williams, M.A.K.	Pectin Gelation and Its Assembly into Functional Materials	*Pectin: Technological and Physiological Properties*	Springer, Cham

Conference papers

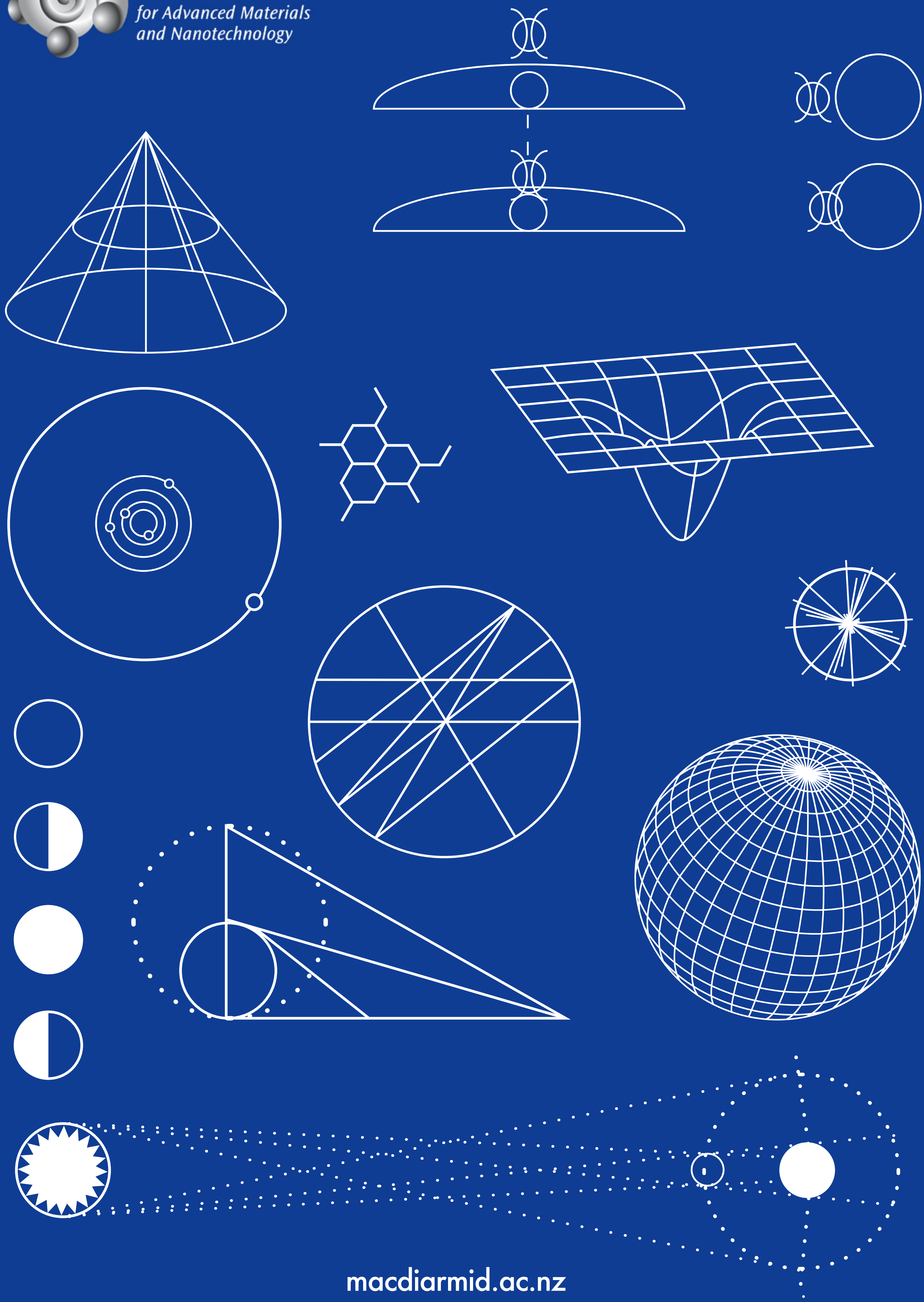
AUTHORS	TITLE OF CONFERENCE PAPER	TITLE OF PROCEEDINGS
Hung, J. H. & **Metson, J. B.**	A Laboratory Study of the HF Generation Potential of Particulate Fluorides from Cell Emissions.	*Light Metals* (2020)
Onal, S., **Alkaisi, M. M.** & **Nock, V.**	A microfluidic platform for applying localized and dynamically-controlled compression on cancer cells.	*23rd International Conference on Miniaturized Systems for Chemistry and Life Sciences, MicroTAS* (2019)
Suhaimi, S. & **Avci, E. A.**	A Micro-Tweezers System for Cell Isolation Task.	*2020 IEEE/SICE International Symposium on System Integration (SII)* (2020)
Bhattacharya, S., Bennet, L., Davidson, J. O. & **Unsworth, C. P.**	A novel approach to segment cortical neurons in histological images of the near-term fetal sheep brain model.	*Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS* (2020)
Abbasi, H., Gunn, A. J., Bennet, L. & **Unsworth, C. P.**	Deep Convolutional Neural Network and Reverse Biorthogonal Wavelet Scalograms for Automatic Identification of High Frequency Micro-Scale Spike Transients in the Post-Hypoxic-Ischemic EEG.	*Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS* (2020)
Warren, A., **Alkaisi, M. M.** & Moore, C.	Design of 2D plasmonic diffraction gratings for sensing and super-resolution imaging applications.	*I2MTC 2020 - International Instrumentation and Measurement Technology Conference, Proceedings* (2020)
Andrew, P.-K., Fan, D., Raudsepp, A., Lofroth, M., Staufer, U., **Williams, M. A. K.** & **Avci, E. A.**	Design of optical micromachines for use in biologically relevant environments.	*IEEE/ASME International Conference on Advanced Intelligent Mechatronics, AIM* (2020)
Aqrawe, Z., Patel, N., Montgomery, J. M., **Travas-Sejdic, J.** & Svirskis, D.	Development of a Low Cost Low Noise Amplification System for in Vitro Neuronal Recording through Microelectrode Arrays.	*2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (2020)
Zong, F., Zhuo, Y., Spindler, N., Liu, H. & **Galvosas, P.**	Diffusion Anisotropy Identification by Short Diffusion-Diffusion Correlation Spectroscopy.	*Computational Diffusion MRI* (2020)
Tapia, N. I., Love, R. J., **Nowak, E.** & East, A. R.	Experimental measurements of the pressure drop loss coefficient for vent configurations of packaging designed for air cooling of horticultural products.	*Refrigeration Science and Technology* (2019)
Sandupatla, A., Arulkumaran, S., Ranjan, K., Ng, G. I., Murumu, P. P., **Kennedy, J. V.**, Deki, M., Nitta, S., Honda, Y. & Amano, H.	Low leakage Mg-compensated GaN Schottky diodes on free-standing GaN substrate for high energy α-particle detection.	*4th Electron Devices Technology and Manufacturing Conference, EDTM 2020 - Proceedings* (2020)
Li, S., Graham, E. S. & **Unsworth, C. P.**	Nanosecond Laser Stimulation in an Organized Grid Network of Human Astrocytes.	*Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS*
Kalsi, S. S., **Storey, J. G.**, Hamilton, K. A. & Badcock, R. A.	Propulsion motor concepts for airplane.	*2019 AIAA/IEEE Electric Aircraft Technologies Symposium, EATS* (2019)
Jaywant, S. A., Arif, K. M., Potgieter, J. & **Avci, E. A.**	Self-assembled optical diffraction patterns for applications in water quality monitoring.	*2019 13th International Conference on Sensing Technology (ICST)* (2019)
Aguergaray, C., Barber, L., Lowe, J., Ashforth, S., Broderick, N. G. & **Simpson, M. C.**	Tailored delivery of ultra-short high-energy lasers for improved material processing.	*Optics InfoBase Conference Papers* (2019)
Li, S., Graham, E. S. & **Unsworth, C. P.**	The Effect of Basic Microshapes on hNT Astrocytes Cytoplasmic Process Outgrowth.	*Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS* (2020)
Ilina, A., Thorn, K. E., **Hume, P. A.** & **Hodgkiss, J. M.**	Uncovering the mechanism of the ultrafast UV-energy dissipation in the eumelanin pigment.	*Proceedings of SPIE - The International Society for Optical Engineering* (2020)
Abbasi, H., Gunn, A. J., **Unsworth, C. P.** & Bennet, L.	Wavelet Spectral Time-Frequency Training of Deep Convolutional Neural Networks for Accurate Identification of Micro-Scale Sharp Wave Biomarkers in the Post-Hypoxic-Ischemic EEG of Preterm Sheep.	*Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS* (2020)

Keynote & invited speaker addresses

NAME	DETAILS
Margaret Brimble	Keynote talk at the Teachers Professional Development Symposium. November 2020, Timaru, New Zealand
	Keynote talk at the Teachers Professional Development Symposium. November 2020, Christchurch, New Zealand
	Keynote talk at the Teachers Professional Development Symposium. November 2020, Nelson, New Zealand
	Keynote talk at the Teachers Professional Development Symposium. November 2020, Auckland, New Zealand
	Keynote talk at the School of Chemical Sciences, University of Auckland, Innovation Showcase. November 2020, Auckland, New Zealand
Sally Brooker	Keynote talk at the U3A 'Passionate Pursuits of Otago's Sesquicentennial Distinguished Professors' lecture course. 20 October 2020, Dunedin, New Zealand
Keith Gordon	Keynote talk as part of the Royal Society of Chemistry (UK) Australasian Lectureship 2019. January 2020, Perth, Australia.
	Keynote talk at the Asian Spectroscopy Conference (ASC2020). December 2020, Singapore (online)
Erin Leitao	Keynote talk at the Flinders Fringe Festival Symposium. 21 February 2020, Adelaide, Australia
Aaron Marshall	Keynote talk at the International Virtual Conference on Advanced Nanomaterials. 17-19 June 2020, Vellore, India (online)
Carla Meledandri	Plenary lecture at the 32nd Australian Colloid and Surface Science Student Conference. January 2020, Churchill, Gippsland, Australia
Jadranka Travas-Sejdic	Keynote talk at the 14th Annual International Electromaterials Science Symposium. 5-7 February 2020, Canberra, Australia
	Keynote talk at the 71st Annual Meeting of the International Society of Electrochemistry. 30 August-4 September 2020, Belgrade, Serbia (online)
	Keynote talk at the Global Virtual Conference on Bio Nano Innovation. 6 June 2020 (online)
Catherine Whitby	Keynote talk at the 17th Australia-Japan Colloids Symposium. 17-18 September 2020 (online)
Martin (Bill) Williams	Invited lecture at the Northern Lights Food Masterclass. 31 August-4 September 2020, Sweden (online)
	Special speaker at the Pacific Rim Web Conference on Food Hydrocolloids. 17-18 December 2020, China (online)

The MacDiarmid Institute
for Advanced Materials and Nanotechnology

The MacDiarmid Institute
for Advanced Materials and Nanotechnology



macdiarmid.ac.nz