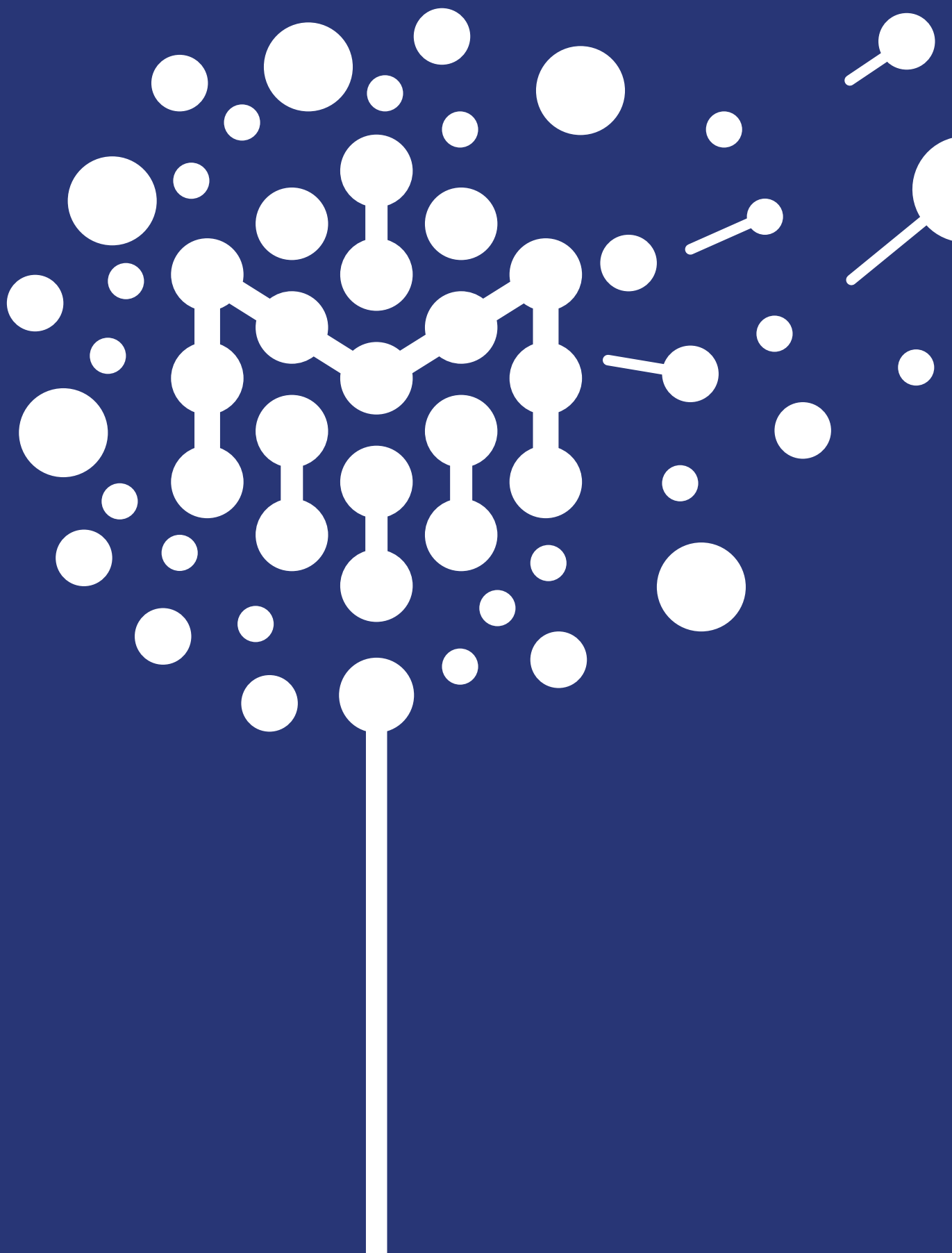
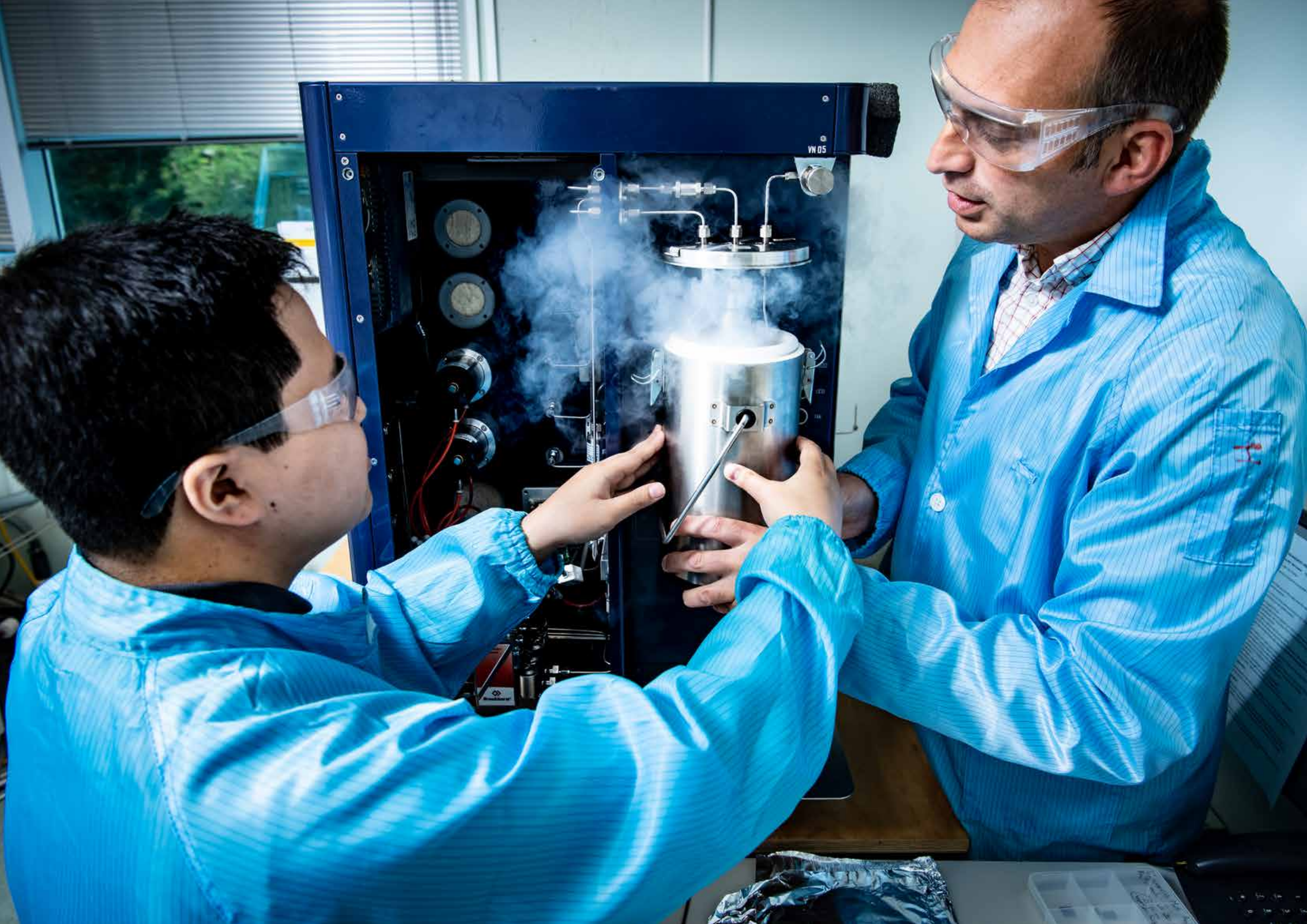
# MacDiarmid Institute Annual Report 2022



MacDiarmid Institute
Annual Report
2022

# Twenty years at the forefront of materials research 2002 - 2022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# Nicola Gaston and Justin Hodgkiss

Co-Directors

When the MacDiarmid Institute turned 20 years old in 2022, we took the opportunity to celebrate what the Institute has achieved so far, and to look forward to the next 20 years.

This annual report shares our stories and achievements from 2022 and puts them in the context of our 20-year journey so far.

In his first MacDiarmid Interface piece – included in this report – Sir Paul Callaghan outlined his vision for a national scale centre; a centre with a commitment to partnership within New Zealand's research sector, and one with the ambition to change New Zealand's social and economic culture.

The weight of Sir Paul's ideas is measured by the profound impact they've had over the past two decades. Few of us today will have read those words in 2002, but that we are living them is what really matters.

Take economic culture change: the research entrepreneurialism that Sir Paul envisaged is now completely part of our DNA, and you will find plenty of evidence of that in this report.

Sir Paul understood that there was much work to do when it came to meeting the aspirations of Māori through science. Structural change internally and strong long-term partnerships mean that that work is now flourishing in the Institute more than ever before.

Public engagement has always been a strength of the MacDiarmid Institute. Today, through partnership and empowering our people, the reach and depth of our engagement is having the positive influence that Sir Paul imagined.

Sir Paul spoke in 2002 about the buzz of new faces arriving, and new ideas to explore. The research profiles in this report illustrates that today's MacDiarmid Institute still has that sense of renewal in abundance.



# Hēmi Rolleston

Board Chair

Tēna koutou katoa

It is my absolute privilege to provide you with my first Chair's Report. Let me start by acknowledging the previous Chair Paul Atkins. It was a pleasure to work under Paul's Chairmanship on the Board as he steered our waka through to the success it is today. Paul had a significant role in leading us through our successful rebid and we are extremely grateful to him for leading the Institute through such a crucial time.

| **Board Chair** | **Time in position** |
|---|---|
| Ian Watson | 2002 - Dec 2009 |
| Steve Thompson | Jan 2010 - Dec 2014 |
| Ray Thompson | Jan 2015 - Dec 2017 |
| Paul Atkins | Jan 2018 - Dec 2021 |
| Hēmi Rolleston | January 2022 - present |

| **Directors / Co-Directors** | **Time in Position** |
|---|---|
| Paul Callaghan | 2002-2007 |
| Richard Blaikie | 2008 - 2011 |
| Kate McGrath | 2011 - 2015 |
| Thomas Nann | 2015 - 2017 |
| Nicola Gaston | 2018 - present |
| Justin Hodgkiss | 2018 - present |

| **Deputy Directors** | **Time in Position** |
|---|---|
| Richard Blaikie | 2002 - 2007 |
| Shaun Hendy | 2008 - 2011 |
| Simon Brown | 2011 - 2013 |
| David Williams | 2013 - 2015 |
| Alison Downard | 2013 - 2015 |
| Nicola Gaston | 2015 - 2017 |
| Justin Hodgkiss | 2015 - 2017 |
| Franck Natali | 2018 - 2019 |
| Geoff Willmott | 2018 - present |
| Paul Kruger | 2019 - present |
| Pauline Harris | 2022 - present |

This year we celebrate our 20th birthday. We acknowledge the legacy and the successes of the past as we navigate a challenging yet exciting future, and see the role that the Institute can play in this. In my mihi at the birthday event I made particular mention to those who have played a key role over the 20 years (see the table above) to remind us where we have come from. Earlier that day we had stretched our minds to challenge our thinking of what a future structure in the Institute would look like, allowing the structure and size of the Institute to give us freedom to imagine the future. I have always been clear in my time on the Board that Te Ao Māori can play a key role in the future of the Institute, and the Board has been always very supportive of this.

As I look across the Institute's vision and work, I am extremely heartened by the mahi I see. The Institute's four new research programmes leading Aotearoa New Zealand towards Zero Carbon, Zero Waste, Low Energy Tech and Sustainable Resource Use are truly inspiring. I can't think of a more worthwhile area to apply the minds and hearts of the MacDiarmid Institute's researchers than to support Aotearoa New Zealand and the world out of this climate emergency. And I again acknowledge the brilliance and foresight of the Institute's founder, Sir Paul Callaghan, who 20 years ago when he set up the Institute, saw the critical state of the planet and knew the vital role a materials science institute would play in mitigating this coming crisis.

I am impressed by the calibre of commitment, passion and leadership among all of those working for the Institute. As someone who has a day job within the science system, I can certainly vouch for the strong reputation the Institute has within the ecosystem. I am extremely heartened by the focus we have on rangatahi and the efforts we are applying to bring through the next generation of science leaders.

I thank the Board for the support you have given me and the Institute, and the Directors for your excellent mahi as always. I also acknowledge the management team who make everything happen. A huge thank you to you all.

I invite you to read these stories of continued science excellence, key collaborations with our Māori partners, commercialisation of materials research through startups and with industry, the drive to improve public understanding of technology for sustainability, and the creation of a high-earning NZ-trained science workforce.

# From the inaugural Chair

Ian Watson

## Our founding Chair Ian Watson looks back at the 20 years of the Institute.

I congratulate the MacDiarmid Institute on its longevity in such a competitive environment. Looking back, I believe it was because from day one all of its members worked as a team, worked in pursuit of excellence, shared high ethical values and had a strong sense of social responsibility. Further, the modus operandi was collegial. In these ways, the Institute rapidly built up an enviable track record on which, as its survival shows, it has clearly subsequently built further upon.

A key figure in all of this was Sir Paul Callaghan. There is no doubt that his goals of academic excellence and economic relevance, coupled with his charisma and charm, were a source of inspiration for the Institute. They were also a source of admiration for internationally renowned scientists, local politicians, local businesspeople, and university administrators alike.

Had he read the above, Paul would have chided me for once again going over the top. He would, however, have strongly endorsed my next remarks, which is much of the success was due to that first group of Institute members who over its first five years shaped its structure, culture and ethos. Here I would like to especially acknowledge Richard Blaikie, Shaun Hendy, Kate McGrath and Jeff Tallon.

The Institute was born out of the fusing of two CoRE (Centre of Research Excellence) bids from Canterbury and Victoria University of Wellington (VUW) into one. The only two universities in New Zealand, by the way, who have each produced a Nobel Laureate. The fact that the two universities were prepared to act in this way is remarkable and it is appropriate to thank them both for being prepared to do so. Later, like most of the CoREs, it involved scientists from most other New Zealand universities. Such co-operation has not gone unnoticed and is a major reason why the CoRE concept still finds favour.

*“From day one all worked as a team, worked in pursuit of excellence, shared high ethical values and had a strong sense of social responsibility”*

The merger also underscored the vital role played by both Canterbury and VUW in universities establishing a research culture at all. Until the mid 1960s, students at the master's level at any university college were rare and PhDs even rarer. In the 1940s a group of reformers including academics from Canterbury and Victoria began agitating for a greater research component which took until the mid 1970s to take hold, at least to the point where scientists like Paul Callaghan chose to make their careers in New Zealand rather than overseas. It took until the mid 1990s for research to be better though still inadequately funded through such instruments as the Marsden Fund and, in 2002, the CoREs themselves. Here, acknowledgment of the Royal Society of New Zealand is in order.

As someone who was, in the early 1960s, a colleague one of the reformers, Hugh Parton and, in the 1970s and ‘80s a colleague of one of the best practitioners of the result of their dream, Paul Callaghan, it has been a great thrill to see what this Institute has achieved thus far. There is, of course, more to be done.  But of all the institutes currently in place, I believe this one is the best placed to further advance that dream. Congratulations again.

Ian Watson was the foundation chair of the MacDiarmid Institute from 2002 to 2009. At the time of appointment he was Principal of the Albany Campus of Massey University, a post he held from 1992 until his retirement in 2003. Between 1988 and 1994 he was the inaugural Assistant Vice-Chancellor (Research) of Massey University.
Before that he was an Associate Professor in the Department of Chemistry, Biochemistry and Biophysics at Massey University whose research interest was in the Thermodynamics of Solutions.
Ian was the Deputy Chair of the Foundation of Research, Science and Technology between 1992 and 1996, and is a Fellow of the Institute of Chemistry. In 2004 he was awarded an Honorary Doctor of Science Degree by Massey University.
At a personal level, Ian and his wife, Patsy, recently celebrated their 61st wedding anniversary. They have three children and five grandchildren.



## From 2002 - 2022

**758**
PhD graduates

**27**
affiliated start-up companies created

**925**
research alumni

**87**
inventions patented

**4500+**
AMN conference attendees

Curators House. Photo by Simon Brown

# It all started with a paper napkin

Prettily situated at the edge of the Christchurch Botanic Gardens, the Category II English-style two-storey house, with its steep pitched slate roof and gables, had opened as a restaurant just a year before. The night we're there, the dark wood and ornate upholstery absorb any early evening light filtering in through the leadlight windows. Clustered around a dark wooden table in an upstairs alcove, are five people apparently deeply intent on a paper napkin.

The five are Professor Paul Callaghan, Dr Maan Alkaisi, Dr Simon Brown, Dr Steve Durbin and Dr Roger Reeves (all themselves now Professors) and the understandings being worked out on the paper napkin become the basis of the MacDiarmid Institute.

But it might not have been so.  At the time of this 2001 meeting at the historic Curator's House, there were two competing bids for the government's newly announced 'Centres of Research Excellence' (CoREs) funding, both in the materials science space. The stakes were high: the funding was new and significant and would provide the successful bidder with the security of funds to set up an entirely new institute. Sir Paul Callaghan was leading the Victoria University of Wellington (VUW) bid and the team from the University of Canterbury (UC) team the other. Only one bid (if any) would be funded.

One of the five sitting around the table that night, Simon Brown, says he remembers he and his UC colleagues were expecting a very tense meeting: "But Paul Callaghan cut straight to the chase and offered us a very good deal to merge with the VUW bid, and everything was okay from then on.

"That will stick in my mind forever as a pivotal moment."

Maan Alkaisi says he remembers the meeting well. "Paul proposed we join efforts to increase our chances of getting funded. It was about how to collaborate and not compete."

In a conversation recorded in 2012, just a month before he died, Sir Paul Callaghan (as he was by then) recalled the meeting: "I'd got on a plane, flown down to Christchurch and met up with all the Canterbury players apart from Richard (Blaikie) who was abroad. I remember being driven out there to this restaurant where they gathered after work. We got a table napkin out and we drew up the deal."

Simon Brown says he remembers clearly the earlier announcement of the new government funding. He says it was a significant new tranche of funding and that the Canterbury team sprang into action: "We were always going to put in a bid."




A selection of the slides Steve Durban presented to the University of Canterbury's research committee in 2001.

Professor Paul Callaghan

Professor Maan Alkaisi

Professor Richard Blaikie

Professor Jeff Tallon

Simon says the UC crew had already set up a Nanostructure Engineering, Science and Technology (NEST) group at the UC and several researchers had shared a $1m Marsden Grant in 1998: "In those days that was a lot of money." He says the Canterbury team had already set up what is now the University of Canterbury's 'Electrical Engineering Nanofabrication Lab' and had, as early as Feb 2001, run an 'Advanced Research Workshop on Semiconductor Nanostructures' in Queenstown. "We realised that getting a hundred top people, including a Nobel Laureate (Klaus von Klitzing) to come to a meeting on nanotechnology in NZ was quite a milestone– we take them for granted now, but I don't think such meetings had ever happened before."

The UC registration of interest was called 'New Zealand Centre for Nanoengineered Materials and Device Research'.

Steve Durbin (now Professor Professor of Electrical and Computer Engineering at Western Michigan University) recalls his surprise at receiving the call from Paul Callaghan.
"I was a lecturer at the time, wondering how I ended up in a position that Professor Paul Callaghan was calling me! I had just gotten done pitching our bid to the University of Canterbury's research committee - Roger went along, but they made me go in and present alone. I was told NOT to do PowerPoint, so I used - believe it or not - an overhead projector.

"Two bids were going in at the same time, one from Canterbury and one from Vic. The Vic team had strong reputations and Canterbury had what we believed was a strong case for high risk/high payoff in a field that was just starting to catch large-scale, world-wide attention (nanotechnology). Paul (and others, I'm sure, including Joe Trodahl) was concerned we'd end up cancelling each other's bids out, and he reached out to see if we could join forces. Simon said the VUW and Canterbury teams had known about each other's bids."

Steve says he remembers collecting Paul at Christchurch airport for the crucial meeting at the Curator's House.

"It was just as Simon said. Paul was open, friendly, and sincere - and was very keen to ensure Canterbury's ideas didn't disappear in a joint bid. He was suggesting that VUW lead the CoRE and I suggested that Canterbury put forward a deputy director for balance (it ended up being Richard Blaikie). Paul agreed on the spot, without a moment's hesitation. We talked about the name and he was 110% adamant that it be named after Alan (I didn't know Alan at the time). Paul was right. Alan was a true gentleman and a strong supporter of our efforts. Shortly before he passed away Paul asked me if any of us had kept the napkin, but I guess none of us did - after all, we weren't sure we'd get funded, and I don't think any of us ever dreamed of the size or scope the Institute would eventually reach!"

*"Shortly before he passed away Paul asked me if any of us had kept the napkin, but I guess none of us did - after all, we weren't sure we'd get funded, and I don't think any of us ever dreamed of the size or scope the Institute would eventually reach!"*

**PROFESSOR STEVE DURBIN**

In the 2012 recording, Sir Paul Callaghan, who had in early 2001 moved from Massey to VUW to take up the position as Alan MacDiarmid Professor of Physical Sciences, speaks of being asked to lead the VUW bid: "I guess it would have been about August, September 2001, that somehow or other, I got asked to lead a bid from Victoria University. Jim Johnston was Head of School at the time said, "Paul why don't you do it." Jim was no doubt busy enough and it seemed like a tall order that we would get the money, a long shot just like Marsden grants and all these other things. But I didn't have any major administrative responsibilities, I wasn't a Head of School, I was a professor teaching at University, I had time on my hands, and I thought why not that would be fun.

"And so we put together an EOI and we called it 'The MacDiarmid Institute for Advanced Materials'."

Having seen the round of bids that had come through to the Tertiary Education Commission in the first EOI application process, Paul says his VUW colleague Joe Trodahl said to him: "Paul, why don't we get together with the Canterbury lot and form a joint bid?". Paul says it just seemed such an obvious thing to do. "I'm very grateful for Joe's suggestion. Many of the people involved were erstwhile collaborators of ours, people like Steve Durbin, like Roger Reeves, Simon Brown and others. And the bid from Christchurch was led by a man called Richard Blaikie."

Richard Blaikie is rather humble on this point: "It's a fairer reflection to say the NEST group was a true collective, not so much that the bid was led by me." He smiles: "Because I was overseas at the time of the meeting, I was nominated to lead the Canterbury bid in my absence."

He says there had been a building of capacity at Canterbury across physics, chemistry and electrical engineering for some time: "We had a group of young and up and coming people, and had run the Queenstown founding event, which I like to call AMN0, organised by Simon and Joe (Trodahl), so there were already good connections between us and the VUW material scientists."

Simon Brown says he always had the sense that the Canterbury researchers were the new arrivals compared with the Wellington crowd who were well established names such as Paul Callaghan and Jeff Tallon. "So it was a natural thing to bring together the heavy hitters and the young upstarts."

Richard Blaikie says that although the Canterbury researchers were younger and more junior than the VUW team, they had an advantage:
"We were the real exciting nanotechnologists in the country. They needed our vibrancy and the nano side of things. But if Canterbury had stuck to a separate bid, we'd have been going up against the leadership of Sir Paul; it would likely have been mutually assured destruction."

Like any birth, it wasn't entirely straightforward. Richard said the UC leadership took quite some convincing that Canterbury should give up its EOI and join forces as junior institute partner to the VUW-led bid:
"As Paul said, bragging rights are ultimately what universities care most about and these were not easily given up by the Canterbury leadership who were really wanting a Canterbury-led bid. Paul Callaghan was very persuasive, but ultimately the decision was an internal Canterbury one."

Richard says once the decision had been made to join forces, there were multiple hurdles: further months of showing the government that this combined bid was a genuine collaboration.
"We had to show a united front to the panel led by (former Governor General) Sir Paul Reeves. It was clear our combined bid would be a partnership with full collaboration. There was always a double-act kind of approach in the presentations. I had the privilege to lead many of the presentations for example to Michael Cullen and others."

Richard says that as a result, a lot of his time on sabbatical leave (at Massachusetts Institute of Technology) was spent on phone calls: "I was taken to meetings 'in a box' – one of those early black polycom speaker phones - and I'd dial in."

Fellow founding Investigator (and now Emeritus Professor) Alison Downard, who was brought into the Canterbury meetings at that time, recalls Richard dialling into meetings on the polycom speaker phone. "Richard was definitely a major driver of the bid development."
University of Otago researcher Keith Gordon, who was involved in the VUW bid, says it was interesting to see how Sir Paul couched it:
"The mentality of how to work collaboratively with people didn't exist much in NZ, because you needed to move from A to B to do that. Interacting within NZ wasn't valued. This had created a certain culture that Paul pretty much didn't agree with. He managed to convince the government that these people really did want to work together, which they did. And when promoting the Institute in later years, he would be adamant that the success of someone in Auckland or Canterbury was success of the Institute."

Simon Brown adds, "It was a real credit to Paul that he went out of his way to make sure that Canterbury, as a co-host of the Institute, shared the limelight as much as possible. For example, it was very common in those days for politicians to be pointed towards the Canterbury nanofabrication facilities."

Jeff Tallon who wrote the first half of the combined bid recalls that David Bibby, who was Pro Vice-Chancellor of Science, Engineering, and Architecture and Design at VUW at the time, had been working to bring together the chemists and the physicists:
"David had been speaking with me about my coming to VUW, which I eventually did, and the two of us then convinced Paul Callaghan to come to VUW about six months later. All these movements were directly around the planned establishment of a new materials science institute at VUW that bridged chemistry and physics. Jim Johnston (who was head of chemistry at the time) and I had been drafting a document of establishment for this – the 'Rutherford' Institute was a working title."

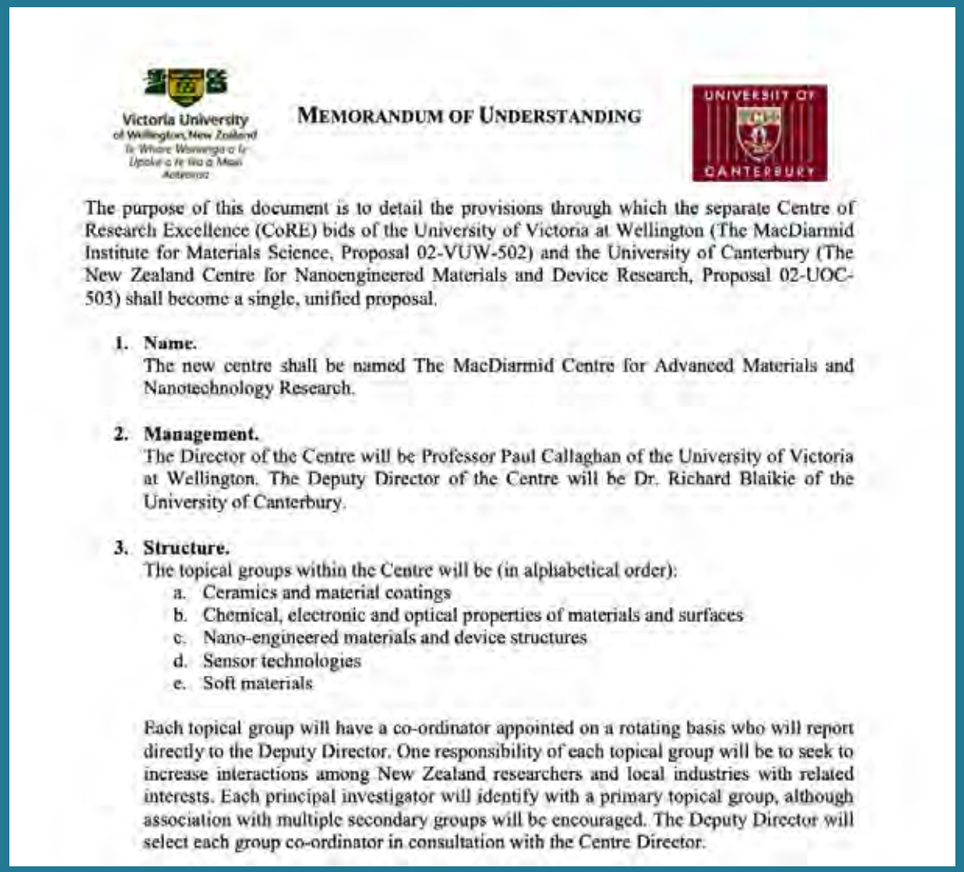
But then, he says, the government announced the invitation to establish CoREs and invited bids:
"It was obvious this was a better thing and better funded, so we switched to drafting the CoRE bid. When we were about halfway through, Paul

Professor Simon Brown

Professor Steve Durbin

Professor Roger Reeves

Professor Alison Downard



Victoria University of Wellington, New Zealand
Te Whare Wānanga o te Ūpoko o te Ika a Māui
Aotearoa

**MEMORANDUM OF UNDERSTANDING**

UNIVERSITY OF CANTERBURY

The purpose of this document is to detail the provisions through which the separate Centre of Research Excellence (CoRE) bids of the University of Victoria at Wellington (The MacDiarmid Institute for Materials Science, Proposal 02-VUW-502) and the University of Canterbury (The New Zealand Centre for Nanoengineered Materials and Device Research, Proposal 02-UOC-503) shall become a single, unified proposal.

1. **Name.**
   The new centre shall be named The MacDiarmid Centre for Advanced Materials and Nanotechnology Research.

2. **Management.**
   The Director of the Centre will be Professor Paul Callaghan of the University of Victoria at Wellington. The Deputy Director of the Centre will be Dr. Richard Blaikie of the University of Canterbury.

3. **Structure.**
   The topical groups within the Centre will be (in alphabetical order):
   a. Ceramics and material coatings
   b. Chemical, electronic and optical properties of materials and surfaces
   c. Nano-engineered materials and device structures
   d. Sensor technologies
   e. Soft materials

   Each topical group will have a co-ordinator appointed on a rotating basis who will report directly to the Deputy Director. One responsibility of each topical group will be to seek to increase interactions among New Zealand researchers and local industries with related interests. Each principal investigator will identify with a primary topical group, although association with multiple secondary groups will be encouraged. The Deputy Director will select each group co-ordinator in consultation with the Centre Director.



Callaghan came onto the scene. To me it was very clear that if Paul was around, the bid would be better led by him with his political name and whole approach with the public – it was just what we needed."

Jeff says Paul Callaghan then took over writing the bid: "He came back to me and asked me to draft the final closing statement, which was incidentally used by the Minister of Science on a number of occasions to articulate the vision for CoREs:"

*Ngā tapuwae*
*We close with a few general observations. Scientific advancement is not fundamentally predicated on the breakthroughs of a few elite individuals but is a collective movement of peer understanding. We build on ngā tapuwae o ngā tupuna - the footsteps of our intellectual predecessors. We build for ngā tapuwae o ngā mokopuna – the footsteps of our intellectual descendants. Though we honour the famous, find inspiration in their tenacity or insight and perhaps model our own ideals on theirs, no individual is indispensable to the progress of science. The absence of a Newton may have tethered the march of science for a mere ten years or so and made little difference to its current state. No individual captures knowledge as his exclusive domain nor should the resources used in the pursuit of knowledge be subject to exclusive capture. Scientific endeavour and technological application are social activities that work best when organised so that the total is much more than the sum of the parts. The challenge of organised science is to harness the champions, use them as mentors and guiding lights but within a team context where individuals may come and go but the peer unit advances from strength to strength. These principles are fervently espoused by the MacDiarmid Institute. We acknowledge ngā tapuwae o ngā tupuna and commit to establish on a sure footing ngā tapuwae o ngā mokopuna o Aotearoa.*

Keith Gordon says Paul led the change in the culture: "Someone had to pull it all together and convince the more senior university staff to take the chance and convince government to shell out a ton of money."

Joe Trodahl agrees: "The bid was successful in no small part to Paul's personality. He connected very well with everyone. He could speak just as easily to politicians as to the whole country. That's what made the big difference."

So an Institute was born, on 1 July 2002, beginning as it meant to go on as a true partnership, initially between researchers at VUW, Canterbury, Industrial Research Limited (now Callaghan Innovation), Otago, Massey and GNS, and later extending to include Auckland and Callaghan Innovation. The genetic pedigree was clear, building on 'Ngā tapuwae o ngā tupuna'- the footsteps of our ancestors - or in this case, intellectual predecessors - much like any new life. And like any new creature, the total was immediately more than the sum of its parts.

Professor Joe Trodahl

*"Richard, Jeff and all the others made an excellent team. And we were just so fortunate to have Paul Callaghan as our figurehead."*

**PROFESSOR SIMON BROWN**

Professor Keith Gordon

No one has been able to describe exactly where they were when they heard news of the success of the bid, beyond saying that it was likely that bottles of champagne were bought. Simon reckons they were pretty confident: "By the time the bid went in, there was a sense we'd nailed it. We knew what the panel was looking for. We benefited enormously from Paul's understanding of politics and sense of what was needed to make this an outstanding bid. It was very clear the director had to have mana, as Paul did, as well as Jeff (Tallon) and others involved.

"Richard, Jeff and all the others made an excellent team. And we were just so fortunate to have Paul Callaghan as our figurehead."

# First Director’s piece - 2003


This newsletter is the first of a regular series of bulletins in which we will communicate the work of the MacDiarmid Institute to our friends and stakeholders. In this issue we report on just a few of our activities and as you read this you will gain a flavour of what we stand for. Yes, of course, we are about advanced materials and nanotechnology. But we are, in my view, about something much larger than that. Of all the CoREs, we are unusually committed to being a “distributed centre”, an oxymoron if you will, but an idea whose time has come. We stand for a sense of partnership in which the corporate ego of any one university will be secondary. Victoria, Canterbury, Otago or Massey universities can all feel proud of us.

But we are equally determined that we will draw on the strengths of our Crown Research Institute partners, Industrial Research Limited (IRL) and the Institute of Geological and Nuclear Sciences Limited (GNS). In turn, we want to impact on the way they see their future. In the end we need to build something new, crossing the boundaries of universities and CRIs to build a critical mass out of New Zealand’s fragmented and distributed talent. We are determined in that goal.

The first six months at the MacDiarmid Institute have been spent in hectic implementation, focused on ordering and installing the new research equipment that was made possible by the capital injection to the CoRE. With the operating funding, which has now started to flow, we have been able to establish new positions, prepare advertisements and select appointees. We have advertised for new Principal Investigators and Associate Investigators to join us, using the open and competitive process that we set out in our original plan. Two new PIs will join this year, funded at a rate of $40,000 per annum.
We have also run regular video link- up seminars during these first six months, connecting researchers across the country and as far away as the United States. The Board met in Wellington in August, in an excellent atmosphere of cooperation, and will meet again in Christchurch in March 2003. The expertise which that Board brings to the Institute from the wider research and business community will be of enormous value to us. In February 2003, the International Advisory Board will be invited to comment on our productivity so far.

At the same time many of us have been involved in preparing for AMN-1, the major international conference in Wellington that, this February, will launch the Institute in a very public way. The presence of three Nobel laureates, most of our International Advisory Board, and a large number of other distinguished international speakers will give a prominence to New Zealand materials and nanotechnology research that has rarely been seen in the past. AMN-1 will be opened by the Governor- General Dame Silvia Cartwright and will feature a reception at the Grand Hall of Parliament officiated by the Prime Minister, the Rt Hon. Helen Clark.

In a sense we are still catching our breath. As we look at our new equipment, and as we see new faces arriving and joining our effort, we can only feel a sense of optimism for the future. This is a rather unusual feeling in New Zealand research, but it is welcome and gives us renewed energy. At the same time the optimism is tempered by some harsh realities. First, the New Zealand university system within which our Institute operates is chronically under- funded, especially so in science and engineering. As a consequence we are trying to build world-class science and technology on an infrastructure so diminished that it is barely credible. It functions only because of the nearly superhuman efforts of some remarkably talented and committed people. Second, there is an almost complete disconnection between the agencies of government that deal with education and the agencies that deal with research, science and technology. Whatever the goals of our nation’s RS&T strategy, they will fail if they are not comprehended and incorporated by those who frame policies for tertiary and secondary education. The obstacles the Ministry of Education put in the way of our partnerships with the CRIs have caused us great difficulty, but they have not stopped us in our intent and we have overcome these, by the most creative means. Finally, we are all aware that we while can train the best re- searchers in the world, they may take their skills away from New Zealand.

*Changing the social and economic culture of New Zealand (is) a task a bit big for the MacDiarmid Institute, but we will play our part. We are all in a race against time, a race that can only be won through partnership and understanding.*

While we may produce the best inventions, that intellectual property may yet end up being exploited by the rest of the world. How do we avoid that? We change the social and economic culture of New Zealand. It’s a task a bit big for the MacDiarmid Institute, but we will play our part. We are all in a race against time, a race that can only be won through partnership and understanding.

- Paul Callaghan, 2003

*(We're) crossing the boundaries of universities and CRIs to build a critical mass out of New Zealand’s fragmented and distributed talent*

MacDiarmid
Interface

Issue No 1 February 2003

Inside this issue
Jeff Tallon strikes gold! page 7

## Three Nobel Laureates visit New Zealand

Alan MacDiarmid, Hideki Shirakawa and Alan Heeger will all visit Wellington in February 2003, as part of the MacDiarmid Institute’s Advanced Materials and Nanotechnology conference (AMN-1), to be held at Te Papa and at Victoria University of Wellington. This conference, which has attracted over 250 registrations from around the world, will showcase New Zealand research and bring the world’s leading materials scientists to New Zealand. Professors MacDiarmid, Shirakawa and Heeger won the 2000 Nobel Prize in Chemistry for their discovery of conducting polymers, a development which promises to deliver a new generation of electronic and optical devices. While in Wellington they will present scientific addresses at the conference, speak at a public meeting to be held at Te Papa on the evening of Tuesday 11 February, and unveil a plaque commemorating the Kelburn Parade site of the home of Maurice Wilkins, another New Zealand Nobel prize winner.

Alan MacDiarmid, Hideki Shirakawa and Alan Heeger

## Nanotechnology: the Sum of Success by Alan Samson

Imagine the advantage for the Kiwis if an America’s Cup yacht could be built that was lighter yet stronger than competitors’ models thanks to revolutionary materials designed from scratch in a laboratory. The new materials might allow for a flexible mast that would be untroubled by sudden Hauraki wind shifts, for instance, or for a thin hull coating that markedly reduced the friction with the water. For applied mathematician Shaun Hendy, who works for both Victoria University of Wellington and Industrial Research Limited at Lower Hutt, such a breakthrough is not only inevitable, but relatively imminent. What does a mathematician know about such things? Dr Hendy’s confident prediction is soundly based on some pretty groundbreaking research going on in New Zealand into the underlying processes of inorganic materials - what they comprise and how they function.

The research is being done by scientists at the MacDiarmid Institute for Advanced Materials and Nanotechnology, one of New Zealand’s new “centres of excellence” that spans Victoria and Canterbury Universities,

Continued on page 3

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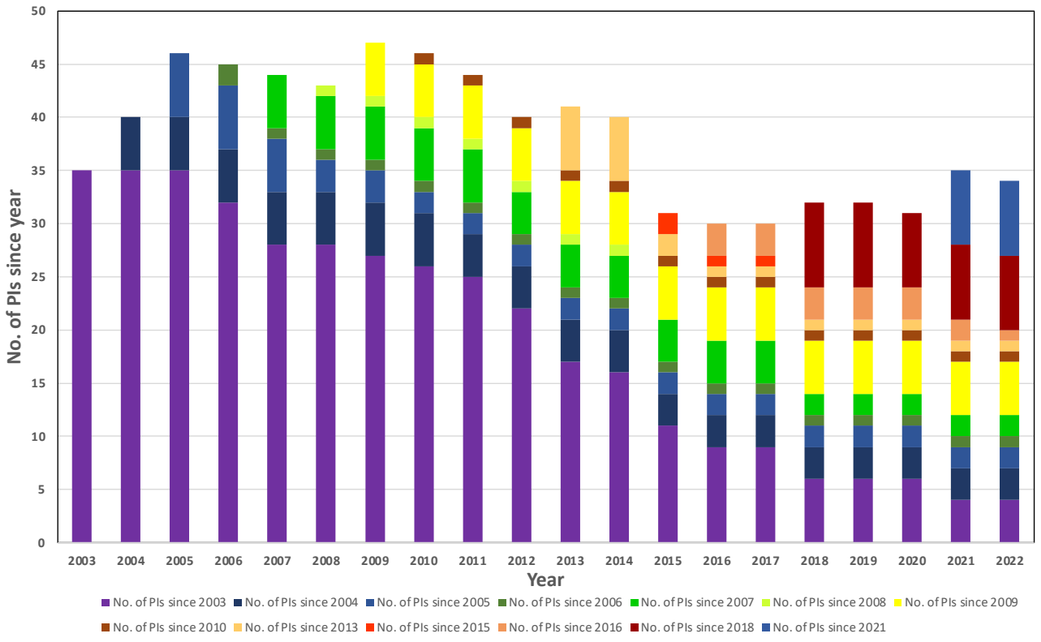
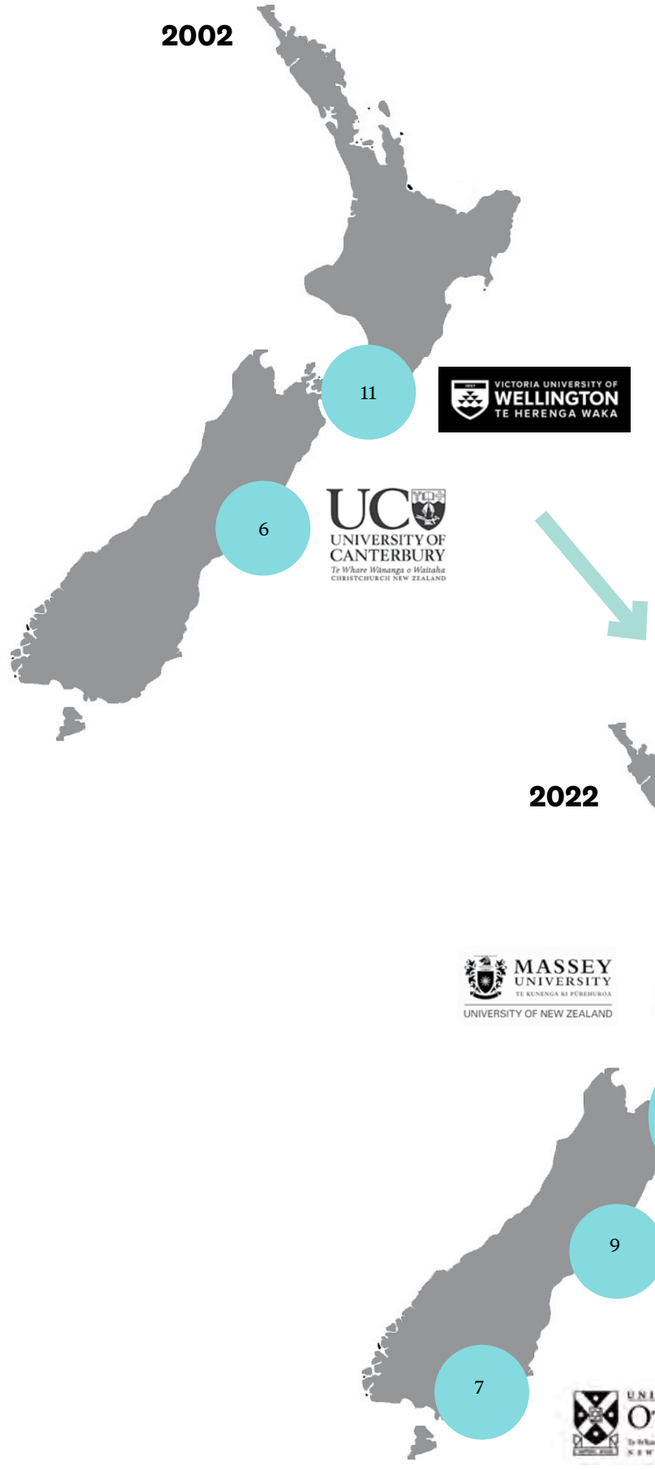
The MacDiarmid Institute
for Advanced Materials and Nanotechnology

*The New Zealand university system within which our Institute operates is chronically under- funded, especially so in science and engineering. As a consequence we are trying to build world-class science and technology on an infrastructure so diminished that it is barely credible.*

# The changing face of the MacDiarmid Institute

Using colour, this graph indicates the years when Principal Investigators joined the Institute, showing that most of our current cohort of Principal Investigators joined since 2009 and that more than 40% of our current Principal Investigators joined in the last five years (since 2018).



# AMN conferences through the ages

When we celebrate an institute, we're celebrating not only an organisation, but all that happens as a result of its existence. In the case of the MacDiarmid Institute, there are many impacts we can point to – the culture-shifts, the camps and scholarships for Māori and Pacific Island secondary and undergraduate students, our alumni pathways, affiliated spin-out companies and, more recently, the development of Mātauranga Māori within the Institute.

One of the most impactful outcomes of the Institute over the past 20 years has been our series of international conferences on advanced materials and nanotechnology (AMN), each of which attracts several hundred delegates from New Zealand and around the world and is the largest in its field in the Southern Hemisphere in the year it is run. The conferences have become a key feature of the materials science landscape in Aotearoa New Zealand.

These biennial in-person conferences have been attended by nine Nobel Prize laureates including Alan MacDiarmid, Alan Heeger, Hideki Shirakawa, Klaus von Klitzing, Stephen Chu, Sir Harry Kroto, Sir Anthony Leggett and Roald Hoffmann. The AMN conferences have offered high-impact presentations at the forefront of their fields.

| | Date | Location | No. of Attendees | NZ delegates | International delegates | No. of Countries |
|---|---|---|---|---|---|---|
| AMN1 | Feb-03 | Wellington | 231 | 184 | 47 | 17 |
| AMN2 | Feb-05 | Queenstown | 413 | 182 | 231 | 30 |
| AMN3 | Feb-07 | Wellington | 450 | * | * | * |
| AMN4 | Feb-09 | Otago | 331 | 182 | 149 | 18 + |
| AMN5 | Feb-11 | Wellington | 392 | 210 | 182 | 30 |
| AMN6 | Feb-13 | Auckland | 454 | 250 | 204 | 27 |
| AMN7 | Feb-15 | Nelson | 524 | 227 | 297 | 34 |
| AMN8 | Feb-17 | Queenstown | 521 | 162 | 359 | 32 |
| AMN9 | Feb-19 | Wellington | 362 | 234 | 128 | 28 |

* No information available


AMN1 (Left to right) Nobel laureates Professors Alan Heeger, Hideki Shirakawa and Alan MacDiarmid


(Left to right) Professor Alan Kaiser with Nobel laureate Professor Klaus von Klitzing

AMN3 (Left to right) Nobel laureates Professors Stephen Chu and Sir Harry Kroto

We asked a couple of our regular international attendees for reflections on the AMNs over the years.

MacDiarmid Institute International Science Advisory Board member and Karlsruhe Institute of Technology Professor Annie Powell has been to every AMN conference since her first AMN (AMN5) in Wellington in 2011. She says that as a molecular scientist, the inclusivity of the AMN conferences has been important and supportive.

"It's awesome that I can be a molecular scientist and still contribute to the materials world. Molecules hold the key to so many things. Some of the most important "large" molecules support our life processes (for example haemoglobin). And when we say "large", we're actually talking about molecules which are small on a materials stage - mostly nanoscale or even smaller. I've enjoyed this about the conferences, and I've noticed the AMNs have become more inclusive over time."

She also says the AMNs are particularly friendly. "Everyone is so welcoming and really appreciative that you've made the effort to travel."

Fellow MacDiarmid Institute International Science Advisory Board member and University of Queensland Professor Matt Trau, who has attended three AMN conferences over the years, says that the conferences are consistently of high value.

"The interdisciplinary nature of the Institute and the AMNs means that scientists from a wide range of backgrounds can join in and meet potential collaborators from related and disparate fields alike".

"The AMN conferences reflect the Institute as a whole. The MacDiarmid Institute is a national treasure. The cross disciplinary, cross-country research programs are of global scale, innovation, and importance. There are so many examples of how high-quality MacDiarmid innovation is building and buttressing the high-tech industrial base in New Zealand. The Mātauranga Māori research programme is also immensely impressive."

AMN5 (Left to right) Sir Anthony J. Leggett with Professor Neil Ashcroft and Sir Richard H. Friend

AMN7 Professors Michael Grätzel from EPFL (left) and Hideo Hosono from Tokyo Institute of Technology opening AMN7

AMN9 Professor Dan Nocera (left) speaking at AMN9 and (right) with NZ's then Minister for Research, Science and Technology, Hon Dr Megan Woods


Alan MacDiarmid Building

We asked our Investigators and students where they saw the Institute in 20 years' time. Here's what they told us.

Enhance. Grow together

In 20 years the MacDiarmid Institute will be a key player in mining the valuable e-waste of previous generations. So Reconfigurable Systems to the max!

Continue to focus on sustainable New Zealand, also translate the knowledge/extend it to answer pressing problems facing the world at large

Having contributed to solving the world's biggest issues, through advice, several successful startups and innovative findings, MacDiarmid Investigators and students prepare to fight the next round of global problems

The MacDiarmid Institute's name will be synonymous with green tech innovations around the country, not just within science circles.

More Māori and Pasifika representation

Materials for a greener planet and skilled workforce

Inspiring and uplifting people in Aotearoa and around the globe through passion, care and diligent determination to create a better world

A GUIDING MATERIALS SCIENCE ORGANISATION IN THE ASIA-PACIFIC REGION

There are many women and Māori in science. In 20 years, equity is not a problem anymore!!!

The MacDiarmid Institute will have helped to cut off the global warming and will have found a way to separate and store CO2 and how to reuse it.

Twenty years from now, New innovative Greentech Working together With Mātauranga Māori Lots of events and workshops Nobel prize winners

Greater inclusion of people with different backgrounds has led to new innovation and out of the box thinking

The MacDiarmid Institute will be internationally recognised for the impact and benefits it has provided Aotearoa and the world through our research and commercialisation activities. We will find ways to not only stop the damage to our planet but also help it to regenerate its resources again.

An internationally recognised Hub and thinktank for Deeptech and Cleantech

A lot more green-economy spinoffs = NZ making big impact globally

I really hope that in 20 years we will be able to keep looking after our planet and that we are completely carbon zero and that we will have found a cure for kauri dieback.

Future of industry focussed innovative tech implanted into global communities

# Te Moana Nui a Kiwa

At the MacDiarmid Institute we are committed to building the capacity and capability of Māori and Pacific people and research through our Mātauranga Māori research programme. Through this, we are building the number of Māori and Pacific researchers within the Institute and growing the next generation of Māori and Pacific Island researchers in the wider RST&I sector. Here we celebrate the establishment of our new Deputy Director Māori position and some of the highlights and achievements of some of our Discovery Scholars.

# 20 years through a Mātauranga Māori lens

Of all the lenses we could apply to the MacDiarmid Institute's 20 years, one of the most important to examine is our work in the Mātauranga Māori space. Institute Deputy Director Māori, Associate Professor Pauline Harris, from Rongomaiwahine, Ngāti Rakaipaaka and Ngāti Kahungunu ki Wairoa, says she knew Paul Callaghan and has watched the Institute's journey in Mātauranga Māori over the years:

"I met Paul Callaghan when he went to the Antarctic with Ocean Mercier and Dan Pringle, and then many other times over the years. I used to ask Paul for advice around Mātauranga Māori. He was always really open to talk to me and gave me feedback on my ideas and questions. Over the years also the Institute has always been really supportive of my science outreach to Māori communities, sharing equipment and gifting outreach packs for the kids, which they very much enjoyed."

Pauline says while there were early movements towards building relationships with Māori, particularly through (former Director) Professor Kate McGrath's connections with Taranaki iwi, the earliest MacDiarmid Institute workshops exploring Mātauranga Māori concepts were student-led initiatives, such as the 2015 symposium organised by Bart Ludbrook on 'Mātauranga Māori, Nanotechnology and Advanced Materials'.

She says the Institute has come leaps and bounds in this regard over the last four years in terms of developing relationships and engaging with Mātauranga Māori and Māori on a variety of projects: "The Institute has grown in its ability to nurture and grow these relationships and connect with Māori business in the economic space. And there is now a genuine desire to work with iwi Māori on environmental issues, to develop capacity and capability, and to develop young Māori as well. And, importantly, this commitment to capability and capacity development has been done with Māori leading it."

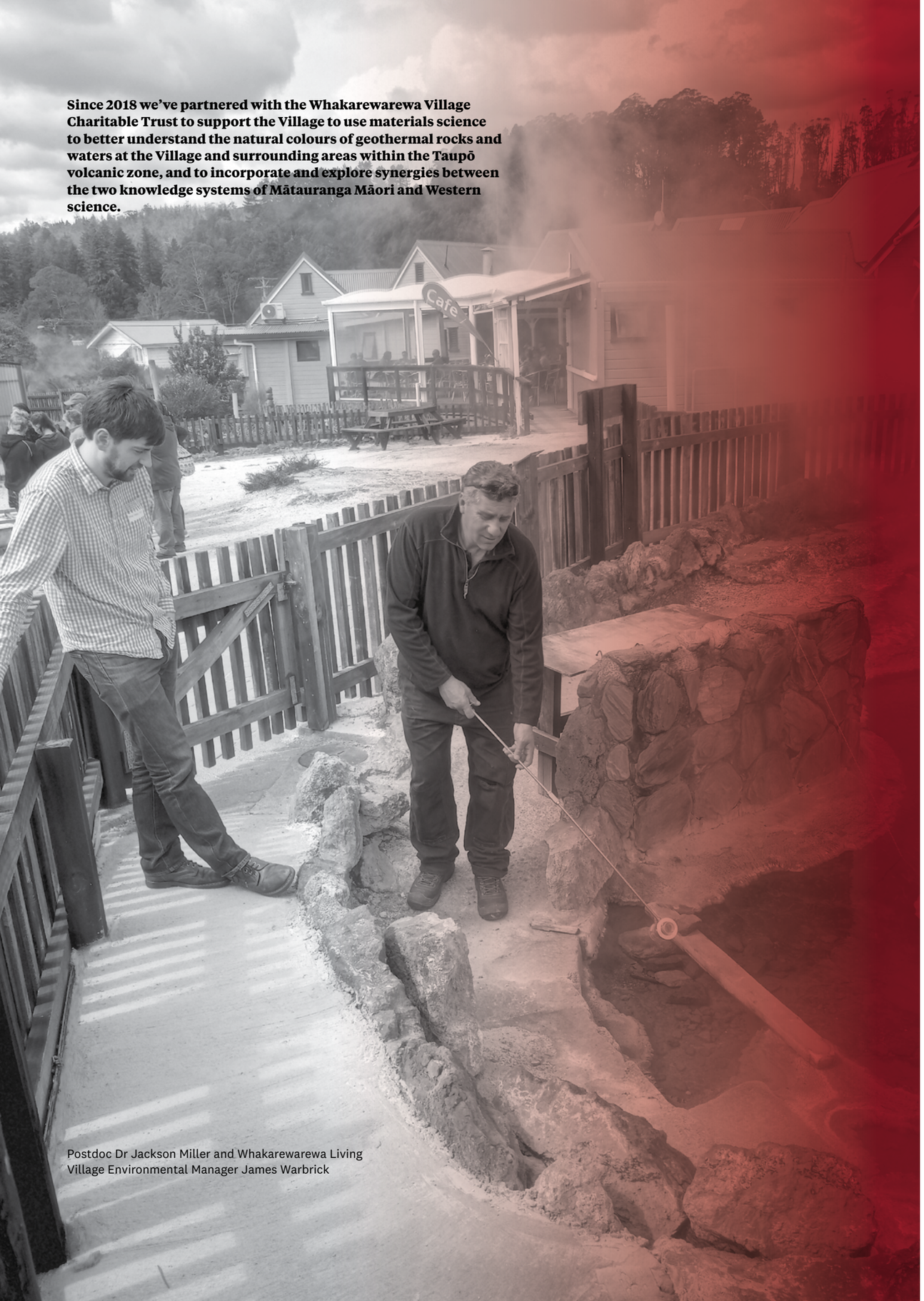
Pauline says she's seen the growth, from the original kōrero in the original 2002 bid to the forming of the Discovery Awards in 2008 (later known as DiscoveryCamp), the Discovery Scholarships (which were set up in 2020), her Science Executive position, and the establishment (this year) of the position of Deputy Director Māori:
"People talk about having Māori PhD students working in this space, but actually we first need to grow the pipeline of Māori and Pacific Island students in the undergraduate physical sciences and Mātauranga Māori and Pūtaiao Māori. We already now have 43 Discovery Scholarship alumni. It's really exciting because people do a lot of talking about needing Māori physics students and wanting to grow the pipeline, but the MacDiarmid Institute is actually doing it. The Institute has made a commitment not just to education, but to Māori education, and to bringing on board Māori and Pacific Island researchers and has now committed to a Mātauranga Māori Research programme, and most recently to a Deputy Director Māori position, which shows inclusivity of Māori in leadership roles within the Institute.

"I've watched the growth of the MacDiarmid Institute over the past 20 years, and seen it blossom in the last four to five years, really embedding Mātauranga Māori and Pūtaiao Māori. It's given us a platform to help grow the pipeline.

"It feels like a really safe place for us to be able to do the work we need to do. I do feel really respected. The Institute is a good home to grow our research and our people."

**"It feels like a really safe place for us to be able to do the work we need to do. I do feel really respected. The Institute is a good home to grow our research and our people."**

**Since 2018 we've partnered with the Whakarewarewa Village Charitable Trust to support the Village to use materials science to better understand the natural colours of geothermal rocks and waters at the Village and surrounding areas within the Taupō volcanic zone, and to incorporate and explore synergies between the two knowledge systems of Mātauranga Māori and Western science.**




Postdoc Dr Jackson Miller and Whakarewarewa Living Village Environmental Manager James Warbrick

# Discovery Scholarships

We have since 2020 offered our Discovery Scholarship programme for Māori and Pacific Island students in science. This is an extension of our long running DiscoveryCamp programme, and supports students studying in the physical sciences, chemical/materials engineering, Māori sciences or sciences related to sustainable innovation. For new scholarship recipients, the award covers university fees up to $8,000 for the 2023 academic year and a one-off cash award of up to $3,000, and previous recipients are able to apply for Te Huarahi ki Mua Award category, which awards recipients a one-off cash award of up to $3,000.

**Number of scholarships awarded**

2020 — 15
2021 — 23
2022 — 22

**Discovery Scholar highlight**

Discovery Scholar Jesse Wood had his first conference paper accepted. Wood, J., Nguyen, B. H., Xue, B., Zhang, M., & Killeen, D. (2022, December). *Automated Fish Classification Using Unprocessed Fatty Acid Chromatographic Data*.

Jesse flew to Perth to present his paper at the Australia Joint Conference on Artificial Intelligence 2022 in December.

*"The honour of being a Discovery Scholarship recipient enabled me to start my Masters paper early. I'm a step closer to achieving my goals. Fa'afetai, Fa'afetai tele lavā."*

**JESSICCA USU**

*"Being the first in my whānau to attend university has given me an immense sense of pride."*

**ZACK AVERY**

*"This scholarship will benefit me immensely, as it supports the momentum of my dreams for te taiao (the natural world), the moana and my people."*

**PIANINA KAHUI- MCCONNELL**

*"Receiving this opportunity has put me closer to my dream of contributing to instrumental changes in science in Aotearoa."*

**LUCAS LARRAMAN**

# Rhodes Trust trip to Oxford


Deputy Director Associate Professor Pauline Harris and Discovery Scholar Juliet Nelson, at the dinner hosted by the Atlantic (Rhodes) Trust in Oxford, England

Our Deputy Director Māori Associate Professor Pauline Harris travelled to Oxford in October with Juliet Nelson. Juliet is one of our Discovery Scholarship alumni and a former Honours student of Principal Investigator Professor Nicola Gaston. They were joined by MacDiarmid Institute Board Chair Hēmi Rolleston and Principal Investigator Professor Duncan McGillivray along with a wider group of 40 students and mentors from iwi across Aotearoa. The group was hosted by the Rhodes (Atlantic) Trust.

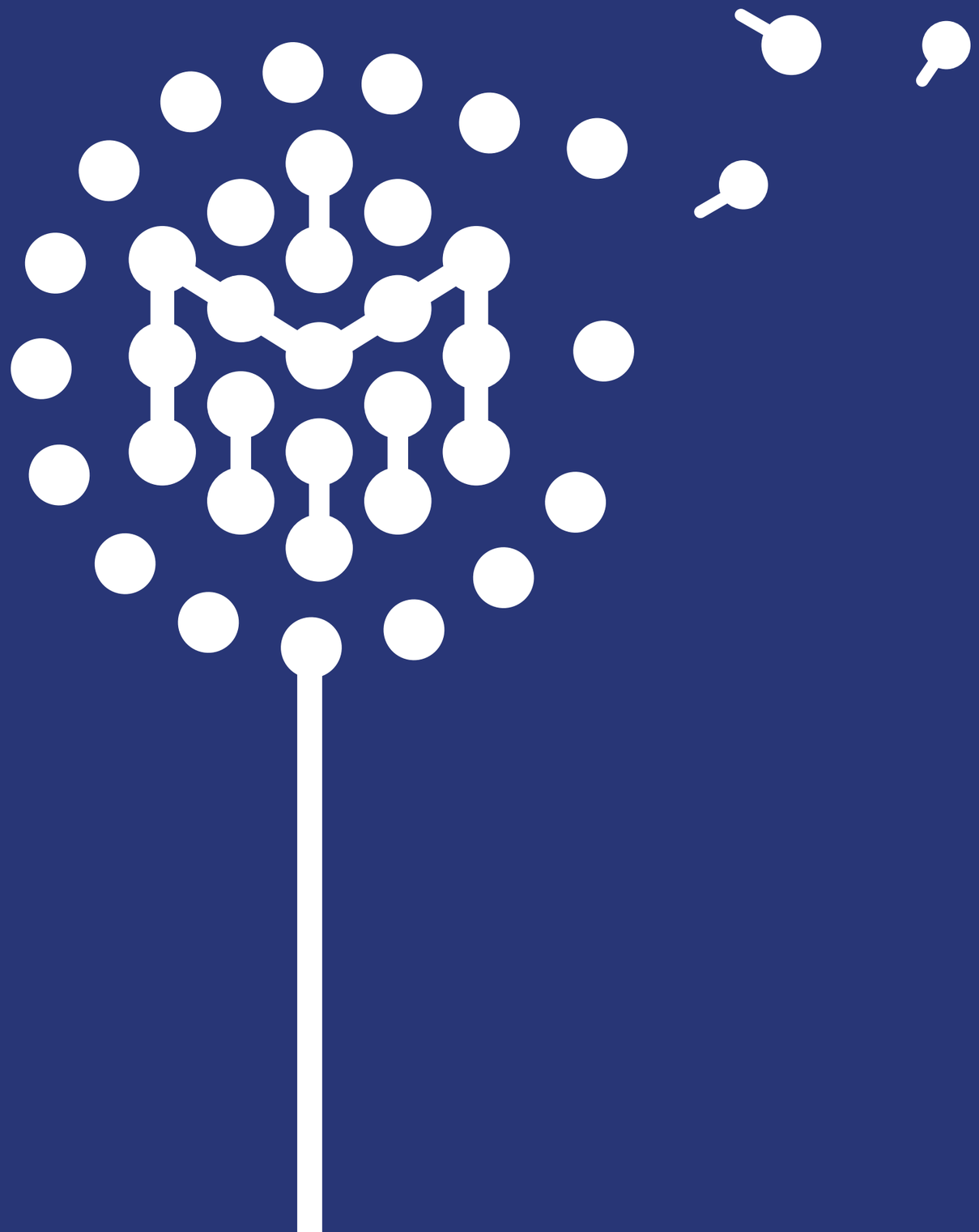
The aim of the trip was to encourage more Māori to apply to the Rhodes scholarship and the like.

Māori are significantly under-represented (only three of the more than 247 New Zealand Rhodes scholars selected since 1904 were Māori). This visit follows the legacy from one of the first Māori to attend Oxford, Makereti Papakura from Whakarewarewa Village, nearly 100 years ago. The trip included an Inaugural Makereti Papakura talk delivered by Professor Linda Tuhiwai Smith. The group visited different departments and colleges to gain a better understanding of the opportunities at Oxford. Juliet and Pauline visited the Physics department and met with the head of department of Physics Professor Ian Shipsey, who gave a tour of the department and arranged for his students to talk about their experiences at Oxford. This was then followed by meet and greet with others including collaborators of Principal Investigator Professor Justin Hodgkiss. Juliet and Pauline were given a tour and met with Professor Henry Snaith's group. They shared their research, what they were doing and what it was like at Oxford.

Current Rhodes Scholar Rhieve Grey (Ngāti Tūwharetoa ki Taupō, Ngāti Manunui, Ngāti Porou), who helped the group organise the visit, describes his journey of getting to Oxford and the strong Māori women who influenced and supported him:
https://thespinoff.co.nz/atea/25-04-2022/the-indigenous-women-who-got-me-to-oxford

Here is the latest news from the actual trip from local Māori media Waatea News:
https://waateanews.com/2022/10/13/plan-for-maori-rhodes-scholars/
https://www.auckland.ac.nz/en/news/2020/11/26/rhodes-scholar-puts-the-mahi-in-to-combat-social-inequality.html





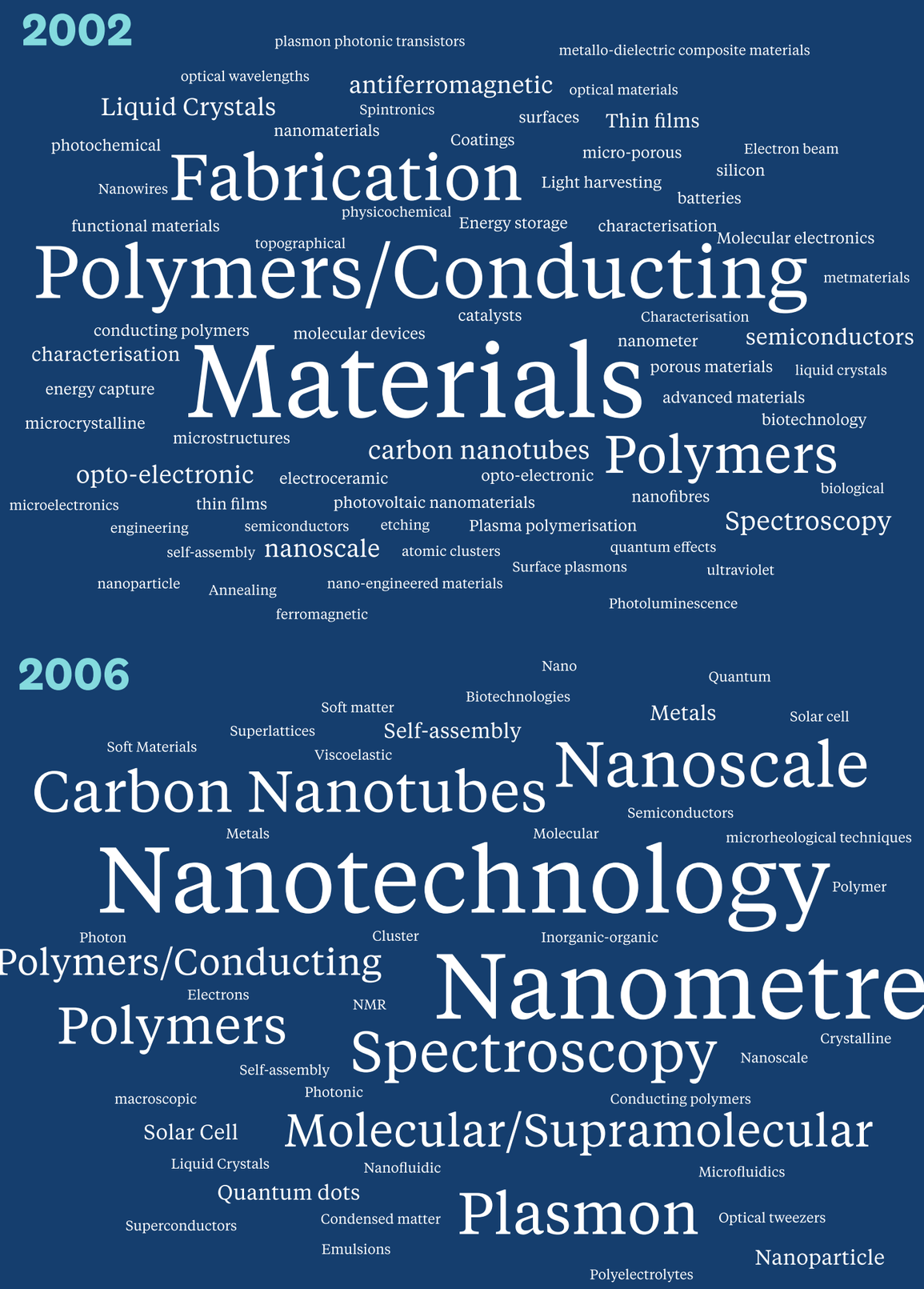
# Out of the lab

Many technologies that we've come to depend upon in our daily lives are currently unsustainable in one way or another, whether through their embodied carbon or the depletion and environmental cost of the materials they're made from. MacDiarmid Institute researchers spanning diverse scientific backgrounds are pursuing ways to produce low-emissions materials, in order to add hi-tech functionality to abundant materials and waste, and even create biodegradable technologies.

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

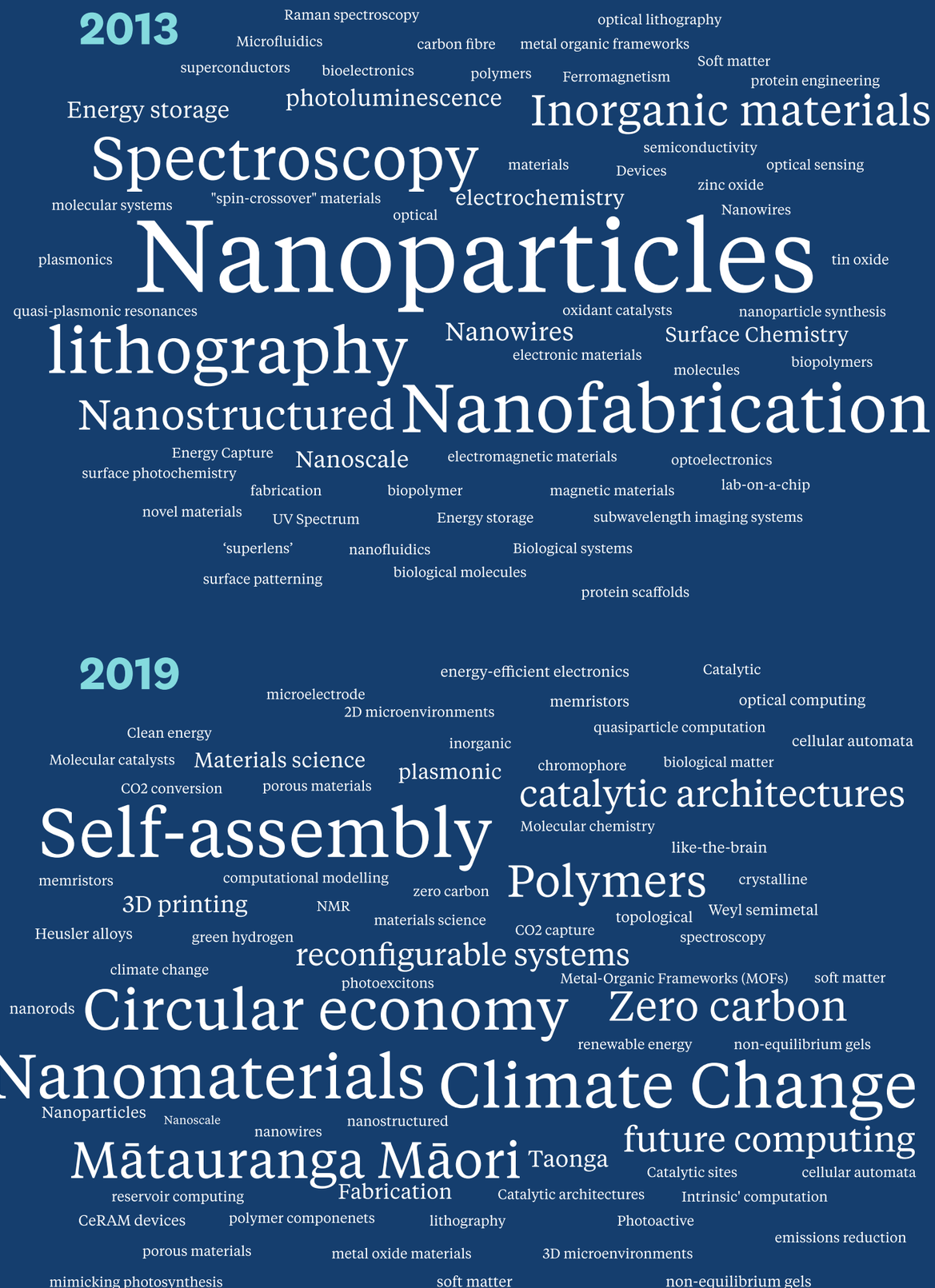

PLOS ONE
Drop impact of dairy product solution
Ayoub Abdollahi, Frederick S. Wells, Ali M. Geoff R. Willmott
ACS Catalysis
Influence of Carbon Support on the Pyrolysis of Phthalocyanine for the Efficient Electroreduction
Michael S. Bennington, Bernt Johannessen, Jessica Han, Golovko, and Aaron T. Marshall
Nano Energy
Selective photothermal CO2 reduction to CO, CH4, alkanes, alkenes over bimetallic alloy catalysts derived from layered double hydroxide nanosheets
Jiaqing Zhao, Run Shi, Geof
ChemComm
HIGHLIGHT
The ultimate Lewis fluorophe siloxane a
PNAS
RESEARCH ARTICLE
The photoprotection mechanism in the black-brown pigment eumelanin
Significance
PHYSICAL REVIEW B 106, 144414 (2022)
Two-channel anomalous Hall effect originating from the intermixing in Mn2CoAl/Pd thin films
Yao Zhang, Simon Granville
ROYAL SOCIETY OF CHEMISTRY
Neural Networks
Reservoir computing with 3D nanowire networks
R.K. Daniels, J.B. Mallinson, Z.E. Heywood, P.J. Bones, M.D. Arnold, S.A. Brown
Use of localised low-carbon geological materials for eco-papakāinga establishment in degraded geothermal environments: Ngāti Tahu hapū at Ohaki, New Zealand
Oliver E. McLeod, Te Herenga Waka / Victoria University of Wellington, New Zealand
Diane Bradshaw, Stakeholder Relations Māori Strategy & Partnerships, GNS Science / Te Pū Ao
Wairakei, Taupō, New Zealand – MacDiarmid Institute, Te Herenga Waka / Victoria University of Wellington, New Zealand
Kora, Tahorakuri A1 Section 30 Trust – Research Partnership, GNS Science / Te Pū Ao
Wairakei, Taupō, New Zealand
RESEARCH ARTICLE
A Novel Electrochemically Switchable Conductive Polymer Interface for Controlled Capture and Release of Chemical and Biological Entities
ADVANCED MATERIALS INTERFACES
CRYSTALLIZATION
Liquid metal synthesis solvents for metallic crystals
Shahada A. Idrus-
Colloids and Surfaces A: Physicochemical and Engineering Aspects
Colloids and Surfac Engin
Journal of Colloid and Interface Science
Interfacial colloidal assembly guided by optical tweezers and tuned via surface charge
Susav Pradhan, Catherine P. Whitby, Martin A.K. Williams, Jack L.Y. Chen, Ebubekir Avci
GRAPHICAL ABSTRACT
Journal of Catalysis
d from computationally-
sts
Arnar Sveinbjörnsson, Jónsdóttir, Anna I. Garden, Lewin, Younes Abghoui, Árni S. Ingason

**Word clouds drawn from our research plans prepared for TEC**












# Our research programmes over the years

Professor Richard Blaikie (Deputy Director upon the Institute's establishment in 2002 and the Institute's Director from 2008-2011) says the evolution of the Institute's research programmes over time clearly showed both the adoption of new research areas and that many of the Institute's core research elements had endured.

"Clearly there are elements of using materials' properties at the nanoscale that are enduring, via chemical physical or engineering approaches, but with an evolution to move the focus of applications more towards global challenges of climate change and sustainability."

He says it was very positive to see more prominence for Mātauranga Māori and recalls that there had been initiatives in the Mātauranga Māori space right from the start.

"There had been support for te reo Māori physics resources in collaboration with the NZIP from right at the time of our founding in 2002."

Looking at the research programmes over time, founding Principal Investigator Professor Jeff Tallon notes that the Institute's superconductivity work had shifted substantially from fundamental research to applied and development research.

"There's a sharp focus on mission-led research rather than blue skies research back at the beginning."

Professor Simon Brown, who has been a Principal Investigator with the Institute since 2002, says he had noticed a shift towards chemistry and biology since the first days of the Institute.

"There were of course researchers at the outset who focused in this area, and the link to Alan MacDiarmid himself of course was strong, so polymers were already a big feature. There was also more of emphasis on nanofabrication in the early days."

Principal Investigator Professor Sally Brooker, who joined the Institute in 2008, says that a particular highlight for her was seeing the substantial growth in the extent and depth of our partnership with iwi.

"You can see this illustrated in the word clouds by the increasing prominence of the words 'Mātauranga Māori' and 'Taonga' in our rebid in 2019. Our commitment to continuing to accelerate this growth is clearly demonstrated by the recent appointment of Associate Professor Pauline Harris as the Institute's inaugural Deputy Director Māori, and of Diane Bradshaw as Stakeholder Relations Partner Iwi."

*"There has been an evolution to move the focus of applications more towards global challenges of climate change and sustainability."*

She says the word clouds also showed a significant shift over the years towards directly addressing the many aspects of climate change.

"Climate change is a huge current challenge that our MacDiarmid Institute team is well placed to contribute to addressing. The Institute's directors over the years, in particular our founding Director Sir Paul Callaghan and our current Co-Directors Professors Nicola Gaston and Justin Hodgkiss, are to be congratulated on leading these substantial and strategic shifts in focus as the Institute and its research has evolved.

"It is essential that we as an Institute continue to develop and evolve to remain current and relevant."

Sally says the word clouds also reveal that a consistent theme over the years has been 'polymers', and in particular 'conducting polymers'.

"This is highly appropriate given that it was conducting polymers that led to Professor Alan McDiarmid's Nobel Prize in Chemistry."

*"There's a sharp focus on mission-led research rather than blue skies research back at the beginning."*

**PROFESSOR JEFF TALLON**

# Awards 2022

**Ebu Avci** – Massey University
2022 College Research Award – Early Career (Massey University)

**David Barker** – University of Auckland
Research Excellence Medal (University of Auckland Research Awards)

**Jack Chen** – Auckland University of Technology
Science of Synthesis Early Career Advisory Board (Thieme Chemistry, Stuttgart, Germany)

**Vladimir Golovko** – University of Canterbury
AINSE Service Recognition Award (Australian Institute of Nuclear Science and Engineering)

**Justin Hodgkiss** - Victoria University of Wellington
Researcher Entrepreneur Award (KiwiNet Research Commercialisation Awards)

**Eric Le Ru** - Victoria University of Wellington
MaramaLabs named in top 200 exporters in TIN report

**Aaron Marshall** – University of Canterbury
Established Researcher Award (University of Canterbury Faculty of Engineering)

**Kim McKelvey** - Victoria University of Wellington
Early Career Researcher Excellence Award (Victoria University of Wellington)

**Franck Natali** – Victoria University of Wellington
Asian Entrepreneurship Award 2022 – 3rd prize (Liquium)
Research Excellence Award (Victoria University of Wellington Staff Awards)

**Volker Nock** – University of Canterbury
Runner-up Research Prize (Food, Fibre and Agritech Challenge)

**Jadranka Travas-Sejdic** – University of Auckland
Research Excellence Medal (University of Auckland Research Awards)

**Geoff Waterhouse** - University of Auckland
Shorland Medal (New Zealand Association of Scientists)
Highly Cited Researcher (Clarivate Analytics)



# 2022 Funding Successes

## 2022 Marsden Grants – Fast Start

**Geoff Waterhouse*** – University of Auckland
“Structural and magnetic Properties of Co implanted diamond-like carbon films deposited by ion beam methods”

## 2022 Marsden Grants

**Baptiste Auguié, Eric Le Ru* and Volker Nock*** - Victoria University of Wellington and University of Canterbury
“UV–vis spectroscopy of ultra-small scattering samples and individual micro-particles”

**Philip Brydon** – University of Otago
“Superconductors that survive ultra-high magnetic fields: Revealing the role of symmetry”

**Renwick Dobson** – University of Canterbury
“TRAPped in an elevator”

**Prasanth Gupta and Geoff Waterhouse*** - GNS and University of Auckland
“Harnessing the power of thermal spikes - A new pathway to fabricate size-controlled transition metal carbide nanoparticles for energy conversion and storage”

**Patricia Hunt and Cameron Weber*** - Victoria University of Wellington and University of Auckland
“Unravelling the electronic structure of highly charged hydrogen- and halogen- bonds; rational chemical design and the creation of novel ionic liquid materials”

**Geoff Jameson** – Massey University
“Structural basis of viral wars: Innate immune system attack on viral genomes and the counterattack by viruses”

**John Kennedy** – GNS
“Can wonder crystal Perovskites transform solar power generation? - Discovering the links between strain and material properties”

**Erin Leitao* and Tilo Söhnel*** – University of Auckland
“A Green Awakening for Radical Chemistry”

**Jami Shepherd*** – University of Auckland
“Hearing and sound communication in crustaceans”

**Contributing as an AI*

## Royal Society Fellowships

**Mathew Anker** - Victoria University of Wellington
Rutherford Discovery Fellowship – “Lanthanide(II) Hydrides for Nitrogen Fixation and Ammonia Production”

## 2022 MBIE Smart Ideas Funding

**Martin Allen** - University of Canterbury
“High-efficiency Gallium Oxide Power Electronics for New Zealand’s Zero Net Emissions Future”

**Ebu Avci** - Massey University
“Smart Robotic Capsule to Advance Management of Gastrointestinal Diseases”

**Jack Chen and Catherine Whitby*** – Auckland University of Technology and Massey University
“Tunable and stimuli-responsive cellulose-based surfactants – from emulsifiers to defoamers”

**Vladimir Golovko*** – University of Canterbury
“*Pūhiko Nukutū: a green hydrogen geostorage battery in Taranaki”

**Simon Granville, Kai Chen* and Keith Gordon*** – Victoria University of Wellington and University of Otago
“Efficient spintronic terahertz emitter for beyond-the-lab applications of terahertz spectroscopy”

**Jim Johnston** - Victoria University of Wellington
“Greater Electricity Generation and Industrial Heat Opportunities from Existing and Greenfields Geothermal Resources”

**Volker Nock and Renwick Dobson*** – University of Canterbury
“A simple capillaric platform for real-time diagnostic devices: Inhouse wine testing as proof-of-principle”

**Geoff Waterhouse** – University of Auckland
“High-energy density rechargeable seawater batteries for marine renewable energy storage”

**Mark Waterland** – Massey University
“The bite of the bumblebee: Biomimicry in flower synchronization”

**Contributing as a Key Researcher*

## 2022 Other MBIE Funding

**Sally Brooker, Nigel Lucas and Chris Bumby** – University of Otago and Victoria University of Wellington
"Safe, low-cost, hydrogen storage materials from New Zealand resources"
Catalyst: Strategic – New Zealand-Germany Green Hydrogen Research Programme

**Justin Hodgkiss** - Victoria University of Wellington
"Towards a Next-Generation Material Data Platform - A New Zealand-Japan Collaboration"
Catalyst: Seeding - New Zealand-Japan Joint Research Project

**Aaron Marshall, Kim McKelvey and Geoff Waterhouse** – University of Canterbury, Victoria University of Wellington and University of Auckland
"Development of highly active anodes for anion exchange membrane electrolysers to enable low-cost green hydrogen"
Catalyst: Strategic – New Zealand-Germany Green Hydrogen Research Programme

**Ben Yin** - Victoria University of Wellington
"Catalytic Membrane Reactor for CO2 Hydrogenation to Methanol"
Catalyst: Seeding General

## 2022 NSC (National Science Challenge) Grants

**Jadranka Travas-Sejdic** – University of Auckland
"Microfluidic cytometer biosensor platform for novel detection of Phytophthora agathidicida" New Zealand's Biological Heritage

## 2022 Domestic Funding – Other

**Ebu Avci** – Massey University
Summer project internship - Palmerston North Medical Research Fund

**David Barker** – University of Auckland
"Development of New Lipophilic Bcl-2 Inhibitors for Pediatric Glioblastoma Multiforme Treatment" Cure Kids NZ Project Grant

**Chris Bumby** - Victoria University of Wellington
"Green Steel Heater Technology" Kiwinet Tier 2

**Jack Chen** – Auckland University of Technology
"Spherelose™" KiwiNet Tier 2

**Kai Chen** - Victoria University of Wellington
"Photo-responsive thrombin inhibitors enable precise control of localised antithrombotic therapy" Heart Research Institute Internal Grant

**Matthew Cowan** – University of Canterbury
- New Zealand Product Accelerator Master's Scholarship
- Consulting projects (12 weeks)
- Investment into start-up company Permeance Limited

**Laura Domigan** – University of Auckland
- "CellCo Aotearoa: New 5th Quarter Products (Opo Bio Application)" AgMardt
- Seed funding for Opo Bio Ltd

**Aaron Marshall** – University of Canterbury
Fee for service - Zincovery

**Duncan McGillivray** – University of Auckland
Consultancy on a legal case

**Volker Nock** – University of Canterbury
"Microfluidic assays for in-field pathogen detection" Postgraduate Scholarship Grant - Ministry of Primary Industries

**Geoff Waterhouse** – University of Auckland
- "Efficient catalysts for the synthesis of liquid biofuels" Energy Education Trust of New Zealand Project Fund
- "Rechargeable metal-air batteries" Philanthropic donation

**Cameron Weber** – University of Auckland
"Tisane - Sleak Initial Tests" Industry fee-for-service – New Zealand Product Accelerator
"Supercare NZ Ltd – Envirocare" Industry fee-for-service – New Zealand Product Accelerator

**Geoff Willmott** – University of Auckland
- Fonterra-sponsored PhD studentship
- Fonterra-sponsored summer studentship

**Ben Yin** - Victoria University of Wellington
"System design and consultation for Globex Engineering" Consultation fee



## 2022 International Funding

**Jenny Malmström** – University of Auckland
"SANS study on conducting polymer hydrogels (pNIPAM/PPy) to investigate temperature responsiveness, physically actuating properties, and interpenetration of components" SANS experiment

**Cameron Weber** – University of Auckland
"Understanding the Effect of Co-Solvents and Composition on the Amphiphilic Nanostructures of Ionic Liquids and Deep Eutectic Solvents" Australian Synchrotron Beamtime

## 2022 University Internal Funding

**Ebu Avci** – Massey University
"Reconfigurable Microrobots with Programmable Assembly Behaviour" Massey University Strategic Research Excellence Fund

**Kai Chen** - Victoria University of Wellington
"Toward next-generation terahertz spectrometer with spintronics emitter and advanced femtosecond laser" Faculty Strategic Research Grant

**Patricia Hunt** - Victoria University of Wellington
"SNAP: VUW Hub for Simulation, Numerical methods, Analytics and Programming" Faculty Strategic Research Grant

**Jon Kitchen** – Massey University
"On Surface CO 2 catalysis: Lanthanide-based coatings for CO 2 activation – towards a CO 2 economy" Massey University Strategic Research Excellence Fund

**Erin Leitao** – University of Auckland
- "FMT Fostering Collaborations" Faculty of Science
- "Transdisciplinary fund for PFAS free Aotearoa" Faculty of Engineering

**Luke Liu** - Victoria University of Wellington
"Hydrogen adsorption in covalent organic frameworks (COFs)" External Research Incentivisation Funding

**Duncan McGillivray** – University of Auckland
"Air Pollution and Environmental Equity in Aotearoa New Zealand" Postdoctoral position

**Franck Natali** - Victoria University of Wellington
"Fundamental understanding of the nitrogen – lanthanide chemical reaction for green and effective ammonia production" Research Excellence Award

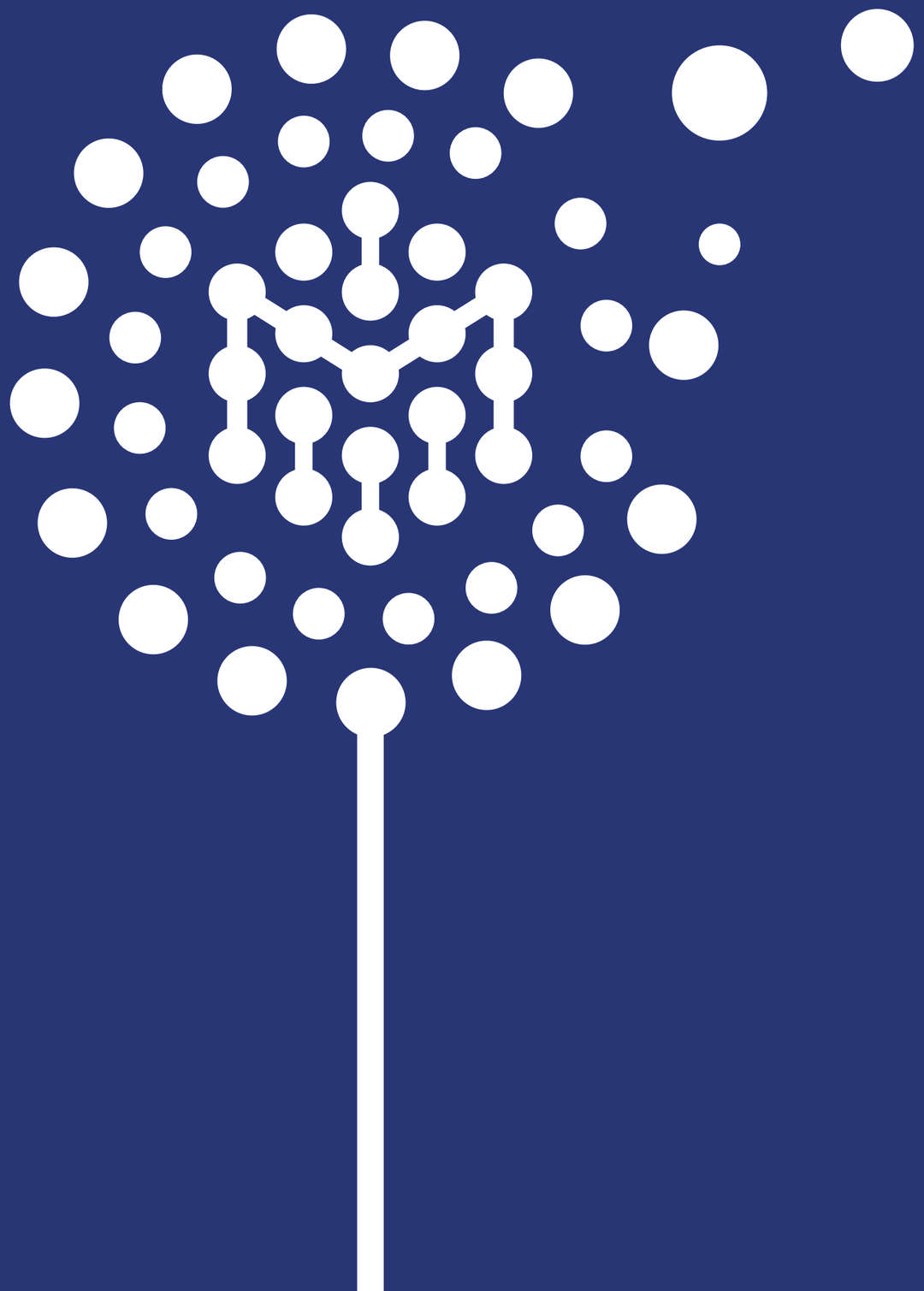
**Volker Nock** – University of Canterbury
Automatic Milling Machine – CAPEX

**Jadranka Travas-Sejdic** – University of Auckland
- "A highly programmable bioactive delivery platform based on novel conductive polymers" Research Development Fund: Fostering Collaboration
- "Near Miss Research Centre: Innovative Materials for Health" Research Development Fund

**Geoff Waterhouse** – University of Auckland
"Electrifying hydrogen peroxide synthesis" Faculty of Science Research Development Fund

**Cameron Weber** – University of Auckland
"Intensifying Hydrogenation Reactions in Ionic Liquids Using a Vortex Fluidic Device" New Staff Fund

**Ben Yin** - Victoria University of Wellington
- "Programming mixed matrix membranes for CO2 capture" Faculty Research Establishment Grant
- Mātauranga Māori Research Fund



# Into the marketplace

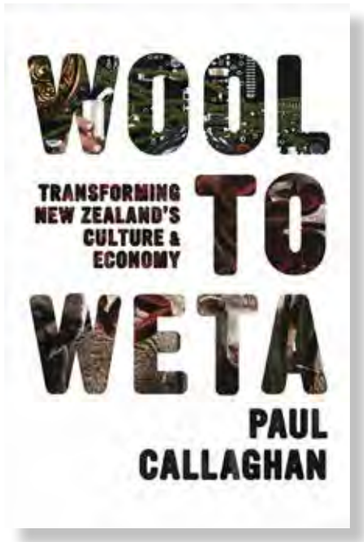
After 20 years of Commercialisation and Industry Engagement at the MacDiarmid Institute, there are many successes and stories to tell. For this year's Annual Report we are featuring a perspective on the beginnings, growth, present and future of the Institute's path to impact in this area. Meanwhile, the Institute had an outstandingly successful year at the 2022 KiwiNet Research Commercialisation Awards, and the award winners provide an excellent illustration of our trajectory.

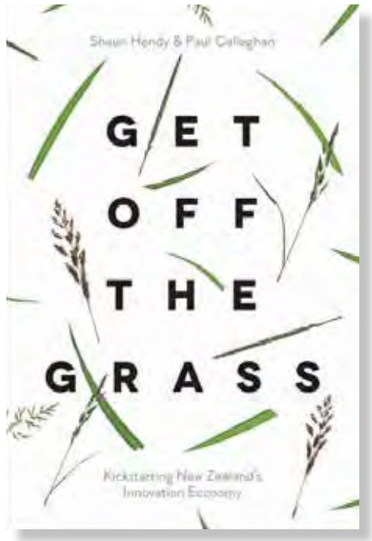
# 20 years of commercialisation and industry engagement

At the MacDiarmid Institute, we like to say that "commercialisation is in our DNA". From the start, our founding director Sir Paul Callaghan's vision was to stimulate greater productivity and diversification in New Zealand's economy through advanced materials science. Sir Paul put forth this vision in two books with titles that speak for themselves: *Wool to Weta*, and (with Shaun Hendy) *Get off the Grass*. Sir Paul's legacy was honoured in the naming of Callaghan Innovation. His company Magritek, that began as a start-up, is now a global leader in manufacturing NMR, and won the Commercialisation Impact Award at this year's KiwiNet Awards. In his acceptance speech, Magritek CEO Dr Andrew Coy spoke of Sir Paul's vision for that company using another of our favourite quotes at the MacDiarmid Institute:

*"We will be good at what we are good at."*

**SIR PAUL CALLAGHAN**





Dr Andrew Coy accepting the KiwiNet Commercialisation Impact Award on behalf of Magritek

*"The MacDiarmid Institute was really helpful in the early stages of the company and helped to smooth the transition out of the lab and into the business."*

**FRASER HUGHSON, CO-FOUNDER AND CTO, ALLEGRO ENERGY**

Having a vision is great, but commercialisation is a tough business and tangible commercial impact was not quickly forthcoming during the first decade of the Institute. A corner was turned in 2011 with the founding of Engender, a MacDiarmid-affiliated spin-out company led by Professor Cather Simpson, who was awarded the Commercialisation Icon Award at this year's KiwiNet Awards. Other influential figures included Ray Thompson, an entrepreneurial Board Chair, and Professor David Williams, who brought commercial experience from a successful career in the UK. Through the work of such pioneers, connections were built between researchers and investors, and the roles of those in the commercialisation ecosystem became clearer. After generating three affiliated spin-outs prior to 2011, the Institute can now count 27. Of those, 41% have MacDiarmid Institute women (Investigators and alumni) as founders or CEOs, with a higher proportion of women founding and leading these companies in more recent times.



Professor Cather Simpson was awarded the Commercialistion Icon Award at the KiwiNet Awards

Today, the MacDiarmid Institute is regularly producing at least two affiliated spin-out companies per year, and five of our researchers indicate their intention to spin out a company in 2023. Our contribution to industry partners is similarly strong and regular. With the ecosystem maturing, the Institute introduced initiatives such as seed funding for commercial projects, enhanced industry engagement through an Interface programme and Tech Week events, and a focus on training opportunities for all members of the Institute.

Our Co-Director Professor Justin Hodgkiss was instrumental in many of these changes, and this year Justin won the Research Entrepreneur Award at the KiwiNet Awards, having led the spectroscopy spin-out Advemto in addition to his contribution to commercialisation at the Institute. The Institute has performed excellently at the KiwiNet Awards for several years now, and there is a clear correlation between MacDiarmid Institute support and successful outcomes.

Co-Director Professor Justin Hodgkiss won the Researcher Entrepreneur Award at the 2022 KiwiNet Awards

Dr Shalini Divya won the Breakthrough Innovator Award in 2021

Associate Professor Carla Meledandri won the Emerging Innovator Award in 2016

## KiwiNet awards winners with MacDiarmid Institute affiliations 2016 – 2022

| Year | Award | Name | Startup company |
|---|---|---|---|
| 2016 | Emerging Innovator | Carla Meledandri | |
| 2016 | Researcher Entrepreneur | Cather Simpson | Engender, Orbis |
| 2016 | Supreme | Cather Simpson | Engender, Orbis |
| 2019 | Breakthrough Innovator | Shalen Kumar | AuramerBio |
| 2019 | Commercialisation Professional | Will Charles | |
| 2019 | Researcher Entrepreneur | Margaret Brimble | Sapvax |
| 2019 | Supreme | Margaret Brimble | Sapvax |
| 2020 | Breakthrough Innovator | Eldon Tate | Inhibit Coatings |
| 2020 | Researcher Entrepreneur | Jim Johnston | Noble Bond, Inhibit Coatings |
| 2020 | Supreme | Jim Johnston | Noble Bond, Inhibit Coatings |
| 2021 | Breakthrough Innovator | Shalini Divya | TasmanIon |
| 2022 | Breakthrough Innovator | Jonathan Ring | Zincovery |
| 2022 | Commercialisation Icon | Cather Simpson | Engender, Orbis |
| 2022 | Researcher Entrepreneur | Justin Hodgkiss | Advemto |
| 2022 | Commercialisation Impact | Magritek | Magritek |

*The MacDiarmid Institute's research is now called 'Deep Tech' by the various investors who beat a path to our door*

We are not standing still, having introduced commercial skills training webinars, Science Advisory Panels, CEO breakfasts and the Career and Relevant-to-Industry Skills Programme (CRISP) under current Commercialisation Manager Kevin Sheehy. Meanwhile, the MacDiarmid Institute's research is now called 'Deep Tech' by the various investors who beat a path to our door - that is, research and technology based on scientific knowledge that is hard-won over reasonably long timeframes, and that is difficult to replicate. We are also increasingly embracing 'Clean Tech' in alignment with the Institute's focus on materials for sustainability, as exemplified by our alumnus Jono Ring (CEO, Zincovery) who won the Breakthrough Innovator Award at the KiwiNet Awards. Clean Tech directly links to one of Sir Paul's goals, making New Zealand "a place where talent wants to live", and there is also strong resonance with the values embedded in the rapidly growing Māori economy.

Clean Tech: it's difficult to think of a more appropriate and challenging focus for the Institute's impact over the next 20 years and beyond.

Associate Professor Aaron Marshall and Jono Ring, co-founders of Zincovery

Associate Professor Franck Natali, founder of Liquium

# Spin-outs formed in 2022

Matthew Cowan – University of Canterbury
Permeance Limited
Laura Domigan – University of Auckland
Opo Bio Limited

Franck Natali - Victoria University of Wellington
Liquium

Shane Telfer – Massey University
Captivate Technologies


**Affiliated start-up activity data from 10 companies (8 of these are pre-revenue) for the 2022 calendar year:**

Total number of employees (FTE): 47.9
Number of PhDs employed: 23
Number of MacDiarmid Alumni employed: 18
Number of patents applied for: 9
Number of patents granted: 4
Amount spent on R&D: $5.7 million
Amount of capital raised: $10.3 million

Of these companies, 8 are aiming to raise capital during the coming year (2023)
Within our funded researchers, 5 have indicated the intention to spin-out a new company in the coming year (2023)

# Alumni Business Scholarship recipients & where are they now

## 2017 Business Scholarship recipients

**Manmeet Kaur**
Prior to being awarded the Alumni Business Scholarship, Dr Manmeet Kaur had been a postdoctoral research fellow at the University of Auckland and worked as a research scientist at Hi-Aspect Limited, a MacDiarmid Institute affiliated spin-out. She says her previous academic and industrial research experiences motivated her to apply for the scholarship.

*"Knowledge in IP, marketing and commercialisation are fundamental to bridging academia and industry."*

With the scholarship, Manmeet further developed skills required to identify new investments and solutions and make sense of the ever-present uncertainty associated with early-stage ventures and start-ups.

**Master of Commercialisation and Entrepreneurship (University of Auckland)**

**2022:** Manmeet now works at Verital Innovations as a business development manager. She says the business scholarship really helped her bridge from science into her new role.

**Matthew Cowan**
Dr Matthew Cowan is an Associate Investigator at the MacDiarmid Institute and a chemical engineer at the University of Canterbury, focussing on using nanotechnology to make the most out of solar energy.

For Matthew, the scholarship supported him towards his goal of introducing innovative technologies to transform the petrochemicals industry.

*"I'm passionate about making a positive impact on the environment and society by adding to New Zealand's high-tech manufacturing ecosystem."*

**Postgraduate Diploma in Business and Administration (University of Canterbury)**

**2022:** Now a senior lecturer in engineering at the University of Canterbury. His research focusses on enhancing sustainability by reducing the energy used and emissions produced by the behind-the-scenes processes we use every day.

**Nihan Aydemir**
Dr Nihan Aydemir completed her PhD in 2016 at the University of Auckland in micro and nanostructure organic conductor biosensors under the supervision of Principal Investigator Professor Jadranka Travas-Sejdic. Nihan then worked as a postdoctoral chemist at Plant and Food Research, focussed on mimicking how insects use proteins to smell.

The Alumni Business Scholarship supported Nihan's work in her and Jadranka's start-up company, Spot-Check, which won the 1st place in the University of Auckland's Velocity 100k Challenge in 2016.

**Master of Commercialisation and Entrepreneurship (University of Auckland)**

**2022:** Nihan is now assistant professor at Gebze Technical University in Turkey and technology transfer manager at Teknopark İstanbul A.Ş. which specialises in defence and space manufacturing.

**Brendan Darby**
As part of his PhD in physics, Dr Brendan Darby developed IP for a new technique to analyse 'cloudy' solutions. He helped launch start-up company MaramaLabs, which commercialised the spectrophotometer technique known as CloudSpec, used in industries such as viticulture and water treatment.

The Alumni Business Scholarship allowed Brendan to kickstart his career as an emerging commercial scientist by exposing him to business practices and fundamental corporate operations that would inevitably be asked of him in his future career as founder of MaramaLabs.

**2022:** Brendan is now also CEO of MaramaLabs, which has developed patented UV-Vis spectroscopy technology and cloud software for rapid and accurate analysis of cloudy liquids. Target markets include winemaking, pharmaceutical manufacturing, and water quality testing. In 2021 MaramaLabs raised $1.25m of growth capital.

## 2018 Business Scholarship recipients

**Eldon Tate**
Dr Eldon Tate developed a new piece of IP technology during his PhD and went on to co-found start-up company Inhibit Coatings Ltd with MacDiarmid Institute Emeritus Investigator Professor Jim Johnston. With the support of the Business Scholarship, Eldon undertook the Advanced Management Programme offered by Melbourne Business School.

**Advanced Management Programme (Melbourne Business School)**

**2022:** Eldon has been CEO of Inhibit Coatings since 2016. Inhibit Coatings makes antimicrobial coatings for food safety and healthcare applications. In 2022 the company received one of four of the Australia New Zealand Leadership Forum Trans-Tasman Innovation and Growth Awards.

**Hannah Zheng**
Dr Hannah Zheng completed her PhD in physics at Te Herenga Waka - Victoria University of Wellington, studying with MacDiarmid Institute Principal Investigator Associate Professor Natalie Plank.

*"I was keen to learn more about the global business sector in order to underpin the technical knowledge I could bring to projects."*

The Alumni Business Scholarship enabled Hannah to complete a Postgraduate Diploma in Global Business at AUT while working as a materials scientist at start-up company Revolution Fibres.

**Postgraduate Diploma in Global Business (Auckland University of Technology)**

**2022:** Hannah is currently a regulation specialist at NanoLayr (formerly Revolution Fibres), with the key responsibility of directing compliance strategy for new and existing products in line with global regulatory requirements.

**Rob Staniland**
Dr Rob Staniland completed a PhD in chemistry at the University of Canterbury with Principal Investigator Professor Paul Kruger before taking up a position at Mint Innovation, a deep-tech start-up company. Rob was keen to study Commercialisation and Entrepreneurship in order to better take scientific solutions out of the laboratory and to the market.

**Postgraduate Certificate of Commercialisation and Entrepreneurship (University of Auckland)**

**2022:** Working as R&D lead at Mint Innovation. In late 2020, the company raised $20m to go global in an investment round led by Rob.

**Sam Yu**
Dr Sam Yu completed a PhD at University of Canterbury supervised by Emeritus Investigators Professors Alison Downard and Richard Blaikie. Sam then used his Alumni Business Scholarship to complete professional development short courses in governance and leadership management from the Institute of Directors and from Icehouse, to further develop his board and investor experiences. Since then, he has been heavily involved in business development and marketing for start-ups wishing to commercialise technologies from within the New Zealand research sector.

**Professional development short courses (Institute of Directors and Icehouse)**

**2022:** Sam currently works as a tech investor and board advisor at Sky High Business Consultancy and Advisory. He is also on the Scientific Advisory Board for Matū and is a mentor for Te Ōhaka – Centre for Growth and Innovation.

## 2019 Business Scholarship recipients

**Akshita Wason**
Dr Akshita Wason completed her PhD at the University of Canterbury under supervision of Emeritus Investigator Professor Juliet Gerrard, and had worked at start-up company Hi-Aspect, and with the Office of the Prime Minister's Chief Science Advisor.

Akshita used the scholarship to develop her skills in taking deep-tech projects from local market launch through to establishing global presence, and to study policy-induced effects on the innovation ecosystem.

**Master of Commercialisation and Entrepreneurship (University of Auckland)**

**2022:** Akshita currently works in Government Incentives as an engagement team lead at Callaghan Innovation.

**Lita Lee**
Dr Lita Lee completed her PhD at the University of Canterbury supervised by Emeritus Investigator Professor Alison Downard. She then took up a position at Mint Innovation.

Through studying a Postgraduate Certificate in Commercialisation and Entrepreneurship, Lita gained a better understanding about the challenges involved in the commercialisation process and ways to assist start-up companies with their commercialisation journey.

**Postgraduate Certificate in Commercialisation and Entrepreneurship (University of Auckland)**

**2022:** Lita continues to work at Mint Innovation as a senior scientist. In 2020, she was guest speaker at the MacDiarmid Institute Future of Work: Sustainability alumni event.

**Amy Zhu**
Dr Amy Zhu completed her PhD on the development of novel biosensors based on conducting polymers under the supervision of Principal Investigator Professor Jadranka Travas-Sejdic. She then worked as a research fellow at the University of Auckland.

Amy used her scholarship to gain practical tools and a solid commercialisation mindset. Her long-term goal is to pursue an R&D and science-led commercialisation career with a focus on translating biomaterial research into products that can benefit human wellness and social wellbeing.

**Postgraduate Certificate in Commercialisation and Entrepreneurship (University of Auckland)**

**2022:** Amy is still working as a research fellow at the University of Auckland with research interests in the development of novel portable and wearable sensors based on conducting polymer; fabrication of 2D and 3D electronics; and development of large-scale manufacturable sensing platform.

## 2020 Business Scholarship recipients

**Anna Farquhar**
Dr Anna Farquhar completed her PhD at the University of Canterbury with Emeritus Investigator Professor Alison Downard and worked as a senior scientist in the R&D team at Aeroqual in Auckland as an electrochemist, focussing on electrochemical gas sensors, and ensuring their reliability in monitoring air pollution.

Anna commenced her scholarship in 2021, gaining skills in business, product management and leadership to help develop New Zealand's reputation in the global air quality industry.

**Master of Business Development, Innovation and Product Management (University of Auckland)**

**2022:** Anna is now R&D team leader at Aeroqual Ltd, a New Zealand-based company that specialises in sensor based real-time ambient air quality monitoring. Her research focusses on electrochemical gas sensors, and their use in ambient air measurements. She spoke at our Techweek 2021 in Christchurch, and contributed to our Regional Lecture Series 2022 event in Tauranga.

**Stephen Lo**
Prior to completing his PhD in chemistry at the University of Auckland, supervised by Associate Investigator Professor David Barker, Dr Stephen Lo had begun a Postgraduate Diploma of Bioscience Enterprise at the University of Auckland. The Alumni Business Scholarship enabled him to complete this programme and commence the Master of Bioscience Enterprise and develop the knowledge and skills required to bring valuable products from scientific research towards the commercial space.

**Postgraduate Diploma, Bioscience Enterprise (University of Auckland)**

**2022:** Stephen is commercialisation manager at UniServices (Engineering and Digital Technologies) supporting researchers at the University of Auckland to evaluate, develop and manage the commercial opportunities for their innovative technologies, research and ideas that will have significant impact in the world. Stephen presented at the MacDiarmid Institute Careers and Relevant-to-Industry Skills Programme (CRISP) 'The Friendly TTO' workshop in 2022.

**Udbhav Ojha**
After completing his PhD in condensed matter and materials physics at Te Herenga Waka - Victoria University of Wellington under Principal Investigator Professor Nicola Gaston, Dr Udbhav Ojha joined financial technology services provider firm FNZ where he worked as a senior analyst developer in the software development team.

The Alumni Business Scholarship enabled Udbhav to develop skills in business accounting and finance that he planned to incorporate in his work from a fintech product development standpoint.

**Postgraduate Certificate, Business (Professional) (Te Herenga Waka – Victoria University of Wellington)**

**2022:** Udbhav is currently senior developer at Adminis, where he contributes to design and implementation, overarching technology, and building the team.

**Davoud Zare**
Dr Davoud Zare completed his PhD at Te Herenga Waka - Victoria University of Wellington with former MacDiarmid Institute Investigator Professor Kate McGrath. He had previously worked as a research scientist/engineer at the Fonterra Research and Development Centre in Palmerston North and says he could see a need for innovation in today's business environment. The Alumni Business Scholarship enabled him to learn more about how to commercialise academic knowledge.

Davoud will use his scholarship to further develop his managerial abilities and business acumen, to unify it with his existing scientific skillset.

**Master of Business Development: Designing for Sustainability, Business (University of Auckland)**

**2022:** Davoud is currently senior research scientist/engineer and sustainability advocate at Fonterra and the key contact for a research collaboration with the MacDiarmid Institute.

## 2021 Business Scholarship recipients

**Maryam Shojaei**
Dr Maryam Shojaei completed her PhD in chemical and process engineering at the University of Canterbury, under the supervision of Principal Investigator Associate Professor Aaron Marshall, and then focussed her research on developing advanced electrodes for flow batteries.

Maryam's interests lie in the intersection between science and industry. The Alumni Business Scholarship helped her develop the skills required to take her science into the commercial space.

**Postgraduate Certificate in Business (University of Canterbury)**

**2022:** Maryam currently works in the three waters area at Christchurch City Council as a water engineer/project manager. She spoke at our Techweek 2022 event in Christchurch and at our Regional Lecture Series 2022 in Nelson.

**Samuel Martin Treceño**
Dr Samuel Martin Treceño completed his PhD at the University of Canterbury in chemical and process engineering, supervised by Principal Investigator Associate Professor Aaron Marshall, and began work as a policy advisor at the Ministry of Business, Innovation and Employment (MBIE). He says the scholarship will help build his business acumen and lead strategic conversations in the policy space.

**Postgraduate Certificate in Business (Professional) (Te Herenga Waka - Victoria University of Wellington)**

**2022:** Samuel is currently a senior analyst at Te Uru Rākau – New Zealand Forest Service.

## 2022 Business Scholarship recipients

**Vipin Kumar**
Dr Vipin Kumar completed his PhD in inorganic chemistry at the University of Auckland with Associate Investigator Dr Erin Leitao. Vipin now works as a development chemist at Hexion Inc. With this scholarship, Vipin intends to develop a practical and theoretical understanding of business management/ development. He says this along with his scientific skillset will help him to develop and commercialise novel and innovative products.

**Postgraduate Diploma in Business (University of Auckland)**

**Farzana Fadakar**
Dr Farzana Fadakar completed her PhD in applied physics and engineering at Te Herenga Waka - Victoria University of Wellington with Emeritus Investigator Professor Bob Buckley. Having worked as a scientist at Measurement Standards Laboratory (MSL), as an R&D advisor for the RDTI scheme, and as an investment manager at the Ministry of Business, Innovation and Employment (MBIE), Farzana has extensive experience and knowledge of the New Zealand science innovation ecosystem. She says she will use this scholarship to sharpen her technical and commercial leadership skills, build partnerships, and learn about market and business trends.

*"My ultimate goal is to lead deep tech ventures to create the next New Zealand unicorn."*

**Postgraduate Certificate in Business (Professional) (Te Herenga Waka - Victoria University of Wellington)**



# Patent applications

| | |
|---|---|
| Chris Bumby, Rod Badcock and Dylan Guja | A mechanically-switched superconducting flux pump. AU2022902496A0 |
| Chris Bumby, Rod Badcock, Jianzhao Geng, James Rice | High temperature superconducting switches and rectifiers. WO2022164330A1 |
| Chris Bumby, Rod Badcock, Jianzhao Geng, James Rice | Improvements in superconducting switches. WO2022164329A1 |
| Jack Chen, Bryan Andres Tiban Anrango | Janus-type spherical cellulose nanoparticles |
| Geoff Jameson | Hairpin DNA enzyme inhibitors. AU2022902039 |
| Aaron Marshall | Methods for Processing Materials Containing Iron and Zinc |
| Kim McKelvey | Scanning bubble electrochemical microscopy |
| Ben Yin | System, method, and apparatus for enhancing a fluid. |

**Patents granted**

| | |
|---|---|
| Matthew Cowan | Selective adsorption of gaseous alkenes into non-porous copper(I) complexes: controlling heat of adsorption and loading pressure. US11517877B2 |
| Nathaniel Davis | Photon multiplying material. US11286420B2 |
| | Photon multiplying material and opto-electronic devices equipped therewith. US11217761B2 |
| Geoff Jameson | Single stranded DNA enzyme inhibitors. WO2022162536A1 |
| Franck Natali, Ben Ruck, Joe Trodahl | Ammonia production method and apparatus for ammonia production. US11498844B2 |
| Franck Natali, Ben Ruck, Joe Trodahl, Jay Chan | Rare earth nitride structures and devices and method for removing a passivating capping. US11217743B2 |
| Simon Granville, Eva Anton, Franck Natali, Ben Ruck, Joe Trodahl, James McNulty | Magnetic materials and devices comprising rare earth nitrides. EP3127125A2 |

# Early Funding to Underpin Commercial Success

**Commercial skills training workshops for all students and investigators**

**Investigators who have been supported through the OnBoard governance training programme**

**Alumni who were supported for Exponential Founders entrepreneurship mentoring**

**Projects which were funded for initial commercial scoping**

**MacDiarmid Institute People**
with commercialisation skills and know-how

**Of whom**

## 19

1 University of Otago
1 Massey University
2 University of Canterbury
6 University of Otago
9 Victoria University of Wellington

2 Board Members
9 Students / Alumni
8 Investigators

**including**

## 17

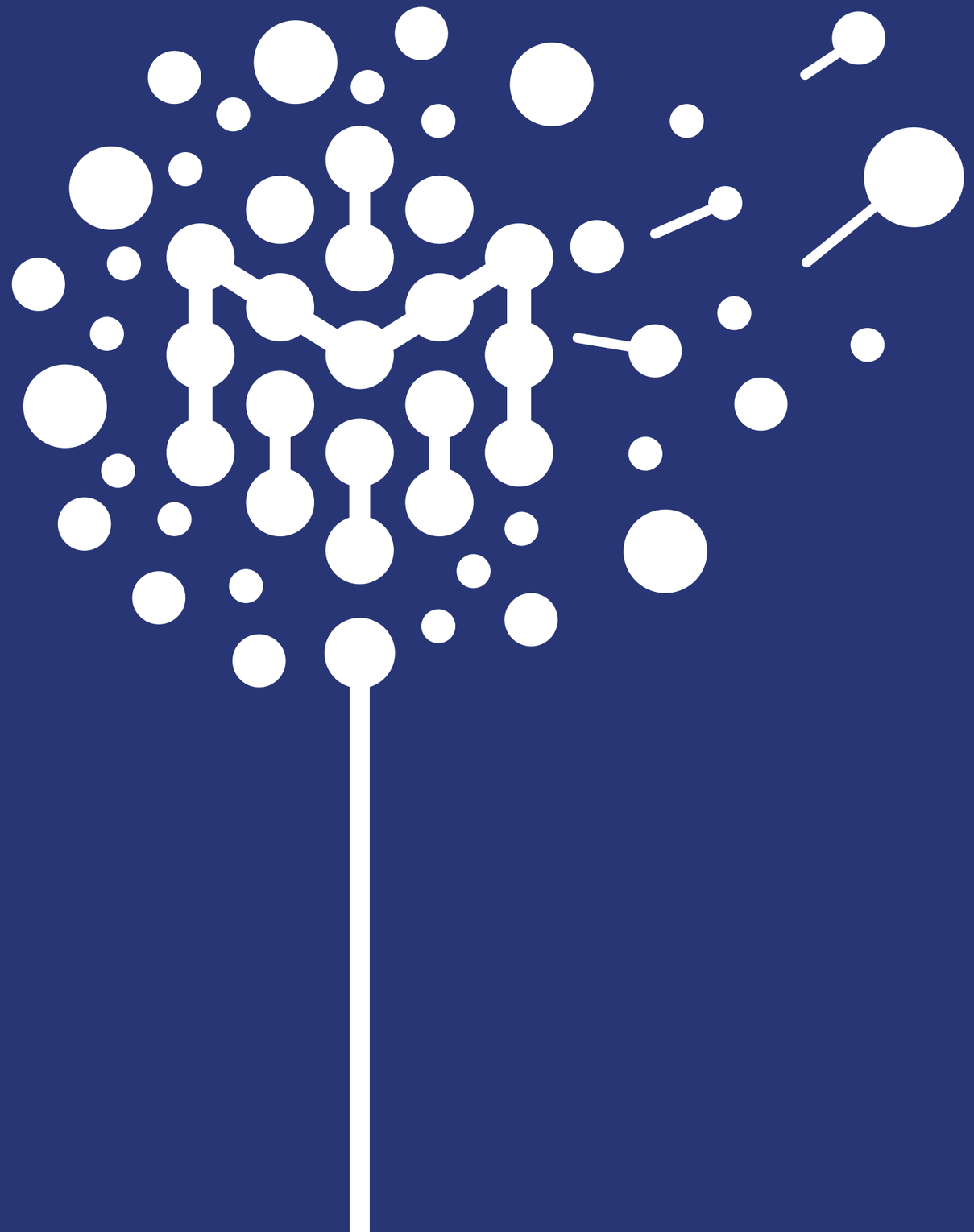
**Founders, CTOs, CEOs of start-up companies**

**have been nominated for**

## 24

**KiwiNet Awards**

9 KiwiNet nominations
15 KiwiNet Winners



# Into the community

Continuing Sir Paul’s 20-year legacy of educational outreach and community engagement has been challenging through the pandemic, but the Institute's outreach continues to go from strength-to-strength. Our NanoCamp and DiscoveryCamp prove ever more popular, and our Regional Lectures strike a chord. Furthermore, our strong partnerships continue to enable us to take our engagement throughout all parts of Aotearoa New Zealand which included our first trip to Rēkohu/Chatham islands this year as part of their festival of science. Sir Paul would no doubt be immensely proud of our engagement.

# DiscoveryCamp over the years

Our first ever Discovery Awards (the precursor to DiscoveryCamp) ran in the summer of 2008/2009 with five Year 12 and 13 Māori and Pacific Island students spending time over the summer in the labs of MacDiarmid Institute researchers, as well as receiving a $1k cash award. The awards aimed to identify and encourage capable Māori and Pacific Island Year 12 and 13 pupils to enroll in science courses at university level.

Kate Tarawhiti, who was one of the first Discovery Award recipients in 2008/2009, says the Award was very valuable for her at that age and that the connections were invaluable.

“It really showed me what university was like. I remember going into a physics lab and doing nanotechnology – it really gave me an insight into the practical things you can do with science.

“The Discovery Awards introduced me to the Māori Centre at the University of Otago, a key contact for me throughout my studies.”

Kate says the students were also invited to AMN4 in Dunedin.

“All of us were invited to this flash conference, given front row seats and the chance to talk to a whole bunch of international scientists. I’m so thankful for those opportunities.

“Programmes like this are very important for Māori students.”

These days what is now DiscoveryCamp brings students to a centre (this rotates around the country from year to year) to spend a week in MacDiarmid Institute labs, hearing from PhD students, running experiments, meeting with our Deputy Director Māori, visiting government and more.

2014 Discovery Awards alumnus Edward Popham went on to study mechanical engineering at the University of Canterbury.

“My Discovery Awards experience helped me strengthen my passion towards science and its use in day-to-day life.” He is now a Lines Asset Management Planner at Transpower.

*“My Discovery Awards experience helped me strengthen my passion towards science and its use in day-to-day life.”*

**EDWARD POPHAM**

Discovery alumna Mariah McDonald cites her time as a Discovery Awards student in MacDiarmid Institute labs at the University of Canterbury as setting her course for her career.

“Receiving the Award when I was 16 invoked a passion for engineering and for research which has hugely influenced my choice to pursue the PhD and I am incredibly grateful to the institute for providing me with the initial experience. As part of the Discovery Awards, Maan Alkaisi showed me around the electrical engineering department at the University of Canterbury and I spent most of my time in the nanofabrication lab. This cemented my desire to study engineering and opened my mind to the idea of doing postgraduate research work.”

Inaugural Discovery Awards recipients Nikita Hunia and PJ Campbell from Hutt Valley High School in Wellington, Kate Tarawhiti, Christchurch Girls' High School, Ben Jones, St Bedes College, Christchurch and Jardin Rose from Buller High School in Westport


Discovery Awards recipients at AMN4 in Dunedin, February 2009. Although initially planning to study health sciences, Kate went on to complete a Bachelor of Science in psychology and then later a law degree



Inaugural Discovery Awards students speaking with Nobel Laureate Professor Sir Harry Kroto at AMN4

During her undergraduate degree in mechatronic engineering, Mariah picked up a MacDiarmid Institute summer lab internship.
“In the summer of 2016/2017 I received a student scholarship from the MacDiarmid Institute in which I worked as a lab assistant to a PhD student in the Canterbury nanofabrication lab which further contributed to my passion for research and desire to do a PhD.”

Discovery alumnus Eden Skipper says that the Discovery Awards were his first experience at a science forum or any other forum for that matter, leadership, culture and so on.

“Attending Discovery Awards gave me confidence to put myself out there more and just go for it.” Eden completed a Bachelor of Science degree in statistics at the University of Canterbury and is now Special Adviser - Māori Capability at the Ministry for Primary Industries.

Discovery alumna Lizzie Tafili attended the Discovery Awards at the end of 2013 and the beginning of 2014.

“Having a fortnight length internship at Callaghan Innovation felt like working at the candy land equivalent for a science junkie where every single day was absolutely enthralling. This experience affirmed my love and passion for science so that I went on to complete a Bachelor of Biomedical Science majoring in medicinal chemistry and molecular pharmacology at Victoria University.”

*“It felt like working at the candy land equivalent for a science junkie where every single day was absolutely enthralling.”*

**LIZZIE TAFILI**

# NanoCamp over the years

Dr Leighton Watson was 17 when he attended the MacDiarmid Institute's first ever NanoCamp in 2009. He cites the experience as key to giving him an early taste of research life.

"NanoCamp gave me early exposure to the university environment and to scientists who were excited by their research and determined to make a difference in people's lives." Leighton, who returned to Aotearoa New Zealand in 2020 as a recipient of a Rutherford Foundation Postdoctoral Fellowship from the Royal Society Te Apārangi, has an honours degree in geophysics from the University of Auckland and a PhD from Stanford. He says he still recalls fondly his week at NanoCamp all those years ago.

"It was as much the fellow NanoCampers I was with, who were energetic and excited about science like me, and I thought - it would be great to work with similar people".

Dr Leighton Watson, NanoCamp alumnus

NanoCamp is a week-long science camp for Year 12 and 13 students held in MacDiarmid Institute labs. The Institute's inaugural NanoCamp was held at Massey University during the week January 19-23, 2009. Principal Investigator Professor Shane Telfer who led the first NanoCamp says NanoCamp was an unreserved success.

*"NanoCamp clearly tapped into a previously unmet demand for this kind of event amongst high school students who are interested in science."*

**PROFESSOR SHANE TELFER**

Left: Inaugural 2009 NanoCamp attendees at Massey University

Right: Callista Booth-Richards in the chemistry lab at the University of Otago

Callista Booth-Richards attended NanoCamp at the University of Canterbury in January 2021 and credits the camp and the people she met for changing her study plans from a double major in chemistry and plant biotechnology, towards a PhD in nanotechnology.

*"NanoCamp really shaped what my future will look like."*

**CALLISTA BOOTH-RICHARDS**

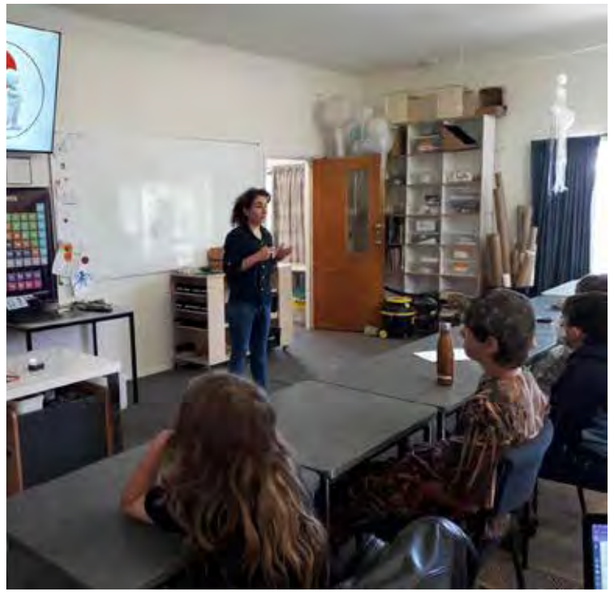
"When I heard (Principal Investigator) Professor Paul Kruger talking about the MacDiarmid Institute's work on sustainable materials, I just knew, that's what I want to do. So I set about finding out what I'd need to study or do at undergrad level in order to be eligible for one of the PhD scholarships the Institute offers. "
She says this also led to her asking her supervisor (Associate Investigator Courtney Ennis) if she could do a six-week part-time research project while in her second year of Chemistry at the University of Otago.
"It's been such a treat to be working on this research project and to be actually working on metal organic framework (MOF) samples sent by Paul Kruger."

She says she's now really interested in MOFs or bioplastics.

# From the lab bench to a start-up company

The theme for the 2022 MacDiarmid Institute Regional Lecture Series was ‘To Industry and Beyond’. Our researchers travelled to Rotorua, Nelson, Tauranga and Hawke's Bay, speaking with science societies about the pathways from science to industry, and visiting schools.

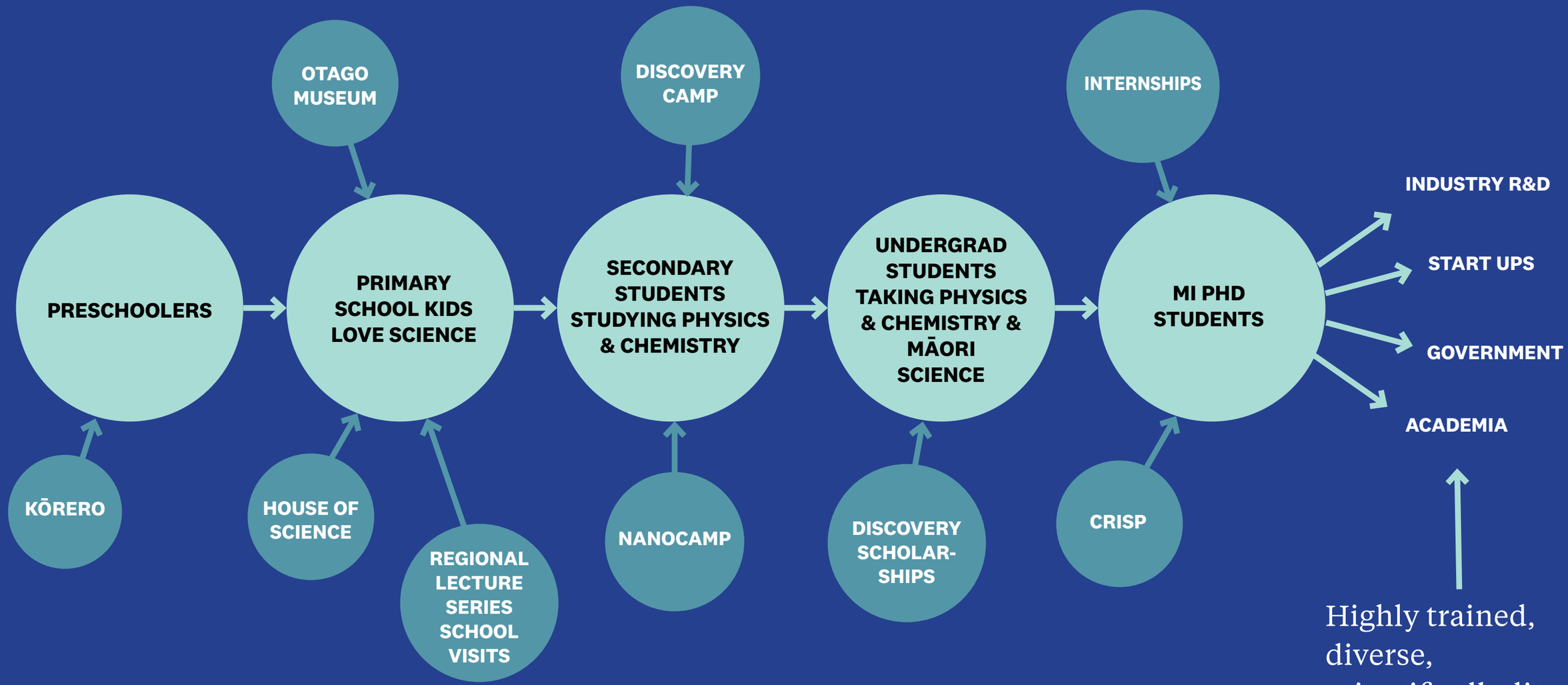
Dr Shalini Divya speaking in Rotorua



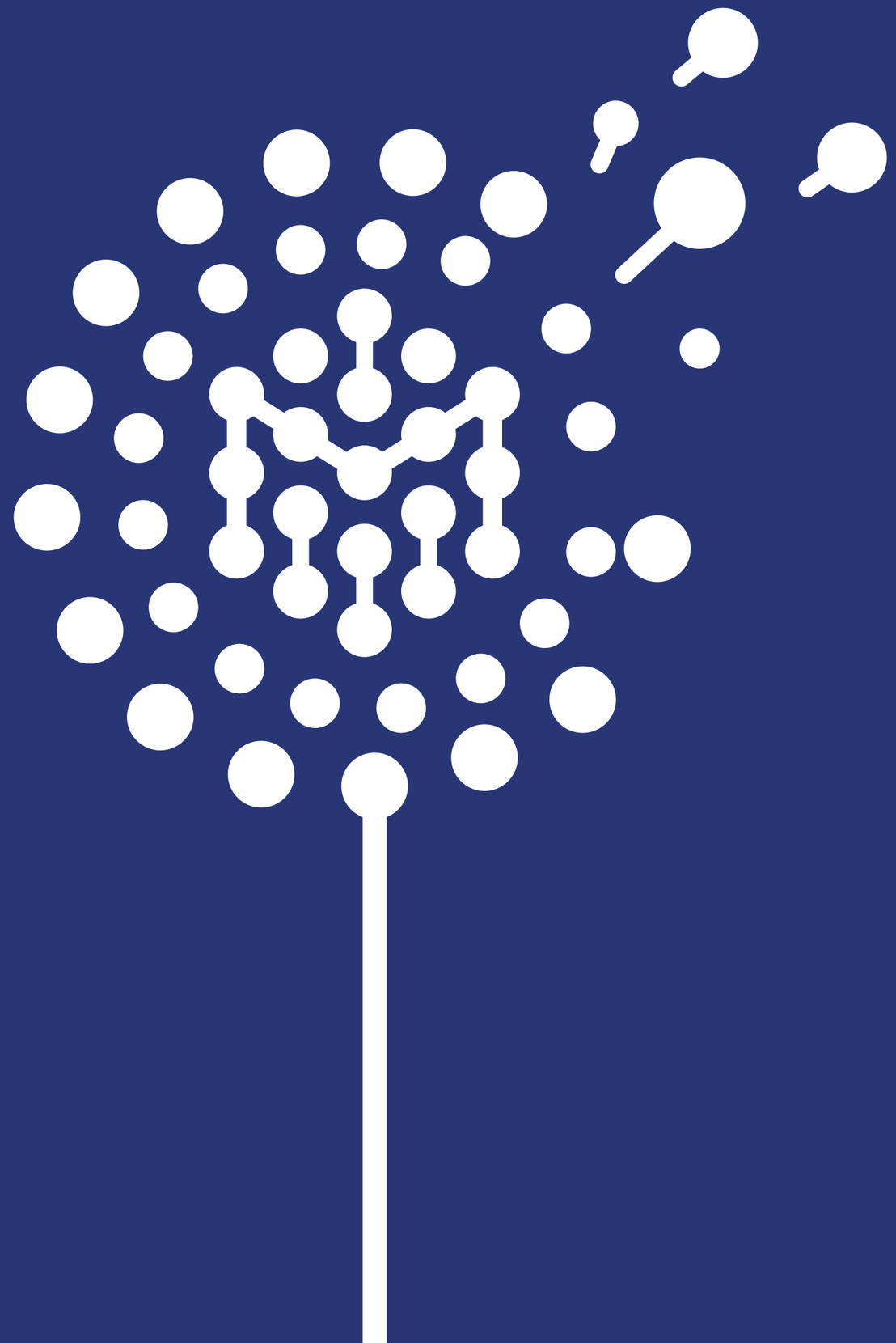
Dr Maryam Shojaei speaking with Nelson school students

Professor Shane Telfer and Dr Anna Farquhar speaking in Tauranga

# Developing a scientifically-literate workforce




Highly trained, diverse, scientifically-literate workforce able to support the growth of the deep tech sector



# Into the future

From the perspective of those who founded the Institute in 2002, we have literally arrived in the future. The Institute has always advanced science with an endgame and real-world impact, and our graduates personify this. These days not only do our researchers launch companies into the deeptech economy, but we launch tech-savvy graduates into careers in those same companies, as well as in government and wider industry.

# 20 years of alumni

# MESA is born

Principal Investigator Associate Professor Natalie Plank recalls walking into the offices of then Deputy Director Shaun Hendy and Centre Manager Margaret Brown back in 2010 and pitching the idea for a MacDiarmid Institute student-led organisation to support training for and connections between students.

“I remember popping into the MacDiarmid offices on Level 4 and suggesting to Shaun and Margaret that I thought we needed to do something to support students to upskill and to get together.”

Natalie, who became the inaugural chair of the new MacDiarmid Emerging Scientists Association (MESA), says that back in 2010 students and postdocs often didn't really know what the Institute was, and many felt little engagement or connectivity to others around the country. She says her idea had come about in part because of her experience in the ‘Grad School UK’ during her time studying in Edinburgh. She says the Grad Programme had connected students from throughout the UK and supported them to gain more ‘soft skills’ in a fun way.

She plays down her role in the establishment of MESA.

“No idea exists in a vacuum. I’d loved the feelings of connectedness I’d had as a PhD student in the UK, being part of a bigger institute and bigger physics department. I wanted to emulate a similar sense of linkages and connectedness here.”

As the conversation developed, she gathered around her a group who would go on to become the first MESA committee, including Franck Natali, Keoni Mahelona, Elf Eldrige, Shrividya Ravi and Ben Mallet (all from Victoria University of Wellington (VUW) or Industrial Research Limited (IRL)) along with Andrew Gross and Ojas Mahapatra from Canterbury, and Cosmin Laslau from University of Auckland (UoA).

“We wanted something geared towards students, so we took over the student and postdoc part of the annual symposium that year, and organised good speakers on topics that we as students needed to hear about. We had a budget, and we ran a Raman workshop led by Joe (Trodahl). And Cosmin organised the first bootcamp, just outside of Auckland.”

The highlights for Natalie are the connections between students and with researchers, the way the culture has shifted, and the opportunities opening up through the bootcamps and other events.

“I could see students gain confidence from workshops, particularly the workshop on dealing with failure. And I joined (then MBIE Partnerships Manager) Kjesten Wiig and (alumnus and start-up CEO) Andrew Preston and other speakers at a more recent bootcamp where the conversation was about future pathways and opportunities for materials science graduates in industry and government and elsewhere.”

Current MESA co-chair Shikeale Harris, who is a third year PhD student at Massey University, says that from what she sees, Natalie’s original vision for MESA has come to pass.

*“We’re one family, one team.”*

**ASSOCIATE PROFESSOR NATALIE PLANK**

“100% MESA still aligns with what Natalie planned. Without MESA there’d be no opportunities to make friends with researchers in similar fields.”

She says being a researcher in a specialised field can feel isolating.

“It’s not necessarily the case that the three students you happen to be sharing a lab with are working on the same research as you. So being able to, through MESA, develop a shared experience with others doing the same experiments – with all the good, the bad and the ugly – is beneficial for mental health, for building bonds and networking.”

She says this period of time in young researchers’ lives may well be the hardest they’ve endured to date due to constant failure and the constant unknowns for years on end.

“So getting opportunities to reach out and be heard and knowing we’re not all alone is so important in my opinion.

“The workshops offer students the chance to step out of their research for a bit, do something they’re interested in, in a relaxed environment without financial obligations. By providing low obligation and free workshops, bootcamps and other events to a busy and often stressed group of people who can take newly learnt skills, MESA helps us all grow in our own time and with the support of our peers.”

Fellow co-chair Dr Azy Hashemi, a postdoc at the University of Canterbury, recalls giving a student talk and receiving a prize at the 2014 Symposium.

“It was really affirming to me at the time to know my work mattered to the rest of the MacDiarmid Institute. As a student – this can be daunting – you sometimes wonder – does anyone else care?”

Inaugural MESA committee comprising back, left to right: James "Elf" Eldridge (IRL Gracefield), Ben Mallett (IRL Gracefield), Andrew Gross (Canterbury), Ojas Mahapatra (Canterbury), Franck Natali (VUW), Cosmin Laslau (Auckland) Front, left to right: Natalie Plank (VUW), Shrividya Ravi (VUW), Keoni Mahelona (VUW)

She regrets not having been more active in MESA while a student.

“I felt I didn’t have spare time, but I wish I had done more of the workshops and meetups.”

Now that she’s co-chair and able to make decisions that can influence and provide opportunities for students, she sees the MESA-led events as having real impact for students.

“MESA is a one stop go-to place for skills building.”

Shikeale says that students like to participate in different ways and that it’s great to have the budget to involve as many people as possible and to support MESA members in all their diversity.

“For some, it’s networking. For others it’s the workshops. We understand that everyone is different, no two MESA members are the same, so we strongly believe that providing a range of opportunities is important to allow maximum involvement throughout the year. We’re so grateful that MESA has been given this opportunity by ways of financial and other support from the MacDiarmid Institute to do so.

“The people in MESA are a really interdisciplinary cohort of interesting people who come from very different backgrounds, with very different life and research experiences, and who will all go off on their own paths down a myriad of career pathways. Through MESA we can all share experiences (the good, the bad and the ugly) and know we’re not alone in this journey.”

She says the MESA process is organic and continually changing.

“The recent initiative to give third year students access to the MacDiarmid LinkedIn alumni page will be beneficial to students looking for connections and job opportunities as they head towards graduation, as will opening the alumni newsletter to any student who wants to sign up, to get a feel for the opportunities that will arise closer to their hand in period.”

Azy says that there’s an ongoing need to educate Investigators that ALL affiliated students are MacDiarmid Institute students and able to be part of MESA, especially when the MacDiarmid Institute investigator is the co-supervisor. “This is an ongoing process.”

Natalie agrees.

“One of the fundamental understandings was that ALL students associated with a MacDiarmid Institute Investigator would be part of MESA, part of the Institute.

“We’re one family, one team.”

# 2022 MESA report

## From the MESA Co-Chairs Azy Hashemi and Shikeale Harris

The year 2022 has been a great year for the MacDiarmid Institute Emerging Scientists Association (MESA). We are very happy that we have been able to hold our usual full variety of scheduled events such as workshops, welcome events and site visits, after the past two years facing event cancellations and many limitations due to Covid 19. As always, we kicked off the year by holding welcome events in each of our centres. These always have a great turn out and are a fantastic and fun way to start networking with other MacDiarmid Institute students from each centre.

MESA had two of the famous Python workshops, held in both the North and South Islands for the second year in a row, hosted by Massey and Canterbury Universities respectively, with special thanks to Ben Westberry for running the workshops. The Python workshops have been incredibly popular and sought after in the past few years and have an excellent turnout. Other MESA-organised events this year included an industry site visit to Mint Innovation in July, a 3D/CAD workshop at the University of Auckland in September, a video editing workshop at Victoria University of Wellington in October, and a video tutorial competition. We also held our extremely popular MESA bootcamp, which took place in the days following the MacDiarmid Symposium, in Wellington this December.

During the symposium, a very fruitful and engaging Q&A session was held between the MESA committee and the MacDiarmid Institute students, research assistants and postdoctoral fellows, with hugely engaged and really amazing discussions around inclusivity, diversity and student participation. As a result of this session, the committee is proposing changes to MESA's constitution and the way MESA is run, going forward into 2023.

Photos from the MESA bootcamp in 2022, Wellington

2022 MESA Committee: Georgia Richardson, Brianna Nally, Lara Browne, Calum Gordon, Isabel Cowlishaw, Roisin Mooney, Azadeh Hashemi, Ludwig Petters, Sarah Sale, Daniel Mak and Mohsin Ijaz

# Wellbeing within the Institute

We continue to implement the recommendations from our 2020 Wellbeing Report by celebrating student and postdoc success via our internal newsletters, collecting information via our exit interviews (online and via Zoom) for graduating and departing students and postdocs, and supporting individual training sessions for personal development run by Associate Investigator Dr Emilia Nowak from Massey University.

As part of the recent Career and Relevant-to-Industry Skills Programme (CRISP), this year we held a hybrid in-person and zoom 'Developing Healthy Habits for Resilience and Wellbeing in the Workplace' module, facilitated by Julene Hope of Brightspot Consulting. Attendees were led through a day of evidence-based learning about wellbeing and resilience in the workplace, and supported to apply these immediately through the creation of individual wellbeing plans. As part of the follow up process, participants were asked to consider resilience and wellbeing within their research experience and to provide feedback on how we can further assist in improving wellbeing within the Institute.

Feedback from both this wellbeing module and our exit interviews provided the basis of a 2022 addendum to the original 2020 Wellbeing Report. This addendum summarised progress since the original report and identified new potential initiatives. It was a valuable exercise to reflect on the efforts made by the Institute to improve wellbeing over the last two years and showed that despite the challenges of COVID, researcher and student views and experiences of the Institute had remained positive.

**"Was good to know that there are others who go through similar stuff and how they cope with it."**

**"Excited to see more offerings!"**

**PARTICIPANTS WHO ATTENDED THE 'DEVELOPING HEALTHY HABITS FOR RESILIENCE AND WELLBEING IN THE WORKPLACE' MODULE**



# Career Internships

This year seven of our graduates interned with government and industry.

**Sunandita Ghosh**
*MBIE*
Involved with the MBIE Contestible Investments contract management system, working across the different funding mechanisms. Reviewed and assessed project reports and contract variation requests.

**Kenneth Ortega**
*MacDiarmid Institute/NZPA*
Developed/updated the National Testing Register, an NZPA-hosted directory of scientific testing equipment throughout NZ. The Register provides a streamlined pathway for connecting companies to research expertise, as strong relationships often develop through simple requests to use equipment.

**Zeineb Ayed**
*Marama Labs*
Explored the CloudSpec ability to analyse cloudy wine samples without the need of any pre-preparation, working directly with the R&D team in determining the colour and phenolics of untreated wine samples.

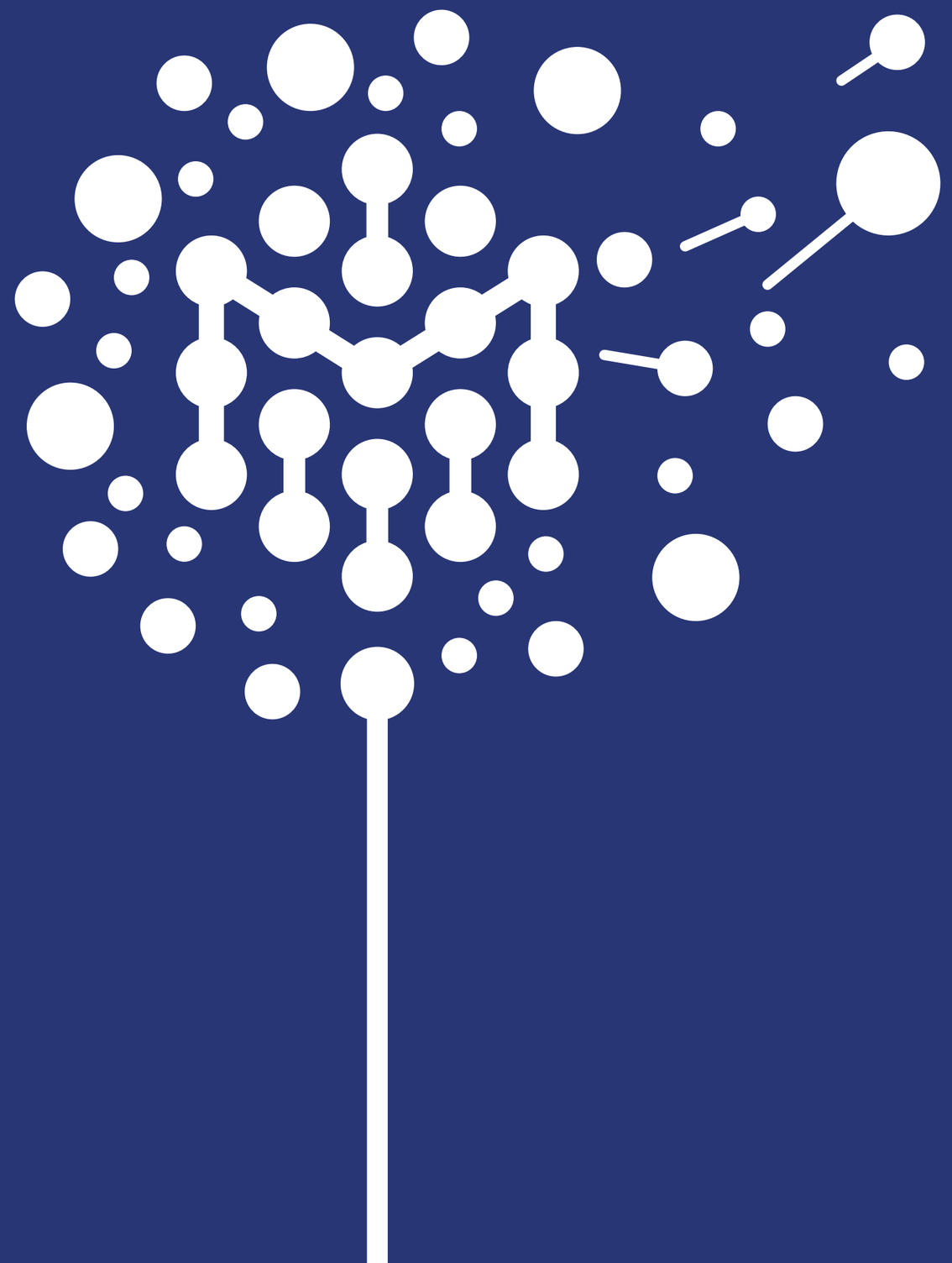
**Thomas Grant**
*UniServices*
Learned about the internal triage process that goes into assessing the commercial viability of an idea, including market analysis, creating a target product profile, and novelty searching/competitor analysis.

**Matthew Brett**
*Power Trip*
Worked on programming an electric vehicle battery tracking tool to monitor statistics for the battery owner. worked on creating a series of calculations using battery data, and transforming this into a dashboard for users to view.

**Dion Thomas**
*Wellumio Ltd*
Worked on the development of an NMR device for stroke diagnosis.

**Alyssa Thomas**
*Ministry for the Environment*
Contributed to Aotearoa's Environmental Reporting Framework, including a case study on Kaipara Moana, and worked on projects across the Evidence Data and Insight's group's work programme.

# Into the metrics



# Financials

| | 2021 | 2022 |
|---|---|---|
| **Income** | | |
| CoRE Funding | $3,200,000.00 | $6,400,000.00 |
| Surplus Carried forward | N/A | $2,160,868.54 |
| Total Revenue | $3,200,000.00 | **$8,560,868.54** |
| | | |
| **Salaries and salary related costs** | | |
| Directors and Principal Investigators | $152,672.99 | $733,610.16 |
| Associate Investigators | $ — | $ — |
| Post-Doctoral fellows | $ — | $346,154.48 |
| Research/Technical assistants | $71,004.78 | $401,088.05 |
| Others | $219,084.17 | $457,797.14 |
| Total Salaries & Salary-related costs | $442,761.94 | **$1,938,649.83** |
| | | |
| **Other Costs** | | |
| Overheads | $167,933.72 | $756,544.54 |
| Project Costs | $302,736.00 | $1,389,905.63 |
| Travel | $3,795.00 | $81,303.18 |
| Postgraduate students | $121,904.80 | $1,459,226.68 |
| Equipment depreciation/rental | $ — | $46,549.74 |
| Subcontractors | $ — | $ — |
| Extraordinary expenditure | $ — | $ — |
| Total Other Costs | $596,369.52 | **$3,733,529.77** |
| | | |
| late partner invoices to be paid out in following financial year | $973,165.58 | $820,364.92 |
| | | |
| **Total CoRE Expenditure** | | |
| Total Expenses | $1,039,131.46 | **$5,672,179.60** |
| *with late invoices* | *$2,012,297.04* | *$6,492,544.52* |
| | | |
| Net Surplus/(Deficit) | $2,160,868.54 | **$2,888,688.94*** |
| *with late invoices* | *$1,187,702.96* | *$2,068,324.02* |

** Committed to independent postdocs starting in 2023*



# At a glance

| | |
|---|---|
| **Headcounts by category** | |
| Emeritus Investigators | 22 |
| Principal Investigators | 34 |
| Stakeholder Relations Partner Iwi | 1 |
| Associate Investigators | 50 |
| Postdoctoral Researchers | 144 |
| Students | 339 |
| **Total** | **590** |
| | |
| **Peer reviewed research outputs by type** | |
| Journal articles | 399 |
| Book chapters | 5 |
| Conference papers | 16 |
| Books | 1 |
| **Total** | **421** |

# Board, executive, staff and students

## Governance Representative Board

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

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

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

**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**
Chair of the Board
General Manager Te Ao Māori and Science Services
Scion

**Professor Ian Wright**
Deputy Vice-Chancellor Research and Innovation
University of Canterbury

### Ex-Officio

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

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

**Associate Professor Pauline Harris**
Deputy Director Māori/Māori Research Representative/Research Programme Leader: Mātauranga Māori
Victoria University of Wellington/ Massey University

**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 Anna Garden**
Science Executive Representative, MacDiarmid Institute
University of Otago

*Partial year

## International Science Advisory Board

**Professor Sir Richard Friend**
Cavendish Professor of Physics
University of Cambridge, United Kingdom
Physics of energy materials, condensed matter

**Dr Anita Hill**
Chief Research Scientist, Future Industries
Commonwealth Scientific and Industrial Research Organisation (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, United States of America
Chemistry of renewal energy

**Professor Ivan Parkin**
Dean of Mathematical and Physical Sciences Faculty
University College London, United Kingdom
Nanomaterials

**Professor Annie Powell**
Professor of Inorganic Chemistry, Institute of Inorganic 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, United Kingdom
Materials for computing

## Science Executive

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

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

**Associate Professor Pauline Harris**
Deputy Director Māori/Māori Research Representative/Research Programme Leader: Mātauranga Māori
Victoria University of Wellington/ Massey University

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Deputy Director Stakeholder Engagement, MacDiarmid Institute
University of Canterbury

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

**Shikeale Harris**
MESA Co-Chair
Massey University

**Dr Azy Hashemi**
MESA Co-Chair
University of Canterbury

**Professor Simon Brown**
Research Programme Leader: Future Computing
University of Canterbury

**Dr Jack Chen**
Associate Investigator Representative
Auckland University of Technology

**Dr Laura Domigan**
Principal Investigator Representative
University of Auckland

**Associate Professor Anna Garden**
Principal Investigator Representative
University of Otago

**Professor Shane Telfer**
Research Programme Leader: Catalytic Architectures
Massey University

**Professor Jadranka Travas-Sejdic**
Research Programme Leader: Reconfigurable Systems
University of Auckland

### Ex-Officio

**Gabrielle Holmes**
Programme Manager, MacDiarmid Institute
Victoria University of Wellington

**Kevin Sheehy**
Commercialisation and Industry Engagement Manager, MacDiarmid Institute
Victoria University of Wellington

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

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

## MacDiarmid Emerging Scientist Association (MESA) 2022

**Shikeale Harris**
Co-Chair
PhD Student
Massey University

**Dr Azadeh Hashemi**
Co-Chair
Postdoctoral Fellow
University of Canterbury

**Brianna Nally**
Secretary
PhD Student
University of Otago

**Calum Gordon**
Treasurer
PhD Student
Victoria University of Wellington

**Rosanna Rov**
Social Media Representative
PhD Student
University of Auckland

**Daniel Mak**
Commercialisation and Industry Representative
PhD Student
University of Auckland

**Bushra Anam**
Centre Representative
PhD Student
University of Canterbury

**Lara Browne**
Centre Representative
PhD Student
Victoria University of Wellington

**Mohsin Ijaz**
Centre Representative
PhD Student
University of Otago

**Roisin Mooney**
Centre Representative
PhD Student
Auckland University of Technology

**Georgia Richardson**
Centre Representative
PhD Student
Victoria University of Wellington

**Rosanna Rov**
Centre Representative
PhD Student
University of Auckland

**Sarah Sale**
Centre Representative
PhD Student
University of Canterbury

**Ben Westberry**
Centre Representative
Postdoctoral Fellow
Massey University

## Principal Investigators (34)

Martin Allen
Sally Brooker
Simon Brown
Chris Bumby
Laura Domigan
Anna Garden
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
Aaron Marshall
Duncan McGillivray
Carla Meledandri*
Volker Nock
Natalie Plank
Ben Ruck
James Storey
Shane Telfer
Jadranka Travas-Sejdic
Charles Unsworth
Geoff Waterhouse
Catherine Whitby
Grant Williams
Martin (Bill) Williams
Geoff Willmott
Ulrich Zuelicke

* Indicates resigned as PI

## Stakeholder Relations Partner Iwi (1)

Diane Bradshaw

## Associate Investigators (50)

Mathew Anker
Eva Anton**
Baptiste Auguie
Ebubekir (Ebu) Avci
David Barker
Catherine Bishop
Margaret Brimble
Philip Brydon
Peng Cao
Jack Chen
Kai Chen
Shen Chong
Martyn Coles
Matthew Cowan
James Crowley
Nathaniel Davis
Renwick Dobson
Courtney Ennis*
Christopher Fitchett
Robin Fulton
Petrik Galvosas
Vladimir Golovko
Prasanth Gupta
Muhammad Hanif
Shaun Hendy***
Patricia Hunt
Geoff Jameson
Marcus Jones
Vedran Jovic
Jon Kitchen
Erin Leitao
Jérôme Leveneur
Luke Liu
Taniela Lolohea*
Ben Mallett
Steven Matthews
Kim McKelvey
Franck Natali
Michel Nieuwoudt
Emilia Nowak
Elke Pahl
Kannan Ridings*
Viji Sarojini
Jami Shepherd*
Tilo Söhnel
Krista Steenbergen
Mark Waterland
Cameron Weber
Stuart Wimbush**
Ben Yin

* Indicates appointed as AI
** Indicates resigned as AI
*** Indicates change of status from AI to EI

## Emeritus Investigators (22)

Maan Alkaisi
Richard Blaikie
Penny Brothers
Ian Brown
Bob Buckley
Sally Davenport
Alison Downard**
Juliet Gerrard
Simon Hall
Shaun Hendy*
Jim Johnston
Tim Kemmitt
Ken MacKenzie
Andreas Markwitz
Jim Metson
Roger Reeves
Mike Reid
Craig Rofe
Cather Simpson
Jeff Tallon
Richard Tilley
David Williams

*Indicates shift in status from AI to EI
**Indicates retired as EI

## Professional Staff

**Genevieve Fitzjames**
Project Coordinator, MacDiarmid Institute
University of Auckland

**Gabrielle Holmes**
Programme Manager, MacDiarmid Institute
Victoria University of Wellington

**Kevin Sheehy**
Commercialisation and Industry Engagement Manager, MacDiarmid Institute
Victoria University of Wellington

**Rosie Wayte**
Institute Manager, MacDiarmid Institute
Victoria University of Wellington

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



# MI students in 2022

## Masters (52)

| | | |
|---|---|---|
| **Baiju** | Sajith | University of Canterbury |
| **Bui** | Phuong | Victoria University of Wellington |
| **Buzas Stowers-Hull** | André | Massey University |
| **Chan** | Sanutep | Victoria University of Wellington |
| **Clague** | Lily | University of Otago |
| **Desilva** | Karnika | University of Canterbury |
| **Faulkner** | Logan | University of Otago |
| **Ferguson** | Alexander | University of Auckland |
| **Fernandez** | Irene Marice (Mai) | Victoria University of Wellington |
| **Filatov** | Yuri | University of Canterbury |
| **Francois** | Jack | University of Auckland |
| **Gao** | Hetian (Henry) | University of Auckland |
| **Girdwood** | Megan | University of Canterbury |
| **Grant** | Mason | University of Auckland |
| **Ha** | Stephen | University of Auckland |
| **Hackner** | Nico | University of Otago |
| **He** | Jing | Massey University |
| **Kuang** | Ze | University of Auckland |
| **Kumar** | Barath | Massey University |
| **Mare** | Alaigne (Lenny) | Victoria University of Wellington |
| **McIntyre** | Sam | University of Otago |
| **Mendoza** | Shaira | Victoria University of Wellington |
| **Monkman** | Aleece | University of Auckland |
| **Moree** | Lana | University of Otago |
| **Nielsen** | Benjamin | Victoria University of Wellington |
| **Otter** | Sam | Massey University |
| **Pearcy** | Aston | University of Otago |
| **Plummer** | Sam | University of Canterbury |
| **Rex** | Angelique | Massey University |
| **Said** | Sultan | Auckland University of Technology |
| **Sansom** | Gabriela | Massey University |
| **Scott** | Victoria-Jayne | Massey University |
| **Sheard** | William | University of Auckland |
| **Siesicki** | Jessica | Victoria University of Wellington |
| **Stephens** | Emily | Victoria University of Wellington |
| **Stone** | Madeline (Dana) | University of Canterbury |
| **Summers** | Hannah | Victoria University of Wellington |
| **Taylor** | Marcus | University of Canterbury |
| **Tong** | Marco | University of Auckland |
| **Unsworth** | Sophie | Victoria University of Wellington |
| **Venkatesh** | Siddharth | Massey University |
| **Wallace** | Rachel | Victoria University of Wellington |
| **Wang** | Runzhong (Derek) | University of Auckland |
| **Ward** | Ciaran | University of Otago |
| **Watson** | Hosea | University of Canterbury |
| **Watt** | Carlie | University of Auckland |
| **Whiting** | John | University of Otago |
| **Wiley** | Richard | University of Canterbury |
| **Wong** | Emily | Victoria University of Wellington |
| **Xie** | Haotian | University of Auckland |
| **Zhang** | Hongliang (Ryan) | University of Auckland |
| **Zhang** | Zizhong (Victor) | Victoria University of Wellington |

## PhD (287)

| | | |
|---|---|---|
| **Acheson** | Chris | Victoria University of Wellington |
| **Adams** | Ryan | University of Canterbury |
| **Agnieray** | Heiana | University of Auckland |
| **Aguilar** | Clouie Justin (CJ) | University of Auckland |
| **Ahangarpour** | Marzieh | University of Auckland |
| **Ahmmed** | Fatema | University of Otago |
| **Allan** | Claudia | University of Canterbury |
| **Altenhuber** | Nicola | University of Canterbury |
| **Ambadiyil Soman** | Arya | Victoria University of Wellington |
| **Anand** | Aljo | University of Auckland |
| **Andarini** | Rizki Putri (Putri) | Victoria University of Wellington |
| **Andrew** | Phillippa-Kate (Kate) | Massey University |
| **Appletree** | Lun | University of Auckland |
| **Ashraf** | Jesna | University of Auckland |
| **Auer** | Bernhard | Massey University |
| **Ayed** | Zeineb | Victoria University of Wellington |
| **Bagus Pambudi** | Agung | Victoria University of Wellington |
| **Bandi** | Bhanumathi | Auckland University of Technology |
| **Battley** | Andrew | University of Auckland |
| **Bayat** | Afrooz | University of Canterbury |
| **Beikzadeh Ghelejlou** | Sara | University of Auckland |
| **Bell-Tyler** | Joseph | University of Auckland |
| **Bernach** | Michal | University of Canterbury |
| **Bhaskar** | Subhasree | University of Auckland |
| **Bjareborn** | Oscar | Victoria University of Wellington |
| **Board** | Amanda | University of Canterbury |
| **Booth** | Tony | Robinson Research Institute |
| **Brar** | Navneet Kaur | University of Auckland |
| **Brett** | Matthew | Victoria University of Wellington |
| **Brooks** | Justin (Gus) | Victoria University of Wellington |
| **Browne** | Lara | Victoria University of Wellington |
| **Bryant** | Devon | University of Auckland |
| **Burling** | Sophie | Massey University |
| **Busher** | Lal | University of Auckland |
| **Carleton** | Daniel | Auckland University of Technology |
| **Carlisle** | Nicholas | Massey University |
| **Carroll** | Liam | University of Canterbury |
| **Cassie** | Erica | Victoria University of Wellington |
| **Chahal** | Harpreet Kaur | University of Auckland |
| **Cheema** | Jamal | University of Auckland |
| **Chen** | Qun (Queenie) | University of Auckland |
| **Chen** | Xize | University of Auckland |
| **Choudhury** | Minati | University of Otago |
| **Chourasia** | Shivangi | Massey University |
| **Christopher** | Tim | University of Auckland |
| **Chung** | Stephen | University of Auckland |
| **Cleland** | Josiah | Massey University |
| **Clyde** | Daniel | University of Auckland |
| **Coombes** | David | University of Canterbury |
| **Cowlishaw** | Isabel | University of Auckland |
| **Currie** | Michael | University of Canterbury |
| **Dahalan** | Ghadir | Massey University |
| **Das** | Dona | University of Auckland |
| **Data** | Shailja | University of Auckland |
| **Deas** | Robert | University of Auckland |
| **DeMonte** | Kieran | University of Otago |
| **Devese** | Samuel | Victoria University of Wellington |
| **Dierkes** | Marissa | Victoria University of Wellington |
| **Dong** | Yusong | University of Auckland |

| | | |
|---|---|---|
| **Doran** | Conor | University of Auckland |
| **Drummond** | Grace | University of Auckland |
| **Earl** | Andrew | University of Auckland |
| **Edens** | Samuel | University of Canterbury |
| **Elahi** | Asrar | University of Otago |
| **Emeny** | Chrissy | University of Canterbury |
| **Esmaeili** | Fatemeh | University of Auckland |
| **Estiri** | Arash | Victoria University of Wellington |
| **Evans** | Matthew | Victoria University of Wellington |
| **Fellner** | Daniel | University of Auckland |
| **Ford** | Kathryn | University of Canterbury |
| **Francis** | Tait | University of Otago |
| **Franke** | Christine | University of Canterbury |
| **Galli** | Edoardo | University of Canterbury |
| **Gearing** | Hayden | University of Auckland |
| **Geurts** | Alisha | University of Auckland |
| **Ghosh** | Sunandita | University of Auckland |
| **Gilbertson** | Fletcher | University of Canterbury |
| **Gito** | Donn Adam (Adam) | University of Auckland |
| **Glasson** | Judith | University of Auckland |
| **Gonzales** | Jofferson | Victoria University of Wellington |
| **Gordon** | Calum | Victoria University of Wellington |
| **Gordon** | Hugo | University of Auckland |
| **Grant** | Mason | University of Auckland |
| **Grant-Mackie** | Emily | University of Auckland |
| **Green** | Lewis | University of Auckland |
| **Gunukula** | Venkata | University of Auckland |
| **Guo** | Lun | University of Auckland |
| **Haack** | Alexander | University of Otago |
| **Hamonnet** | Johan | University of Canterbury |
| **Happe** | Erica | Victoria University of Wellington |
| **Hardy** | Jake | Victoria University of Wellington |
| **Harper** | Aimee | University of Canterbury |
| **Harpreet** | Chahal | University of Auckland |
| **Harris** | Samuel | University of Otago |
| **Harris** | Shikeale | Massey University |
| **Harvey-Reid** | Nathan | University of Canterbury |
| **Hayali** | Ahmed | University of Canterbury |
| **He** | Qishu | University of Otago |
| **Hedley** | Gavin | University of Canterbury |
| **Heenan** | Alex | University of Canterbury |
| **Hermanspahn** | Lily | University of Canterbury |
| **Heywood** | Zachary | University of Canterbury |
| **Horrocks** | Matthew | University of Auckland |
| **Hou** | Caixia | University of Canterbury |
| **Hughson** | Fraser | Victoria University of Wellington |
| **Hung** | Jenny | University of Auckland |
| **Hunt** | Liam | University of Auckland |
| **Hunter** | Gray | University of Auckland |
| **Ijaz** | Mohsin | University of Otago |
| **Islam** | Atif | Victoria University of Wellington |
| **Itumoh** | Emeka | University of Auckland |
| **Jangodaz** | Elnaz | Massey University |
| **Jena** | Kumar (Debajyoti) | University of Auckland |
| **Jia** | Zong Hao (Bill) | University of Auckland |
| **Jin** | Ang (Jin) | University of Canterbury |
| **Joshy** | Elma | Victoria University of Wellington |
| **Kahlon** | Navjot Kaur | University of Auckland |
| **Kan** | Wen-Fa (Regis) | University of Auckland |
| **Kasim** | Johanes Kevin | University of Auckland |
| **Kim** | Alex | University of Auckland |
| **King-Hudson** | Te-Rina | University of Canterbury |
| **Koia** | Sydnee | University of Canterbury |
| **Kumar** | Aditi | Victoria University of Wellington |
| **Kumar** | Saawan | University of Auckland |
| **Lamba** | Saurabh | University of Auckland |
| **Lambie** | Stephanie | University of Auckland |
| **Latif** | Qaisar | University of Auckland |
| **Li** | Sheung Yin (Tony) | University of Auckland |
| **Lim** | Keemi | University of Auckland |
| **Lin** | Chao Yang (Sunny) | Victoria University of Wellington |
| **Lin** | Crystal Yongqi | University of Auckland |
| **Lin** | Rolland | University of Auckland |
| **Lucarelli** | Valentina | University of Auckland |
| **Luong** | Tuan Minh | University of Auckland |
| **Ma** | Chao | University of Auckland |
| **Mahendra** | Anmol | Victoria University of Wellington |
| **Maisuria** | Bavinesh | Victoria University of Wellington |
| **Mak** | Daniel | University of Canterbury |
| **Makinde** | Zainab | University of Auckland |
| **Malone** | Niall | University of Auckland |
| **Mandal** | Ramkrishna | University of Otago |
| **Manners** | Sarah | University of Canterbury |
| **Mao** | Yubing | University of Auckland |
| **Markwitz** | Martin | Victoria University of Wellington |
| **Marone-Hitz** | Ombéline | University of Otago |
| **Maslin** | Thomas | University of Canterbury |
| **Mataira-Cole** | Ratu | Victoria University of Wellington |
| **Matich** | Olivia | Auckland University of Technology |
| **Matthewman** | Emma | University of Auckland |
| **Matthews** | Brooke | University of Canterbury |
| **Mautner** | Ira | University of Auckland |
| **McArdle** | Sophie | University of Canterbury |
| **McIntyre** | Finn | University of Canterbury |
| **McIntyre** | Sam | University of Otago |
| **Mendoza** | Shaira | Victoria University of Wellington |
| **Miller** | Jackson | Victoria University of Wellington |
| **Mills** | Chris | University of Otago |
| **Misiiuk** | Kirill | University of Otago |
| **Mohandas** | Nimisha | Massey University |
| **Mohd Darbi** | Nur Maizura | University of Auckland |
| **Molloy** | Ellen | Victoria University of Wellington |
| **Montoya Mejia** | Jessica Rocio | University of Canterbury |
| **Mooney** | Roisin | Auckland University of Technology |
| **Murali** | Sai | Victoria University of Wellington |
| **Na** | Tae Ung (Tony) | University of Auckland |
| **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 |
| **Newton-Vesty** | Michael | 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 |
| **O'Neil** | Alex | Massey University |
| **O'Reilly** | Andrea | Victoria University of Wellington |
| **Otter** | Sam | Victoria University of Wellington |
| **Owens** | Adrian | Auckland University of Technology |
| **Palpal-latoc** | Dennise | University of Auckland |
| **Pandian** | Santhosh Kumar | University of Auckland |
| **Park** | Kun Woo | University of Auckland |
| **Park** | Luke Hyung-Keun | University of Auckland |
| **Patel** | Hamesh | University of Auckland |
| **Patel** | Sahil Dineshbhai | University of Auckland |
| **Patel** | Shae | Victoria University of Wellington |
| **Patel** | Sneh | University of Auckland |
| **Paulin** | Emily | University of Auckland |
| **Petters** | Ludwig | Massey University |
| **Porritt** | Harrison | University of Auckland |
| **Posa** | Luka | University of Auckland |
| **Pot** | Catherine | Victoria University of Wellington |
| **Poudel** | Pitambar | University of Canterbury |
| **Prasad** | Shyamal | Victoria University of Wellington |
| **Pu** | Yuguang | University of Auckland |
| **Pulickal Joseph** | Delsa | University of Auckland |
| **Qicheng** | Zhang | University of Auckland |
| **Raghavan** | Harikrishnan | University of Canterbury |
| **Rajchakit** | Urawadee | University of Auckland |
| **Ramamirtham** | Sashikumar | Massey University |
| **Randall** | George | University of Auckland |
| **Rees** | Shaun | University of Auckland |
| **Rehan** | Muhammad | Massey University |
| **Ren** | Zhijun | Auckland University of Technology |
| **Richardson** | Georgia | Victoria University of Wellington |
| **Robb** | Matthew | University of Otago |
| **Rosli** | Zulfitri (Fitri) | University of Auckland |
| **Rov** | Rosanna | University of Auckland |
| **Safaei** | Sina | University of Auckland |
| **Sale** | Sarah | University of Canterbury |
| **Sansom** | Gabriela | Massey University |
| **Sarkar** | Debolina | University of Canterbury |
| **Sarwar** | Mian Makhdoom | University of Otago |
| **Schuurman** | Joel Chris | University of Canterbury |
| **Scott** | Jacob | Massey University |
| **Sen** | Anindita | Victoria University of Wellington |
| **Shaib** | Ali | Victoria University of Wellington |
| **Shepperson** | Oscar | University of Auckland |
| **Shiraz** | Fathumma Rizana | University of Auckland |
| **Siamaki** | Mohammad | Victoria University of Wellington |
| **Singh** | Varinder | University of Otago |
| **Siu** | Christy | University of Auckland |
| **Smith** | Caitlin | University of Auckland |
| **Smith** | George | Victoria University of Wellington |
| **Smith** | Mark | University of Auckland |
| **Smith** | Nicholas | University of Otago |
| **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 |
| **Studholme** | Sofie | University of Canterbury |
| **Subhasree** | Bhaskar | University of Auckland |
| **Sun** | Xin | University of Auckland |
| **Sweet** | Tylah | Victoria University of Wellington |
| **Tan** | Shi Min | University of Auckland |
| **Tang** | Da | University of Auckland |
| **Taylor** | Ross | Victoria University of Wellington |
| **Thomas** | Dion | Victoria University of Wellington |
| **Thompson** | Kadin | Victoria University of Wellington |
| **Tiban Anrango** | Bryan Andres | Auckland University of Technology |
| **Titheridge** | Laura | University of Canterbury |
| **Tong** | Juliana | University of Auckland |
| **Treacher** | Eddyn | Victoria University of Wellington |
| **Van Hilst** | Quinn | University of Otago |
| **Vas** | Marco | University of Auckland |
| **Vella** | Joe | University of Auckland |
| **Vincent** | Emma | 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** | Tony | University of Auckland |
| **Wang** | Yuxin (Sunny) | University of Auckland |
| **Wang** | Zhuoyue (Joy) | University of Canterbury |
| **Wang** | Zifei (Linna) | University of Auckland |
| **Warren** | Aran | University of Canterbury |
| **Watkin** | Serena | University of Canterbury |
| **Watts** | Benjamin | Victoria University of Wellington |
| **Webb** | Joshua | University of Auckland |
| **Westberry** | Benjamin | Massey University |
| **Williamson** | Joey | Victoria University of Wellington |
| **Wislang** | Kate | University of Canterbury |
| **Wong** | Chi Hung (Andy) | University of Auckland |
| **Wong** | Peter | University of Auckland |
| **Wood** | David | University of Canterbury |
| **Wu** | Jiazun | Victoria University of Wellington |
| **Xu** | Kristen | University of Auckland |
| **Yang** | Hui | University of Auckland |
| **Yang** | Kourtney | University of Auckland |
| **Yang** | Mingrui (Ray) | Massey University |
| **Yang** | Tingxuan | University of Auckland |
| **Young** | Eilidh | University of Auckland |
| **Yu** | Tiantian (Diana) | University of Auckland |
| **Yudhipratama** | Indra | University of Auckland |
| **Zakaria** | Amir (Winter) | University of Canterbury |
| **Zemke-Smith** | Chase | Victoria University of Wellington |
| **Zhang** | Aicheng | University of Auckland |
| **Zhang** | Ethan | Victoria University of Wellington |
| **Zhang** | Wen | University of Auckland |
| **Zhang** | Yiming | Massey University |
| **Zhoiu** | Huihua | University of Auckland |
| **Zhu** | Yufei | University of Otago |
| **Zhurenkov** | Kirill | University of Auckland |

# MI postdoctoral researchers and research assistants in 2022

## Postdoctoral Researchers (86)

| | | |
|---|---|---|
| **Abdollahi** | Ayoub | University of Auckland |
| **Acharya** | Susant | Victoria University of Wellington |
| **Akbarinejad** | Alireza | University of Auckland |
| **Arif** | Tanzeel | Victoria University of Wellington |
| **Bennie** | Rachel | University of Canterbury |
| **Bonesi** | Marco | University of Auckland |
| **Cameron** | Alan | University of Auckland |
| **Cavanagh** | David | University of Otago |
| **Chalard** | Anaïs | University of Auckland |
| **Chan** | Andrew | University of Auckland |
| **Chan** | Eddie | University of Auckland |
| **Chen** | Linda | University of Canterbury |
| **Clarke** | Daniel | Victoria University of Wellington |
| **Currie** | Michael | University of Canterbury |
| **De Zoysa** | Gayan Heruka | University of Auckland |
| **Ding** | Xiaobo | University of Auckland |
| **Doyle** | Kirsty | Victoria University of Wellington |
| **Furkert** | Daniel | University of Auckland |
| **Gai** | Sinan | University of Otago |
| **Hashemi** | Azadeh (Azy) | University of Canterbury |
| **Haverkate** | Natalie | University of Auckland |
| **Hayat** | Muhammed | University of Auckland |
| **Holmes-Hewett** | William | Victoria University of Wellington |
| **Holtkamp** | Hannah | University of Auckland |
| **Horsfall** | Aimee | University of Auckland |
| **Hubert** | Jonathan | University of Auckland |
| **Hume** | Paul | Victoria University of Wellington |
| **Kammermeier** | Michael | Victoria University of Wellington |
| **Kavianinia** | Iman | University of Auckland |
| **Kerr-Philips** | Thomas | University of Auckland |
| **Kihara** | Shinji | University of Auckland |
| **Kowalczyk** | Renata | University of Auckland |
| **Lambie** | Stephanie | University of Auckland |
| **Li** | Fan (Freda) | University of Auckland |
| **Liu** | Jinlong | University of Auckland |
| **Lowrey** | Sam | University of Otago |
| **Maity** | Tanmay | Victoria University of Wellington |
| **Mallinson** | Joshua | University of Canterbury |
| **Mapley** | Joseph | University of Otago |
| **Martinez Gazoni** | Rodrigo | University of Canterbury |
| **McDougall** | Daniel | University of Auckland |
| **Miller** | Jackson | Victoria University of Wellington |
| **Minnee** | Thomas | University of Auckland |
| **Nalumaga** | Hellen | Victoria University of Wellington |
| **Ng** | Michael | GNS Science |
| **Novikova** | Nina | University of Auckland |
| **Ogilvie** | Olivia | University of Canterbury |
| **Oh** | Jake | University of Auckland |
| **Pandullo** | Marco | Massey University |
| **Paulin** | Emily | University of Auckland |
| **Peng** | Lishan | University of Auckland |
| **Prabowo** | Sigit | Victoria University of Wellington |
| **Price** | Mike | Victoria University of Wellington |
| **Pu** | Yuguang | University of Auckland |
| **Quinsaat** | Jose | Massey University |
| **Radinger** | Hannes | University of Canterbury |
| **Raudsepp** | Allan | Massey University |
| **Rees** | Shaun | University of Auckland |
| **Rennison** | David | University of Auckland |
| **Risos** | Alex | University of Auckland |
| **Rooney** | Jeremy | University of Otago |
| **Rossa** | Thais | University of Auckland |
| **Ruffman** | Charlie | University of Auckland |
| **Sharer** | Heather | University of Canterbury |
| **Sharma** | Shailendra | University of Canterbury |
| **Sikorska** | Celina | University of Auckland |
| **Sun** | Yiling | University of Canterbury |
| **Sun-Waterhouse** | Dongxiao | University of Auckland |
| **Tayagui** | Ayelen | Univesity of Canterbury |
| **Thompson** | Kadin | Victoria University of Wellington |
| **Thorn** | Karen | Victoria University of Wellington |
| **Tu** | Jennifer | Massey University |
| **Weissert** | Lena | University of Auckland |
| **Westberry** | Benjamin | Massey University |
| **Wright** | Joshua | University of Canterbury |
| **Wu** | Chang | University of Canterbury |
| **Xu** | Sherry | University of Auckland |
| **Yang** | Sunghyun | University of Auckland |
| **Yang** | Wuxin | University of Auckland |
| **Yick** | Samuel | University of Auckland |
| **Zhang** | Ao | Victoria University of Wellington |
| **Zhang** | Peikai | University of Auckland |
| **Zhang** | Shengping (Allan) | University of Auckland |
| **Zhang** | Wen | University of Auckland |
| **Zhang** | Yao | Victoria University of Wellington |
| **Zhu** | Bicheng | University of Auckland |

## Research Assistants (58)

| | | |
|---|---|---|
| **Andrew** | Phillippa-Kate (Kate) | Massey University |
| **Banks** | Sophie | Robinson Research Institute |
| **Beikzadeh Ghelejlou** | Sara | University of Auckland |
| **Bennington** | Michael | University of Otago |
| **Bullock** | Catherine | Victoria University of Wellington |
| **Burnett** | Brydon | University of Auckland |
| **Butler** | Tane | Victoria University of Wellington |
| **Chambers** | Eleanor | Victoria University of Wellington |
| **Chen** | Qun (Queenie) | University of Auckland |
| **Clarke** | Jordan | Victoria University of Wellington |
| **Clifford** | Max | Victoria University of Wellington |
| **Cowan** | Ryan | University of Auckland |
| **Dissanayake** | Shama | University of Auckland |
| **Dixon** | Alex | University of Auckland |
| **Durrant** | Matthew | University of Canterbury |
| **Ferguson** | Alexander | University of Auckland |
| **Girdwood** | Megan | Victoria University of Wellington |
| **Hackner** | Luc | Victoria University of Wellington |
| **Huata** | Ringahora | Whakarewarewa Living Village |
| **Ilina** | Aleksandra | Victoria University of Wellington |
| **Itumoh** | Emeka | University of Auckland |
| **Khalil** | Bushra Anam | University of Canterbury |
| **Limlamthong** | Mutjalin (Lin) | Victoria University of Wellington |
| **Makinde** | Zainab | University of Auckland |
| **Matthews** | Hannah | University of Auckland |
| **McConnell** | Fraser | Victoria University of Wellington |
| **McLeod** | Oliver | GNS Science |
| **Mendoza** | Shaira | Victoria University of Wellington |
| **Mohd Darbi** | Nur Maizura | University of Auckland |
| **Monteiro** | Jaimy | Victoria University of Wellington |
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| **Nair** | Mohinder | Auckland University of Technology |
| **Nalumaga** | Hellen | Victoria University of Wellington |
| **Narasimhan** | Badri Narayanan | University of Auckland |
| **Nawaz** | Tehreema | Victoria University of Wellington |
| **Park** | Luke | University of Auckland |
| **Patel** | Krunal | University of Auckland |
| **Phillips** | Tiernan | University of Auckland |
| **Pradhan** | Susav | Massey University |
| **Rani** | Aakanksha | University of Auckland |
| **Reid** | Oscar | University of Canterbury |
| **Russell** | Maisie | University of Auckland |
| **Sen** | Anindita | Victoria University of Wellington |
| **Singh** | Varinder | University of Otago |
| **Siow** | Andrew | University of Auckland |
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| **Wagner** | Isabella | Victoria University of Wellington |
| **Ward** | Ciaran | University of Otago |
| **Watt** | Carlie | University of Auckland |
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| **Wilson** | Eva | Victoria University of Wellington |
| **Woolly** | Ethan | Victoria University of Wellington |
| **Zhang** | Yao | Victoria University of Wellington |
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Paulin, E.K., Leung, E., Pilkington, L.I. & **Barker, D.**

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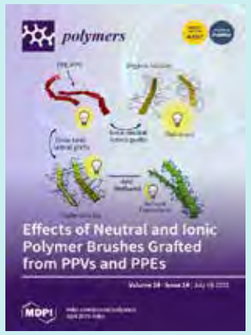


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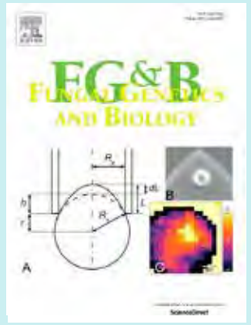


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# Books

| AUTHORS | BOOK TITLE | PUBLISHER |
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# Book chapters

| AUTHORS | CHAPTER TITLE | BOOK TITLE | PUBLISHER |
|---|---|---|---|
| Patel, S.D. & **Weber, C. C.** | 5 Alternative solvents and the UN sustainable development goals | *Green Chemistry* | De Gruyter |
| **Barker, D.** & Pilkington, L. | Bicyclic 5-6 Systems: Five Heteroatoms 2:3 or 3:2 | *Comprehensive Heterocyclic Chemistry IV* | Elsevier |
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| Healy, C., **Kruger, P. E.**, & **Telfer, S. G.** | Photochemistry of Metal-Organic Frameworks | *Springer Handbooks* | Springer Science and Business Media Deutschland GmbH |



# Conference papers

| AUTHORS | TITLE OF CONFERENCE PAPER | TITLE OF PROCEEDINGS |
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| Andrew, P.-K., Raudsepp, A., **Nock, V.**, Fan, D., **Williams, M. A. K.**, Staufer, U., & Avci, E. | Developing an Optical Microlever for Stable and Unsupported Force Amplification | *Proceedings of MARSS 2022 - 5th International Conference on Manipulation, Automation, and Robotics at Small Scales* |
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| Allen, M.C., Lookmire, S., & **Avci E.** | Manufacturing Microfluidic Chips: Micro Milling Approach | *Proceedings of MARSS 2022 - 5th International Conference on Manipulation, Automation, and Robotics at Small Scales* |
| Sarkar, D., Sun, Y., Tayagui, A., Adams, R., Garrill, A., & **Nock, V.** | Microfluidic Platform to Study Electric Field Based Root Targeting by Pathogenic Zoospores | *IEEE Symposium on Mass Storage Systems and Technologies (2022)* |
| van Breugel, S.J., Quinn, L., Holtkamp, H., Araquel-Lacamiento, A., Amirapu, S., Srinivasa, K.K., Low, I., Christie, M.L., **Nieuwoudt M.K.**, Pokorny, M.R., Nagarajan, R., Simpson, M.C., Zargar-Shoshtari, K., & Aguergaray, C. | Needle probe for accurate prostate cancer diagnosis - Results on fresh biopsy cores | *2022 Conference on Lasers and Electro-Optics, CLEO 2022 - Proceedings* |
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| Allan, C., Tayagui, A., **Nock, V.**, & Meisrimler, C.-N. | Novel Bi-Directional Dual-Flow-Rootchip to Study Effects of Osmotic Stress on Calcium Signalling in Arabidopsis Roots | *IEEE Symposium on Mass Storage Systems and Technologies (2022)* |
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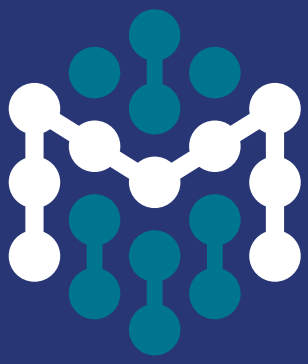
# Keynote and invited speaker addresses

| NAME | DETAILS |
|---|---|
| **Sally Brooker** | Keynote speaker at the 8th Asian Conference on Coordination Chemistry, Taipei, Taiwan, 7-11 August 2022. “Tuneable ligand field leads to correlations with spin crossover T1/2 and redox potential Epa in Fe(II) helicates” |
| | Plenary speaker at the 2nd Asian Conference on Molecular Magnetism, Bhopal, India, 6-10 December 2022. “Spin crossover: towards predictable tuning of switching temperatures in advance of synthesis and dual-functionality” |
| **Simon Brown** | 2nd International Workshop Neurotronics: Bio-inspired information pathways, Kiel, Germany, 5-8 September 2022. “Criticality in Percolating Networks of Nanoparticles” |
| | International School of Solid State Physics: Unconventional Computing: Materials Science, Informatics, Hardware, Software, Erice, Italy, 20-26 October 2022. “Criticality in Percolating Networks of Nanoparticles: Towards brain-like computation” and “Reservoir Computing with Networks of Nanoparticles and Nanowires” |
| **Peng Cao** | International Symposium on the Frontiers of Metallic Structural Materials, Shenyang China, 7 December 2022. “Development of high-performance titanium injection moulding” |
| **Nathaniel Davis** | Australian Research Council Centre for Excellence in Exciton Science Annual Workshop, Lorne, Australia, 21-25 November 2022. “Pushing the limits on renewable energy technology through hybrid organic/inorganic nanomaterials” |
| **Laura Domigan** | Chemeca, Melbourne, Australia, 25-27 September 2022. “Recipes for cultivated meat” |
| **Robin Fulton** | 16th International Symposium on Inorganic Ring Systems, Graz, Austria, 24-29 July 2022. “The influence of the ring on the chemistry of germanimine complexes” |
| **Patricia Hunt** | Plenary speaker at the 27th Thermodynamics Conference, University of Bath, UK, 7-9 September 2022. "Describing ionic systems, how important are partial charges, charge transfer and polarisability?" |
| **John Kennedy** | International Conference on Advanced Nanomaterials & Application, VIT-AP University, India, 16-18 November 2022. “Ion Beam Engineering of Piezoelectric and Electrocatalytic Materials” |
| | International Conference for Emerging Materials for Technological Applications, Visakhapatnam, India, 23-25 November 2022. “Ion beam engineering of advanced materials for energy applications” |
| | 16th Global Congress on Manufacturing and Management GCMM 2022, Auckland, New Zealand, 5-7 December 2022. “Aotearoa: Green Hydrogen Technology Platform” |
| **Jadranka Travas-Sejdic** | International Nanomedicine Conference, Sydney, Australia, 22-24 June 2022. “Conductive Polymers Biointerfaces for Bioelectronics & Controlled Capture-Release” |
| | New Zealand Medical Sciences Congress, Queenstown, New Zealand, 30 August – 1 September 2022. “Applications of Conductive Polymers Biointerfaces” |
| | New Zealand Institute of Chemistry (NZIC) Conference, Auckland, New Zealand, 21-24 November 2022. “Biomimetic conductive polymers for stretchable electronics and capture -release of biological entities” |
| | The 17th Pacific Polymer Congress (PPC17), Brisbane, Australia, 28 November – 2 December 2022. “Novel conducting polymers biointerfaces for bioelectronics” |



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