

# Strategic Plan 2015



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# The MacDiarmid Institute

for Advanced Materials and Nanotechnology

## **The MacDiarmid Institute for Advanced Materials and Nanotechnology is a national network of leading New Zealand scientists.**

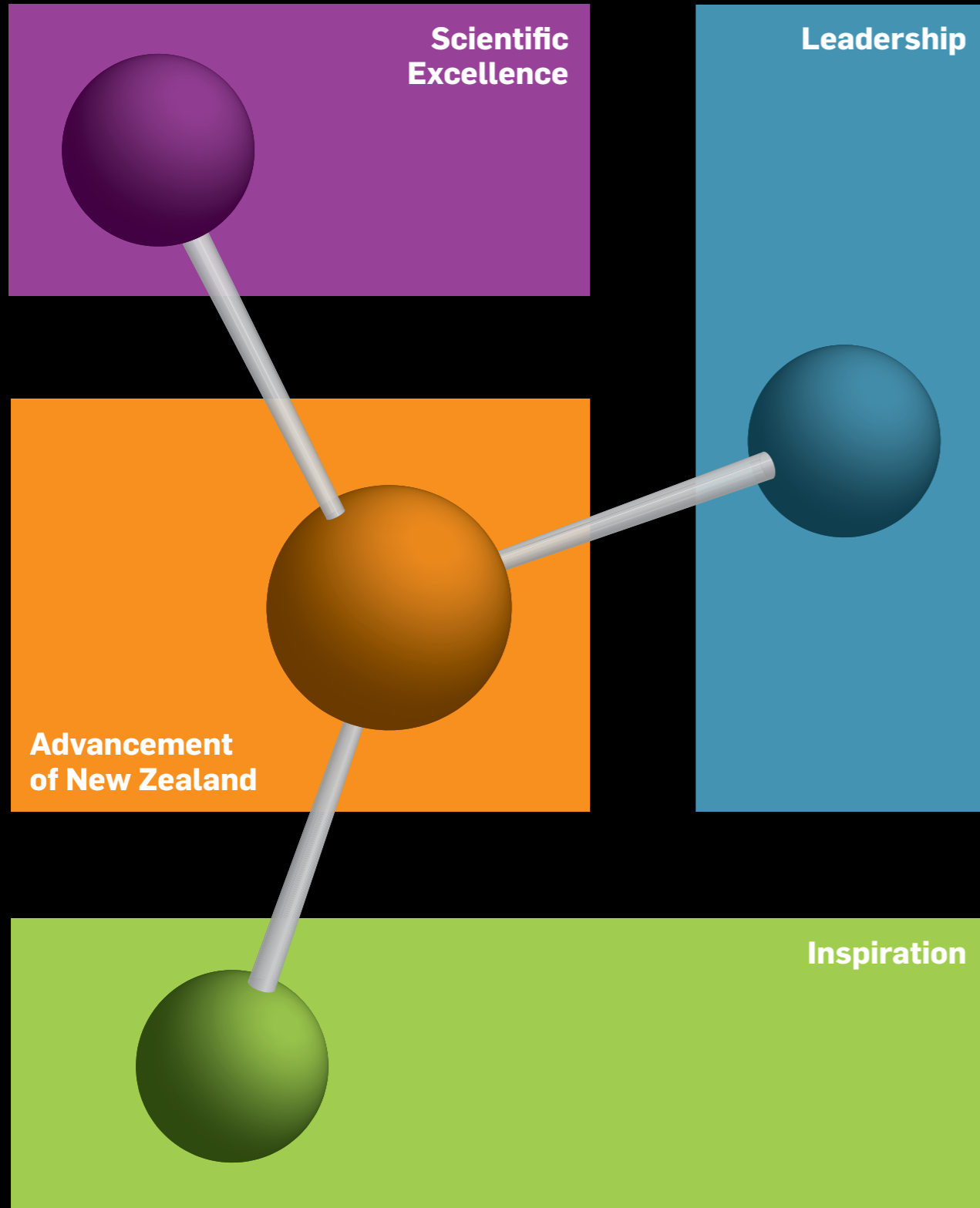
The Institute leverages strengths across the country and internationally, working collaboratively utilising a programme-based approach to undertake harder, higher-level research that drives innovation and economic growth in and for relevant New Zealand industries. The research undertaken by institute investigators includes, but is not restricted to, generating new knowledge in electronic and photovoltaic materials with tailored performance, nanoporous materials for energy- and environment-related applications, functional nanomaterials inspired by biology, or manufactured using biology, for advanced applications in energy, medicine and sensing, and new nanotools for cellular studies. We build materials and devices from atoms and molecules, developing and applying cutting-edge techniques in physics, chemistry and engineering. We capture our diversity to create benefit and build strength. We train entrepreneurial and socially-aware young scientists, many of whom go on to work in industry or start their own companies, in a culture of excellence and collaboration. Through sharing the results of our scientific research with the public and with Government, we are inspiring researchers and working to generate a nationwide culture change where science and innovation are celebrated as the keys to New Zealand's future prosperity.

Our research will deliver important elements of the disruptive science that will underpin the future of technological development that will be on par with, for example, smart-device systems that have already transformed how people live their lives.

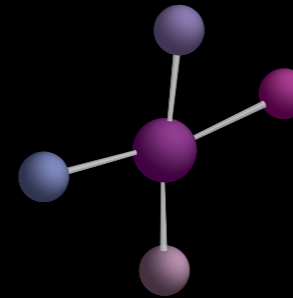
*Nano-straws*

**By Amy Yewdall  
University of Canterbury**

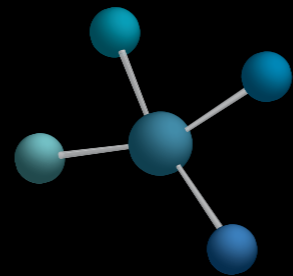
# Our Vision



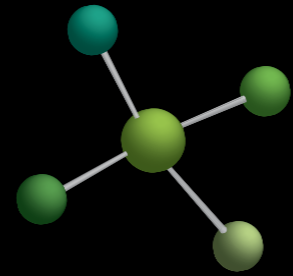
# Our Mission



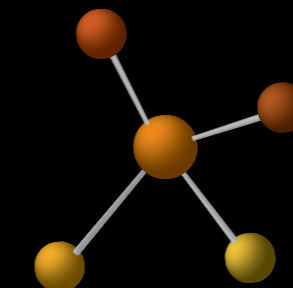
**To deliver excellent scientific research and education**  
 Creative, ambitious, innovative research in advanced materials and nanotechnology



**To forge New Zealand's future leaders**  
 Scientifically astute, entrepreneurial and socially aware leaders

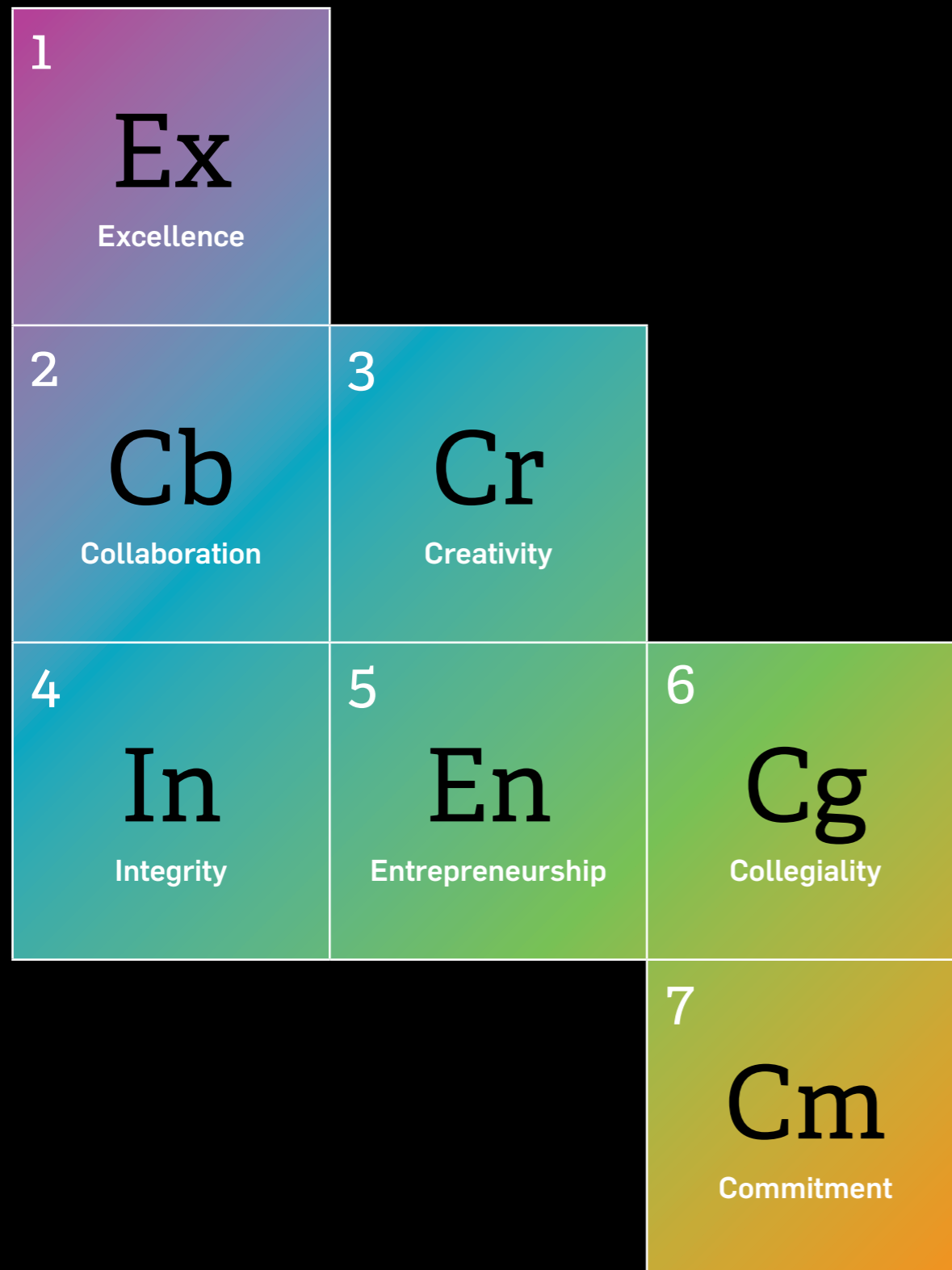


**To inspire New Zealanders**  
 Engendering passion for science and innovation across society



**To advance a new future for New Zealand**  
 Deliver and support responsible economic development

# Our Values



# Our Partnership Strategic Goals



The MacDiarmid Institute is a partnership between five Universities and two Crown Research Institutes. Our Investigators are based in Auckland, Palmerston North, Wellington, Christchurch and Dunedin.

By working cooperatively, within the framework of the MacDiarmid Institute, our partners will collaborate to:

a	ensure that the MacDiarmid Institute spearheads a greater international prominence and increased international linkages for New Zealand materials science and nanotechnology;
b	utilise the different strengths and competitive advantages of each of the partners to reduce barriers, upskill partners and maximise research translation; and
c	provide mechanisms that create a sustainable, well-used research infrastructure that serves the community of research providers.

Together these will enable the MacDiarmid Institute to have impact both nationally and internationally and work to benefit materials science and nanotechnology research within the partnership and in New Zealand.



# Our 6 Year Outcomes

## 1

### Growing New Zealand's human capital and innovation potential:

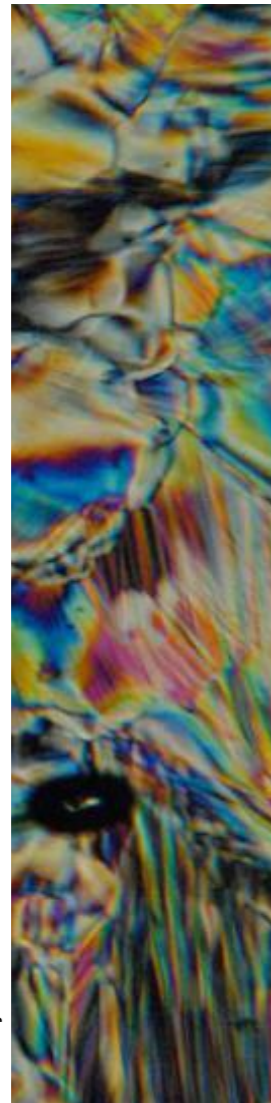
Delivering research outcomes that define both the benchmark for excellence and the knowledge frontier in advanced materials and nanotechnology.

Creating a culture of research excellence that attracts and retains the very best national and international talent in advanced materials and nanotechnology science and its application.

Delivering graduates who are highly sought after by the high value manufacturing sector by adding value to our tertiary education partner programmes through targeted training programmes for our emerging scientists that will improve the commercial skills, knowledge and aspirations of PhD graduates and postdoctoral fellows in advanced materials and nanotechnology, training and mentoring them in IP and commercial assessment, technology transfer and research commercialisation.

Enhancing direct participation and achievement in science and technology by Māori, through further developing our Discovery Awards into a national programme, utilising community science programmes and developing Kōrero ki te Kaipūtaiao – a targeted programme for Māori teachers and learners.

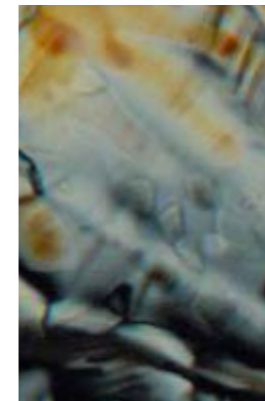
Strengthening knowledge sharing, research translation and utilisation of capability in advanced materials and nanotechnology by partnering with government, industry and tertiary education organisations to create a strong network of practitioners.



Nanoart by Lia van den Kerkhof

## 2

### Influencing societal change:



Improving science literacy, involvement in physical sciences throughout New Zealand society and enhancing the New Zealand public's perceptions of the value of physical sciences for New Zealand by delivering targeted outreach (e.g. Kōrero with Scientists, Media MasterClass) and engagement activities (e.g. public forums), valued by participants.

Provide a well-informed evidence base that is a resource for government policy development and public debate on matters relating to advanced materials and nanotechnology and their future implications for society.

## 3

### Generating Economic Impact:



Exploiting IP generated from our research outcomes in advanced materials and nanotechnology to create differentiating products or lead to opening new markets by actively working with research, commercialisation and industry partners within New Zealand.

Providing pathways for aspiring science entrepreneurs to enter into or start a business by working with partner organisations.

## Scientific Collaborations

### OBJECTIVES

**Delivery of multi-institutional scientific collaborations that embrace the best researchers in advanced materials and nanotechnology and provide an excellent scientific research infrastructure.**

### IMPLEMENTATION

Hold regular face-to-face subject- and capability-based meetings and whole institute meetings to facilitate collaboration

Use our interactive electronic discussion forums to facilitate collaboration and development of new ideas

Integrate strategic science priorities and objectives through a programme-based approach

Ensure balanced pathways for implementation of new ideas by individual researchers and large-scale, high-impact collaborative projects.

### OUTCOME 6 YEARS

Our investigators are involved in productive collaborations that involve all MacDiarmid Institute partners

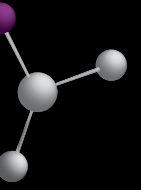
Intensity and range of collaborations increased

Formal working partnerships extend to all relevant individuals and organisations within New Zealand, making us truly a national institution

Two active large-scale programmes are generating high impact outputs and outcomes at any given time that are attracting international recognition.

# Scientific Excellence

**Creative, ambitious, innovative research in advanced materials and nanotechnology**



## Recognising and Supporting Excellence

### OBJECTIVES

**Ensuring that our scientific leadership and impact is sustainable by balancing support for established and emerging research and researchers.**

### IMPLEMENTATION

Our Science Advisory Board meets three times a year to reassess our strategic science priorities

Maintain balance of emerging and established investigators within the Principal Investigator cohort

Balance resource stability for current research programmes with discretionary funding to support new initiatives.

### OUTCOME 6 YEARS

MacDiarmid Institute strategic science priorities are creative, ambitious and innovative, they are integrated across the Institute, are producing high impact outcomes that attract international recognition and lead to the advancement of New Zealand

Profile of research in the institute encompasses individual-led and larger targeted collaborative programmes

Profile of research in the Institute is a mix of new and established research programmes.

## Scientific Leadership and Impact

### OBJECTIVES

**Internationally recognised as the exemplar scientific research organisation in New Zealand and among the very best in our field.**

### IMPLEMENTATION

Provide resource stability and flexibility to Investigators to enable them the ability to be creative and innovative in their research, driving ambitious research programmes

Hold a biennial international conference (AMN series) attracting the best international researchers to New Zealand and showcasing our research and researchers

Brand all our outputs and outcomes and undertake annual analysis of outputs to benchmark us nationally and internationally.

### OUTCOME 6 YEARS

Proportion of published institute papers recognised by peers and appearing in top 10% of journals increased

Two-year impact factors are comparable with internationally recognised AMN Institutes and the library of our publication journals

At least two of our scientific research areas and the Investigators driving these areas are internationally regarded as leading the field

AMN conference series continues to grow in calibre, attracting high numbers of international attendees who rate the conference highly.

## Ensuring Excellence

### OBJECTIVES

**Rigorously and regularly measure our performance as an institute and as individual researchers with respect to the quality of our research outputs.**

### IMPLEMENTATION

Conduct international review of the Institute every three years, the focus of which is directed by the issues of the day

Review Principal and Emeritus Investigators, and call for new Principal Investigators three yearly; consider depth, breadth and career demographics across the Institute and ability to deliver on the strategic plan in finalising cohort

Conduct Associate Investigator census three yearly, with a continuous open call for Associate Investigators

Uphold rigorous recruitment standards for postdoctoral fellows and doctoral students.

### OUTCOME 6 YEARS

Recommendations of review panel are implemented where resources allow

Principal Investigator numbers are sustained with clear evidence of beneficial rejuvenation from new investigators

Twenty MacDiarmid Institute alumni are active lead researchers throughout New Zealand and the world.

## Leadership Development

### OBJECTIVES

Developing and fostering leadership at all levels of the MacDiarmid Institute.

### IMPLEMENTATION

Promote our members for local, national and international opportunities

Provide formal leadership opportunities for our investigators through regular turnover of Science Leaders and Science Executive members

Provide opportunities for training and mentorship for all our members through our internal science groupings

Ensure broad participation by and continuity of knowledge and capability of our students and postdoctoral fellows in MESA, including representation of MESA on the Science Executive.

### OUTCOMES 6 YEARS

Fifteen MacDiarmid Institute members serve on national panels and committees

Fifteen Investigators serve on Science Executive over a six-year period

A strong broadly representative MESA committee is established yearly, with mentoring through MESA committee alumni.

## Integrated Community

### OBJECTIVES

Creating a strong integrated community of investigators, students and alumni.

### IMPLEMENTATION

Provide a diversity of opportunities for Investigators to interact with each other creating cohesion and a sense of belonging, ownership, responsibility, participation and innovation

Develop and maintain an active MacDiarmid Institute alumni network

Establish a formal network of affiliated companies and through this provide opportunities for all our members to interact with them directly.

### OUTCOME 6 YEARS

Clearly identified MacDiarmid Institute community who actively promote their membership

MacDiarmid Institute Investigator engagement is strengthened

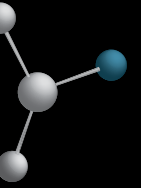
MacDiarmid Institute alumni network is self-perpetuating with 300 alumni actively involved and direct engagement with current students and postdoctoral fellows

Number of MacDiarmid Institute alumni employed in HVMS or supporting sectors (national and internationally) increases

Number of companies that have direct linkages to institute research outcomes increases.

# Leadership

Scientifically astute, entrepreneurial and socially active leaders



## Optimal Learning Environment

### OBJECTIVES

Providing an outstanding learning environment for our students and postdoctoral fellows that extends beyond the lab bench.

### IMPLEMENTATION

Provide our members with direct access to the best equipment, research infrastructure, scientists, innovators, and leaders

Provide appropriate training opportunities that support delivery on our established set of graduate attributes that align with our strategic goals and values

Work with MESA to develop training opportunities for our students and postdoctoral fellows

Work with partners to target the commercial skills, knowledge and aspirations of our emerging scientists by providing training/mentoring in IP and commercial assessment, technology transfer and research commercialisation.

### OUTCOME 6 YEARS

All students and postdoctoral fellows are welcomed and integrated into the MacDiarmid Institute community and initiate and drive collaborations

MESA delivers on average 10 training opportunities per annum that are valued and well attended as evidenced by exit interview data and number of emerging scientists in attendance

Graduates enthusiastically endorse the quality of their training, fully participating in all activities

Graduates confirm that they have achieved the graduate attributes and that they have gained a broad range of employable skills.

## Leadership in science in society

### OBJECTIVES

Demonstrating active leadership in the relationship between science and society.

### IMPLEMENTATION

Conduct a national survey of societal perceptions of science, in partnership with relevant organisations

Hold public forums connecting science with society to address major societal issues of the day, in partnership with relevant organisations

Support our members to present at, and participate in, national and international conferences about science and society

Identify and support our best communicators to be Science in Society Leaders

Speak out on topics of misrepresentation of scientific information in the media or society that relate to the evidentiary expertise held within the Institute.

### OUTCOME 6 YEARS

Public forums act as catalyst for new actions devised to address major societal issues of the day

MacDiarmid Institute regarded as a voice of authority, regularly contributing to media commentary and receiving weekly enquiries from media and public

Findings of national survey of societal perceptions of science are used to inform public policy.



## Benefits of Science & Innovation

### OBJECTIVES

Stimulating nationwide discussion on the benefits of science and innovation to our society.

### IMPLEMENTATION

Develop a media management plan, including media training for staff

Hold public forums connecting science with society to address major societal issues of the day, in partnership with relevant organisations

Conduct a national survey of societal perceptions of science, in partnership with relevant organisations

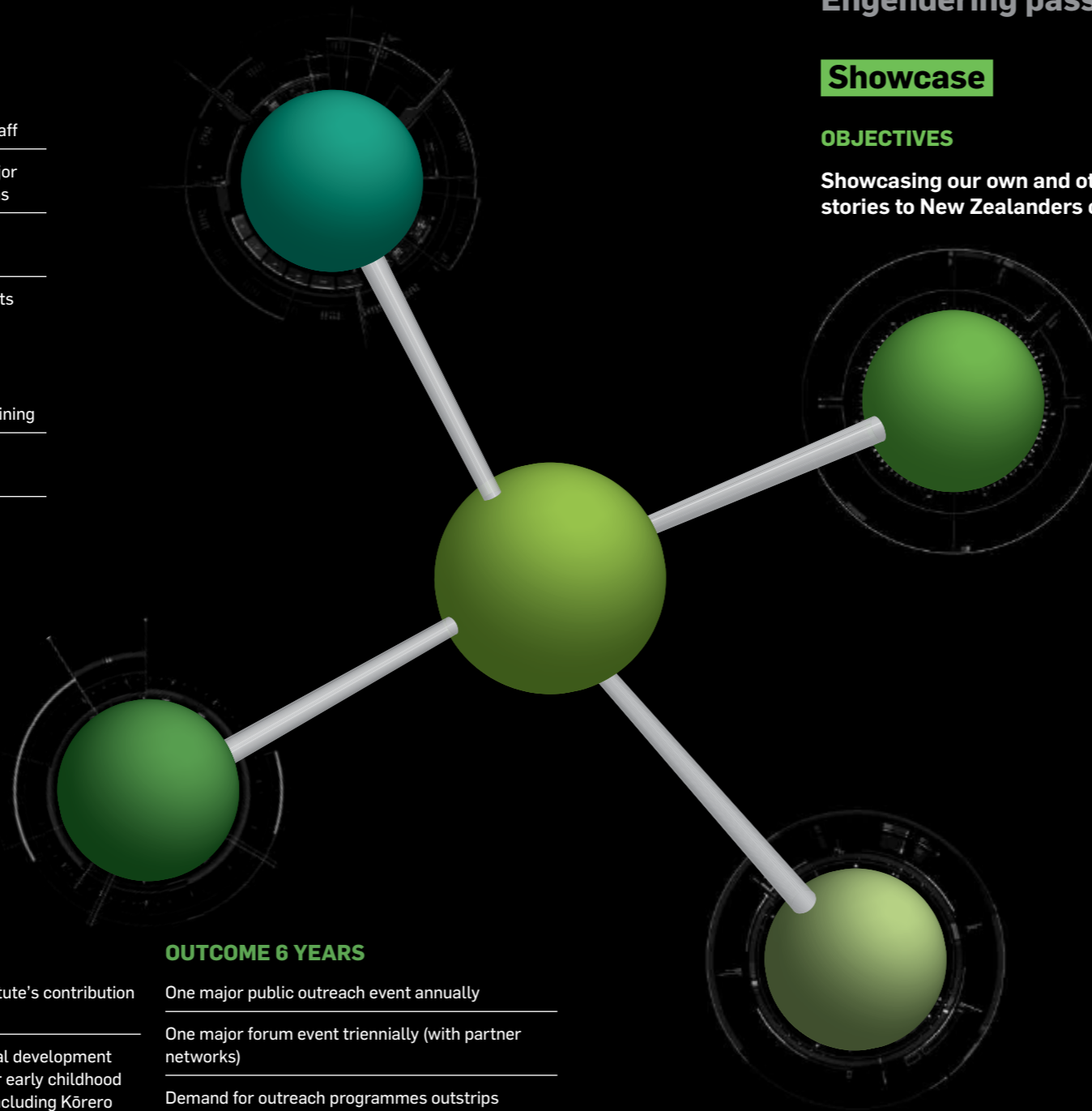
Identify and support our best communicators to express the benefits of science and innovation to our society.

### OUTCOMES 6 YEARS

Fifty percent of our Investigators have completed formal media training

New Zealand public's perceptions of value of physical science for New Zealand are improved

Participants' perception of the value of our activities is enhanced.



## Role of Science & Innovation

### OBJECTIVES

Engaging directly with the New Zealand public, private sector and Government, sharing our vision of the role of science and innovation in New Zealand's future.

### IMPLEMENTATION

Publicise the MacDiarmid Institute's contribution to the economy

Provide a variety of professional development programmes and resources for early childhood and primary school teachers including Kōrero with Scientists and 100 of the Best

Identify key contacts and develop and grow active networks within government, industry, media and schools

Work with our Industry Advisory Board to identify opportunities to connect science, innovation and society

Participate in national strategic advisory groups and grow active networks within government to ensure the national science enterprise gives maximum value for investment.

### OUTCOME 6 YEARS

One major public outreach event annually

One major forum event triennially (with partner networks)

Demand for outreach programmes outstrips capacity

School teacher programmes have 100% uptake and teachers demonstrably value the programmes

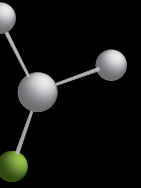
Teacher professional development programmes grown via strategic partnerships

Contributions to Government policy development in five areas of importance within the science and education sectors

Our web resources and stories are visited regularly in strong numbers.

# Inspiration

Engendering passion for science and innovation across society



## Showcase

### OBJECTIVES

Showcasing our own and other science stories to New Zealanders of all ages.

### IMPLEMENTATION

Tell our stories through Update, our website, social media, Interface, and our Annual Report

Provide communications training and public-engagement opportunities for our Investigators, students and postdoctoral fellows

Undertake targeted and impactful outreach activities

Track high school student outreach alumni (Nanocamp, Discovery Awards).

### OUTCOME 6 YEARS

Annual number of website hits from each stakeholder community is increased

Five MacDiarmid Institute stories are picked up by national media each year

Ten MacDiarmid Institute outreach alumni study physical sciences because of participating in our programmes

Thirty MacDiarmid Institute outreach alumni complete science-related degrees and 5% go on to postgraduate studies

One MacDiarmid Institute alumni recognised formally via a communicators award.

## Māori and Pasifika

### OBJECTIVES

Engaging directly with Māori and Pasifika communities, generating opportunities and lifting ambitions.

### IMPLEMENTATION

Develop, grow and formalise relationships with Māori communities founded on mutual exploration of education and business opportunities supported by a science foundation

Provide targeted professional development programmes in science for Māori teachers and Pasifika Teachers, Kōrero ki te Kaipūtaiao.

### OUTCOME 6 YEARS

Sixty Māori and 20 Pasifika MacDiarmid Institute Discovery Awards alumni

Thirty Māori and 10 Pasifika MacDiarmid Institute outreach alumni complete or are enrolled in tertiary education programmes

Continuity of formal relationships and activity between the institute and Māori communities

Kōrero ki te Kaipūtaiao is well supported and demand outstrips capacity, teachers demonstrably value the programme.

## Collaborative Networks

### OBJECTIVES

Partnering with applied research and development organisations; ensuring economic outcomes for our science, and appreciation of the market demands important to New Zealand companies. Thereby delivering maximum benefit to New Zealand, its people and its economy.

### IMPLEMENTATION

Work with our Industry Advisory Board to identify opportunities to connect our science, innovation and people to industry

Establish and foster a formal network of affiliated companies

Foster and utilise our connections with industry, angel and venture capital communities, applied research and development organisations, Callaghan Innovation, affiliated companies, tech-transfer offices, KiwiNet, Return of Science, etc. to facilitate the advancement of science-led economic growth and development of existing and emerging companies and to enable proactive effective two-way engagement

Work with our partners and affiliated companies to advance science-led economic growth and development of existing and emerging companies

Provide industry internships and industry tour opportunities for our PhD students in partnership with our Industry Advisory Group and affiliated companies.

### OUTCOME 6 YEARS

Affiliated company membership has grown to eight

Industry sponsorship of 12 PhD student internships

Industry/partner secondments/exchanges formalised

An average of two seed investments in MacDiarmid Institute start-ups or successful PSAF applications each year

New commercial exploitation of one MacDiarmid Institute technology each year by our partners

Partnership network ensures a navigable homogeneous grouping of science providers are directly engaged with existing industries and supporting emerging industries.

## Alumni as Leading Innovators

### OBJECTIVES

Producing scientists and engineers who make leading contributions to New Zealand's prosperity.

### IMPLEMENTATION

Engage our PhD students and postdoctoral fellows in commercialising MacDiarmid Institute research

Work with MESA, our Innovation Agent and KiwiNet to deliver commercialisation workshops and opportunities that increase awareness and employability

Maintain connections with the MacDiarmid Institute alumni network.

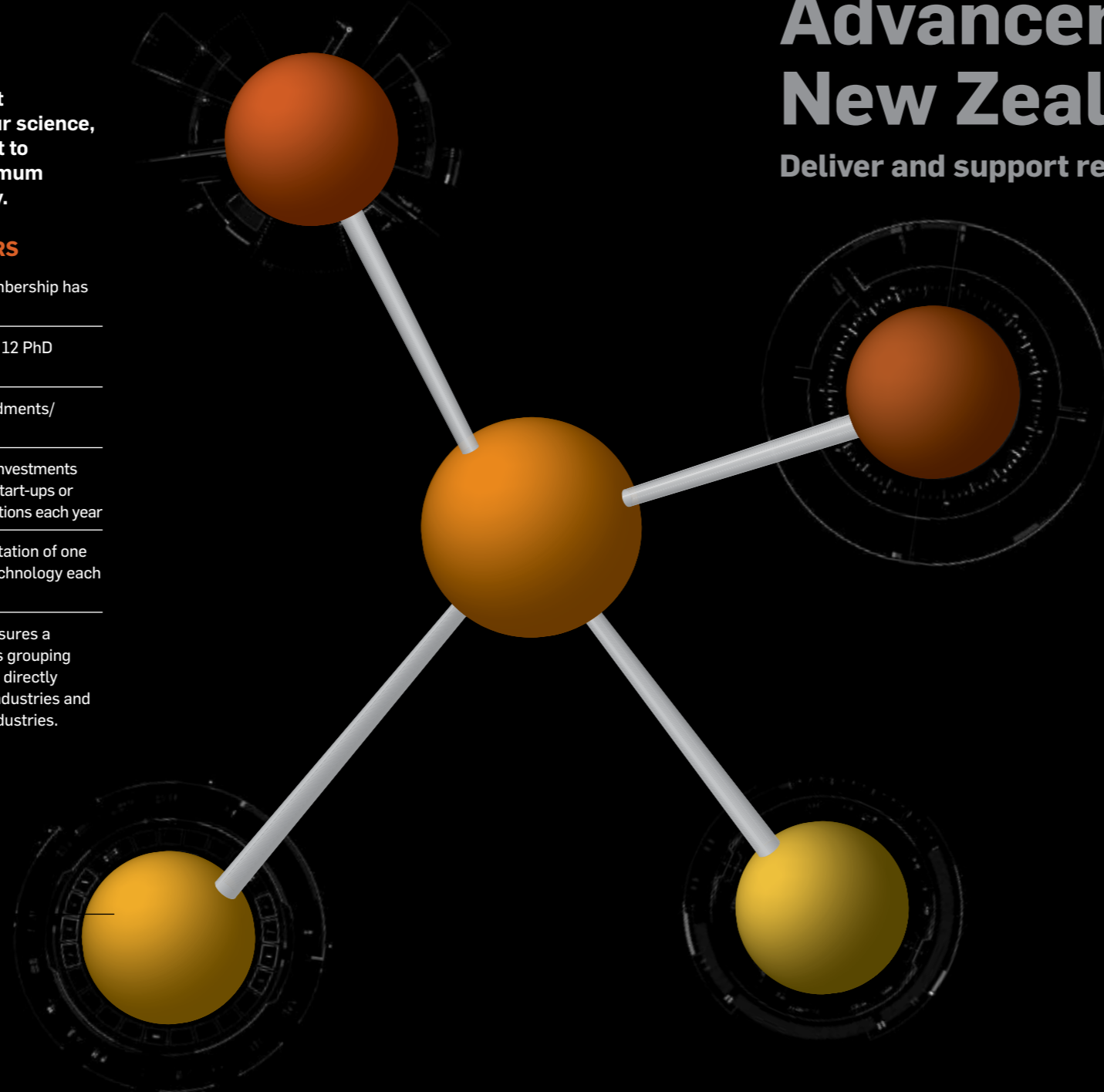
### OUTCOME 6 YEARS

Employable MacDiarmid Institute branded workforce created, confirmed by employment survey

Number of MacDiarmid Institute alumni employed in HVMS or supporting sectors (nationally and internationally) increases, with a positive net inflow to New Zealand due to MacDiarmid Institute activities.

# Advancement of New Zealand

Deliver and support responsible economic development



## Commercialise Research

### OBJECTIVES

Commercialising our research, as appropriate, ensuring the greatest possible benefit to New Zealand, its people and its economy.

### IMPLEMENTATION

Work with our community partners, including Callaghan Innovation, to exploit our intellectual property and generate new businesses

Foster cross-theme, cross-disciplinary and/or cross-CoRE activities that have direct economic outcomes

Support our PhD students and postdoctoral fellows to initiate their own science-based businesses.

### OUTCOME 6 YEARS

Ten MacDiarmid Institute alumni start their own businesses

Research by MacDiarmid Institute members leads to spin out of five new companies

Research by MacDiarmid Institute members leads to licensing of 15 new patents.

## Engendering Advancement

### OBJECTIVES

Sharing and realising our vision for adaptable and sustainable economic growth based on a high-technology export sector.

### IMPLEMENTATION

Tell our stories, ensuring that our vision forms an integral component of the national science/business/innovation agenda

Work with our Partners and affiliated companies to communicate the benefits of commercially-led and scientifically-enabled business development.

### OUTCOME 6 YEARS

The MacDiarmid Institute is recognised as a leading contributor to national innovation strategy

Stories highlighting the benefits of science-led business development appear on the MacDiarmid Institute website quarterly with high numbers of hits from relevant stakeholders.

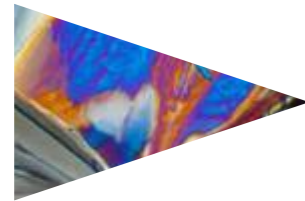
CoRE: Centre of Research Excellence

MESA: MacDiarmid Emerging Scientists Association

PSAF: Pre-Seed Accelerator Fund



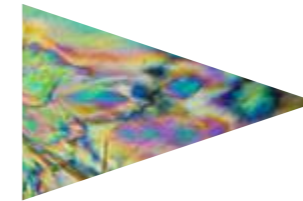
# Measures of activity, impacts and outcomes



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## Annual Measures of activities

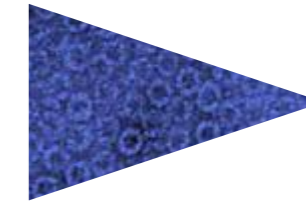
- ▶ Percentage annual growth of emerging scientists attending training forums
- ▶ Continuity of relationship and activity with Māori community towards development of a community science programme
- ▶ Kōrero ki te Kaipūtaiao (1) development, (2) participation and (3) evidence of value (survey data)
- ▶ Annual number of website hits from each stakeholder community
- ▶ Cumulative number of teachers and their locations participating in Kōrero with Scientists and evidence of value (survey data)
- ▶ Demand for discovery/outreach programmes; application vs. places
- ▶ Participant value rating of knowledge exchange and public engagement (survey data)
- ▶ Cumulative number of industry/partner secondments/exchanges
- ▶ Number of students undertaking funded industry PhD internships
- ▶ Citations
- ▶ Collaborative partners
- ▶ Student outcomes
- ▶ Staffing data
- ▶ Research protection



3-5

## Measures of 3-5 year impacts

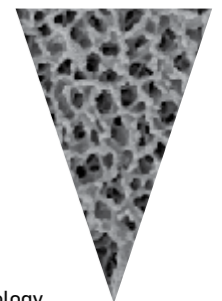
- ▶ Continued success of biennial AMN conference series as measured by the number of international delegates
- ▶ Percentage of discovery/outreach alumni successfully completing higher education/science
- ▶ Percentage of institute papers in top 10% of journals representing institute research activities
- ▶ Percentage of institute papers with five-year average citation rate of >10 per annum
- ▶ Two-year impact factors a) comparison with the average impact factor of the journals that we publish in and b) comparison to other internationally recognised AMN institutes (UQ, LCN, MIT, NUS)
- ▶ MacDiarmid Institute Investigator engagement (survey data)
- ▶ Productivity, intensity and range of collaborations (joint papers and commercialisation activities [people and partners, domestic and international])
- ▶ Commercialisation opportunities generated from MacDiarmid Institute research being explored by the partners
- ▶ Societal perception of physical sciences (national survey data undertaken as part of nationwide stakeholder partnership)



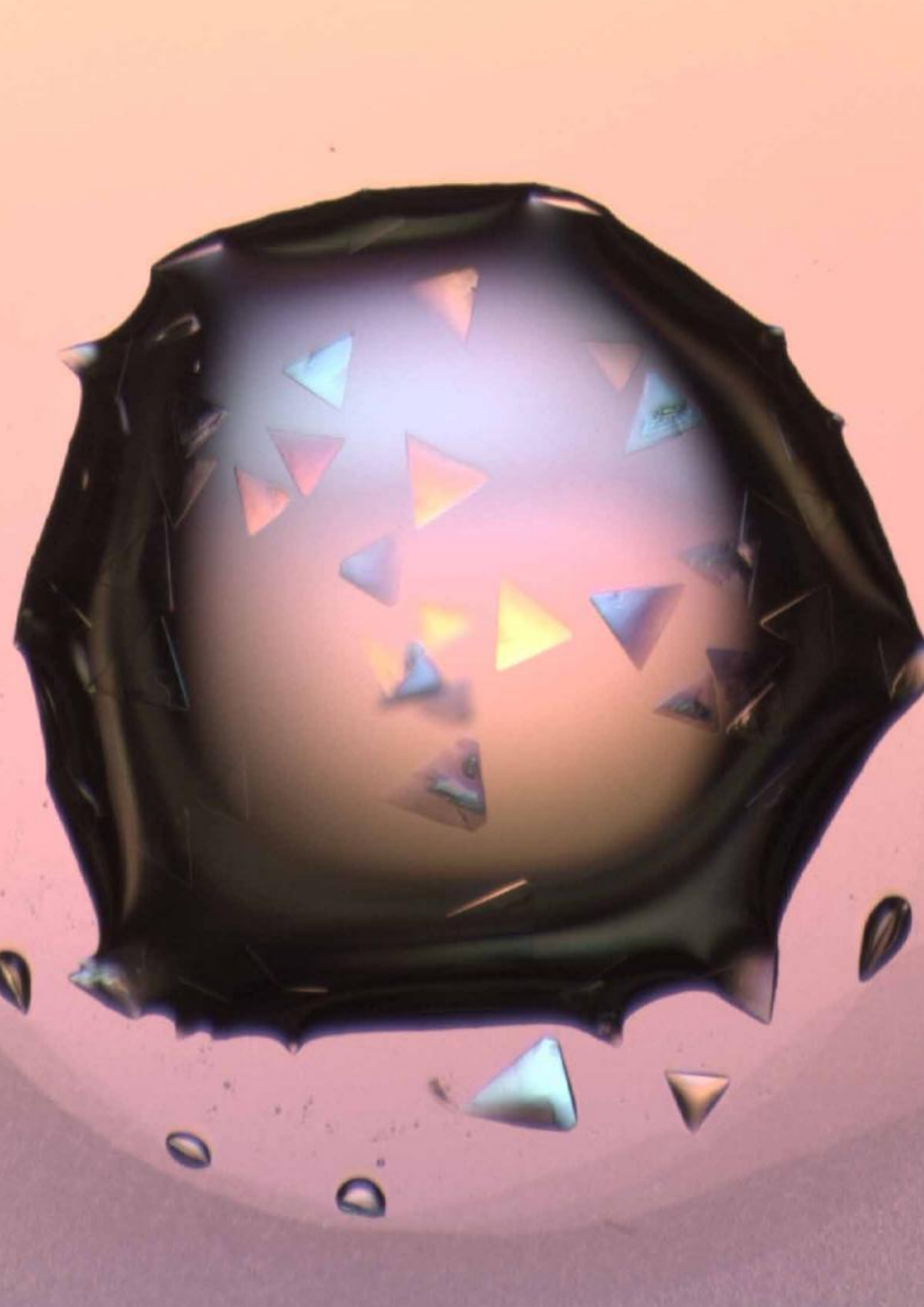
10-20

## Measures of 10-20 year outcomes

- ▶ Percentage of alumni in HVMS or supporting sectors (nationally and internationally)
- ▶ Percentage of alumni starting their own companies
- ▶ Number of companies/products/processes that have direct linkages to institute research outcomes
- ▶ Percentage Discovery Awards alumni in HVMS or supporting sectors (nationally and internationally)
- ▶ Percentage of Discovery alumni starting their own companies
- ▶ Economic and engagement outcomes from community science programme
- ▶ New Zealand public's perceptions of value of physical sciences for New Zealand



AMN: Advanced Materials and Nanotechnology  
 HVMS: High-Value Manufacturing and Services  
 UQ: The University of Queensland  
 LCN: London Centre for Nanotechnology  
 MIT: Massachusetts Institute of Technology  
 NUS: National University of Singapore



*Micro-Crystals of the synthetic Collagen mimetic peptides of triplet repeats of Glycine, proline and hydroxyproline which are 30 amino acid residues long*

**By Deepti Mahapatra  
University of Canterbury**

