
Progress and Achievement Report

Marsden Fund (2023-2024)

Royal Society Te Apārangi



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Summary

For the last 30 years, the Marsden Fund has invested in investigator-initiated research aimed at generating new knowledge, with long-term benefit to New Zealand. The Fund supports excellent research projects that advance and expand the knowledge base, and contributes to the development of people with advanced skills in New Zealand.

The Marsden Fund encourages New Zealand's leading researchers to explore new ideas by fostering creativity and innovation.

The primary objectives of the Marsden Fund are to:

- Enhance the quality of research in New Zealand by creating increased opportunity to undertake excellent investigator-initiated research; and
- Support the advancement of knowledge in New Zealand, and contribute to the global knowledge base.

The secondary objectives of the Marsden Fund are to:

- Contribute to the development of advanced skills in New Zealand including support for continuing training of post-doctoral level researchers and support for the establishment of early careers of new and emerging researchers.
- Contribute in the long-term to economic, social, cultural, environmental, health or other impacts for New Zealand.

Measuring Performance

The objectives and strategic direction of the Marsden Fund are laid out in the Fund Terms of Reference from 2017¹ and the 2021-2024 Investment Plan². Measuring performance is important to demonstrate that public money invested through the Fund is delivering the expected outcomes and benefits described in those documents. It also helps to detect and correct performance issues as they arise and to provide evidence for continuous improvement.

This report outlines the key outcomes and monitoring activities from the 2021-2024 Performance Framework³ using measures of data gathered through the Fund's operation. The key outcomes, activities and data elements from the Framework are intended to provide a manageable number of measures which are strong tests of performance (either alone or taken together). Table 1; Table 2; and Table 3: outline the key outcomes, key activities and key data elements with reference to each specific target agreed. These measures are all further discussed within the body of the report. Together these data will help to assess the performance of the Fund; ensure that funded researchers are making their 'best endeavours' towards contract objectives; and gather evidence for continuous improvement.

Table 1: Key activities and outcomes to provide a manageable number of measures which are strong tests of Marsden Fund performance (either alone or taken together).

Key outcomes – accountability	Measurement approach	Specific targets	Evaluation summary
1. The research performed is excellent 2. The Fund has high scholarly impact	Periodic review by ‘international peer review panel’ of a sample of completed Marsden Fund contracts for excellence and actual or potential scholarly impact Assess bibliometric impact of research outputs identified through self-reporting; annual survey of contracts two-years and ten-years after completion.	A high proportion of Marsden funded publications appear in the top-10% of cited publications for their discipline	Target met: Publications attributed to the Marsden Fund appearing in the top 10% of cited publications at a rate of 1.8 times that of world-publications (7 year rolling average) Analysis of survey responses from awardees completing contracts during the 2021–2022 FY (2 years), and 2013–2014 FY (10 years), will be presented in the 2024-2025 Progress and Achievement Report
3. Marsden Fund awards contribute to the development of advanced skills, including those of post-doctoral and early career researchers. 4. The skills and knowledge of Marsden researchers are usefully applied in the research, business and government sectors	Number of post-doctoral, early career researchers, and post-graduate qualifications supported on Marsden Fund awards. Periodic measurement of fraction of Marsden researchers who have subsequently moved into ‘research-leader’ roles Periodic measurement of career trajectory of Marsden researchers and their involvement in more applied research.	Majority of contracted projects report involvement of an early career researcher or postgraduate student	Target met: 82% of total contracts in 2022-2023 had the involvement of early career roles (6 year average of 82%). Analysis of survey responses from awardees completing contracts during the 2021–2022 FY (2 years), and 2013–2014 FY (10 years), will be presented in the 2024-2025 Progress and Achievement Report
5. The New Zealand research community strengthens its national and international connections	Researcher reports of international funding, resources, collaboration and knowledge come to New Zealand as a result of Marsden funding Reports by contracted researchers; annual survey of contracts two-years and ten-years after completion	Majority of contracted projects report new international collaboration by completion	Target met: 84% of contracted projects reporting new international collaboration by completion (6 year average) Analysis of survey responses from awardees completing contracts during the 2021–2022 FY (2 years), and 2013–2014 FY (10 years), will be presented in the 2024-2025 Progress and Achievement Report

Key outcomes – accountability	Measurement approach	Specific targets	Evaluation summary
6. Marsden research and researchers go on to contribute to economic, environmental, health, social, mātauranga, cultural and other impacts in the long-term	Impacts identified by self-reporting and regular survey of contracts two years and ten years after completion Preparation of in-depth case studies of impact and ‘results chain’ for the pathway to impact to follow-up and validate self-reports	100% of completed contracts have reported on their contribution to impact	Target met: All completed contracts have reported on their contribution to impact. Analysis of survey responses from awardees completing contracts during the 2021–2022 FY (2 years), and 2013–2014 FY (10 years), will be presented in the 2024-2025 Progress and Achievement Report
7. Marsden research and researchers go on to contribute to delivery of the Vision Mātauranga policy to unlock the research and innovation potential of Māori knowledge, resources and people	Researcher reports acknowledging effect of engagement/alignment/participation with the Vision	100% of those indicating alignment in the proposal report outcome	WIP: Data on the alignment of Vision Mātauranga by completed contracts is currently being collected. Analysis of survey responses from awardees completing contracts during the 2021–2022 FY (2 years), and 2013–2014 FY (10 years), will be presented in the 2024-2025 Progress and Achievement Report

Table 2: Key activities relating to monitoring and control show that fund processes are followed and help keep funded research on-track.

Key activities - monitoring and control	Measurement approach	Specific targets	Evaluation summary
8. Procedures for assessment of research applications are followed as set out in the Investment Plan and other relevant documents	Conduct and outcomes of assessment processes (including that of panel meetings and conflict of interest management) are monitored and recorded by Society staff kaimahi	All procedures are followed and reported	Target met: 2023 funding round assessment processes were followed and will be published on the Marsden Fund website, including the outcomes for the round.
9. Researchers are making their ‘best endeavours’ towards contract deliverables	Reports by contracted researchers. Follow-up meetings to contracted researchers by Society staff kaimahi (one visit per contract)	100% of completed contracts assessed with at least 90% of these assessed as meeting ‘best endeavours’	WIP: Data on best endeavours by completed contracts is currently being collected for the next Progress and Achievement Report.

Table 3: Key data elements to measure and report. These data collections are intended to support analysis for continuous improvement.

Key data elements – continuous improvement	Measurement approach	Summary
10. Portfolio mix by: panel, discipline, award type, professional age, follow-on vs new , size of awards ; purpose and type of research	Society application and grant management systems	The success rate for the 2023 Marsden funding round was 13.8% for the Fast-Start (FS) grants and 11.8% for the Standard (STD) grants. The mean professional age of successful PIs for the 2023 funding round was 4.7 years for Fast-Start and 16.7 years for Standard; with a rolling six-year average of 4.8 years for Fast-Start and 18.7 years for Standard.
11. Administrative costs for government, researchers and research institutions	Applicant survey at end of application process Rate of referee acceptance	The mean estimated time for panellists to assess an Expression of Interest proposal was approximately 30 minutes for the 2024 funding round. The referee acceptance rate was 34.5% to review full proposals for the 2023 funding round.
12. Stakeholder perceptions	Applicant survey at end of application process Follow-up survey two years after contract completion	Analysis of survey responses from awardees completing contracts during the 2021–2022 FY (2 years) will be presented in the 2024-2025 Progress and Achievement Report
13. Effects of changes to fund	Monitor the interdisciplinarity of Marsden Fund Council Awards (MFCA) funded research vs other awards, as measured by Inter-Disciplinary Distance scores Follow on awards; monitor the percentage of PIs on Standard contracts that are new to the Fund as PIs each year, review policy if this metric drops below 35%.	Approximately 70% of successful Marsden Fund Standard and 75 % of successful MFCA proposals are highly interdisciplinary (6 year average). Percentage of new PIs to the fund has not decreased after the change to the follow-on grant setting, with an average of 50% over the last 6 years.

The research performed is excellent with scholarly impact

International peer review of research excellence

The Marsden Fund was reviewed most recently in the Marsden Fund: Assessment of Strategy and Management, released in April 2017⁴. This review set expectations for further development of an Investment Plan and a Performance Framework. Within the Performance Framework there is recognition the Fund will undertake periodic independent reviews of a sample of completed Marsden Fund contracts for excellence and actual or potential scholarly impact. The Ministry of Business, Science and Innovation will work toward providing a Terms of Reference outlining the function, scope and approach for such a review to provide a report to the Minister of Science, Innovation and technology on the impacts of the Fund.

The Fund has scholarly impact

The Marsden Fund has high scholarly impact. This is measured using the proportion of Marsden attributed works in the top 10% of world-works by citation⁵, reported as a rolling three-year average in Table 4:. These citation percentages do trend down slightly over the time, which could be due to a number of factors. These factors include a lag in the publication of outputs from Marsden Fund grants and therefore lag in citations, as well as a more diverse range of outputs from grants that may not be captured by this metric.

Table 4: Proportion of Marsden Fund-attributed works in the top 10% of world-works by citation.⁵

Description	2017-2019	2018-2020	2019-2021	2020-2022	2021-2023
Percentage of Marsden Fund-attributed publications in top 10% of the world	20.3	18.7	17.9	16.7	18.0

Conclusion

The specific target for this outcome that a high proportion of Marsden-funded publications appear in the top 10% of cited publications for their discipline has been exceeded. During the last seven years publications attributed to the Marsden Fund have consistently appeared in the top 10% of cited publications at a rate of approximately 1.8 times that of world-publications.

Development of advanced skills

Marsden Fund awards contribute to the development of advanced skills, including those of post-doctoral and early career researchers. Table 5: presents the early career roles that have been directly supported by the active Marsden Fund contracts in a given financial year. ⁶ Early career roles are represented by the number of Fast-Start contracts, along with the number of Standard and Marsden Fund Council Award (MFCA) contracts that have the involvement of at least one postdoctoral fellow and / or postgraduate student. The total number of contracts supporting early career roles has increased over the previous six financial years from 466 in 2017-2018 to 542 in 2022-2023. In the

same time period, the number of active contracts has also increased from 540 contracts in 2017-2018 to 658 contracts in 2022-2023.

Table 5: Early-career roles directly supported by active Marsden Fund contracts over 1 July – 30 June of the given year.⁶

Active contracts	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Fast-Start contracts	187	218	221	234	236	257
Standard and MFCA contracts with postdoc fellow and/or postgrad student involvement	279	291	284	242	251	285
Total contracts with involvement of early career roles	466	509	505	476	487	542
Total contracts	540	596	612	627	618	658
Percentage of total contracts with involvement of early career roles	86%	85%	83%	76%	79%	82%

Conclusion

The Fund has a specific target that the majority of contracted projects report involvement of at least one early career researcher or postgraduate student. This target has been met with 82% of total active contracts in 2022-23 directly supporting early career roles, and with a rolling six-year average of 82%. Hence, these data show evidence for strong support for early career roles by the Fund.

National and international connections

A follow-up survey of Marsden Fund awardees two and ten years after the completion of their grant has been developed to address some key outcomes in the Performance Framework. The survey questions can be found in Appendix A – Follow-up survey questions. These surveys will be run annually, and the responses analysed using qualitative data methods to pull out themes and examples.

The follow-up survey of Marsden Fund awardees will gather researchers' responses about funding, resources, collaboration and/or knowledge inflows to Aotearoa New Zealand.

Full analysis of survey responses from awardees completing contracts two years ago (1 July 2021 – 30 June 2022) and ten years ago (1 July 2013 – 30 June 2014) will be presented in the 2024-2025 Progress and Achievement Report.

Collaborations and international research

Through the award of Marsden Fund contracts, the Aotearoa New Zealand research community strengthens its national and international connections. Three measures of international collaboration are presented across two time periods and for both Standard and MFCA grants in Table 6:⁷ The proportion of Standard contracts awarded that have overseas investigators has remained steady across the last six funding rounds, with an average of 57%. Moreover, both the proportions of awarded investigators that are overseas (average of 31 %), and the contracts that have reported

additional international collaborations at completion (average of 84 %) have remained steady over the last six years.

Table 6: International collaboration and communication on Marsden Fund Standard and MFCA contracts for two periods, 2018-2020, and 2021-2023

International collaboration and communication	2018-2020	2018-2020	2021-2023	2021-2023
	Standard Contracts	MFCA Contracts	Standard Contracts	MFCA Contracts
Awarded contracts that have overseas investigators (percentage of contracts)	61%	100%	53%	100%
Awarded investigators that are overseas (percentage of people)	33%	46%	29%	21%
Completed contracts reporting additional international collaborations (percentage of final reports)	82%	NA	86%	NA

A second measure of international collaboration is presented using the co-authorship of publications attributed to the Marsden Fund and compared to both Aotearoa New Zealand, and World publications (Table 7:).⁵ These publications are proportioned across four exclusive categories of authorship collaboration, which each combine to a total of 100% of the publications for each dataset. For example, if authors are both from the same institution and the same country, that publication would be in the ‘national collaboration’ category. However, if there was also the addition of an international author, then that publication would be in the ‘international collaboration’ category. Moreover, papers with only single authors are classified in the ‘single authorship’ category publication.

In the last 6 years, over 60% of Marsden publications have international collaborations, compared to only 20% of world publications. The profile for world publication collaborations is more evenly weighted across the four categories. The collaboration profile for Marsden publications is like the profile for New Zealand as a whole. However, the Fund has half (5%) the percentage of single authorship than New Zealand (11%). Due to the way the collaborations on publications are categorised, if there are co-authors that are both national and international, they are classified in the international collaboration. Therefore, this publication metric is likely to underrepresent national collaborations that occur.

Table 7: Collaboration data measured by publication authorship proportion for the years 2018-2023. The proportions of the four categories add to 100% for each publication dataset. e.g., if authors on a paper collaborate from the same institution, the same country, and overseas, then that publication will be exclusively classified in the “international collaboration” category.

Publication dataset	International Collaboration	National Collaboration	Institutional Collaboration	Single Authorship
Marsden Fund publications	63%	14%	18%	5%
New Zealand publications	60%	12%	17%	11%
World publications	21%	35%	30%	14%

Conclusion

Over the last six years 84% of contracted projects reported new international collaboration by completion (Table 6:), which meets the specific target that the majority of contracts will gain additional international connections. Moreover, over half of Standard grants are initially contracted with teams containing overseas investigators. In addition, a solid majority of Marsden Fund publications have international collaborations (Table 7:). Hence there is strong evidence that the Fund is fulfilling the remit to strengthen international connections.

Long-term impacts

One of the follow-up survey questions asks researchers about the broader impacts that have come from their Marsden grant. Specifically, these responses will address how Marsden research and researchers go on to contribute to economic, environmental, health, social, mātauranga, cultural and other impacts in the long-term.

Full analysis of survey responses from awardees completing contracts two years ago (1 July 2021 – 30 June 2022) and ten years ago (1 July 2013 – 30 June 2014) will be presented in the 2024-2025 Progress and Achievement Report.

A case study illustrating the long-term impact from Marsden funding, which was captured in the ten year follow-up survey can be found in Appendix B – Research for impact, along with three additional Marsden research in focus articles from the 2023-2024 financial year.

Impact of Vision Mātauranga-aligned contracts

One of the key outcomes of the Fund is that Marsden research and researchers go on to contribute to delivery of the Vision Mātauranga policy⁸ to unlock the research and innovation potential of Māori knowledge, resources and people. The measurement of whether or not researchers acknowledge the effect of engagement/alignment/participation with the Vision in their reports was implemented in the research assessment process at the start of July 2024. This measure can then be used to address the specific target that, where relevant, 100% of those researchers’ indicating alignment to the Vision in their proposals report an outcome. A snapshot will be taken at the end of each financial year and reported as an aggregate.

In addition, two of the questions from the two-year and ten-year follow-up surveys relate to Vision Mātauranga. Where relevant, researchers will have the opportunity to provide survey responses on how these themes have developed since the contract’s completion.

Full analysis of survey responses from awardees completing contracts two years ago (1 July 2021 – 30 June 2022) and ten years ago (1 July 2013 – 30 June 2014) will be presented in the 2024-2025 Progress and Achievement Report.

Procedures for assessment are followed

The 2023 Marsden funding round assessment processes were followed. A report on the conduct and outcomes of the Marsden Fund Round will be published on the Marsden Fund website.⁹ This report includes changes to the Expression of Interest round deadline due to the impact of Cyclone Gabrielle.

Researchers are making their best endeavours

One of the key activities to be monitored in the Performance Framework is whether researchers are making their best endeavours towards contract deliverables. To this effect, a measure for best endeavours was implemented in the research assessment process at the start of July 2024. The Royal Society Te Apārangi Executive will evaluate the project progress for best endeavours and record this for each annual report. Completed contracts will then be deemed to either having met, or not met, best endeavours in the assessment of the Final report. Best endeavours measurements will be collected for each Final report assessed during the time period of 01 July -30 June and reported as an aggregate from the next Progress and Achievement Report onwards.

The Society will use the following definition of best endeavours in their assessment: *A best endeavours obligation is more onerous on a party than an obligation of 'reasonable endeavours'. It obliges a party to take all available courses of action to fulfil the obligation that a prudent, determined and reasonable person would take.*

Continuous improvement

Portfolio mix

The Marsden Fund monitors and holds data on its portfolio mix by panel, discipline, award type, professional age, follow-on vs new, size of awards, purpose and type of research. Some of these categories are discussed below.

The number of proposals by panel across the entire two-stage 2023 funding round process is given in Table 8:⁷ Overall, 24% of Expressions of Interest (EOIs) were invited to submit a Full proposal, of which 50% were then recommended for funding, these percentages vary by panel. While overall 13.3% of the Expressions of Interest had been recommended for funding at the final stage, this percentage is not constant over all panels or categories as a change of just one proposal — attributed to either a Fast-Start or Standard award — in the number of successful proposals causes significant change in this percentage.

Table 8: Number of funded proposals by panel in 2023 (and as a percentage of number of EOIs). For the purposes of clarity, the Marsden Fund Council Award has been presented as a panel (MFC) and is assessed by the Marsden Fund Council.

Panel	EOIs			Full			Offered Contracts			Success Rate		
	FS	STD	Tot.	FS	STD	Tot.	FS	STD	Tot.	FS	STD	Tot.
Biomedical Sciences	24	71	95	6	17	23	3	9	12	12.5%	12.7%	12.6%
Cellular, Molecular and Physiological Biology	21	63	84	6	18	24	3	7	10	14.3%	11.1%	11.9%
Earth Sciences and Astronomy	37	44	81	7	10	17	4	6	10	10.8%	13.6%	12.3%
Ecology, Evolution and Behaviour	28	72	100	9	15	24	4	8	12	14.3%	11.1%	12.0%
Economics and Human and Behavioural Sciences	31	56	87	8	15	23	4	7	11	12.9%	12.5%	12.6%
Engineering and Interdisciplinary Sciences	44	62	106	10	12	22	5	7	12	11.4%	11.3%	11.3%
Humanities	33	32	65	8	9	17	5	4	9	15.2%	12.5%	13.8%
Mathematical and Information Sciences	32	53	85	9	13	22	5	6	11	15.6%	11.3%	12.9%
Physics, Chemistry and Biochemistry	12	56	68	5	12	17	2	6	8	16.7%	10.7%	11.8%
Social Sciences	61	84	145	15	21	36	8	10	18	13.1%	11.9%	12.4%
Marsden Fund Council			6			0			0			0.0%
Grand Total	323	593	922	83	142	225	43	70	113	13.3%	11.8%	12.3%

Another aspect to the Marsden portfolio mix is professional age. Table 9: depicts the mean professional age of Marsden-funded contact principal investigators (PIs) by grant category for the last six funding round cohorts (2018-2023).⁷ Professional age was determined for awardees using the number of years since PhD at each funding round. The mean professional age for Fast-Start PIs at award has remained relatively similar, ranging between 4.6 – 5.3 years post-PhD across the six year time period. The mean professional age for Standard grant PIs at award has more fluctuation, with a 4-year difference between the 2020 (20.8 years) and 2023 (16.7 years) funding round cohorts. However, there is no significant trend here, with the rolling six-year average of 4.8 years for Fast-Start and 18.9 years for Standard grant holders.

Table 9: The mean professional age of successful Marsden Fund contact principal investigator by grant category over the last six funding rounds (including $\pm$ the standard error). Professional age was determined by subtracting an awardee’s year of PhD, which is provided by the applicant, from each funding round year.

Grant category	Mean professional age in years post-PhD $\pm$ standard error					
	2018	2019	2020	2021	2022	2023
Fast-Start (FS)	4.6 $\pm$ 0.3	4.9 $\pm$ 0.3	4.7 $\pm$ 0.3	4.9 $\pm$ 0.4	5.3 $\pm$ 0.3	4.7 $\pm$ 0.4
Standard (STD)	18.8 $\pm$ 1.1	19.8 $\pm$ 0.9	20.8 $\pm$ 1.1	17.5 $\pm$ 0.9	18.5 $\pm$ 0.9	16.7 $\pm$ 0.9

Administrative costs

Some data elements are used to determine the ongoing costs of administering the Marsden Fund for the government, and the research community.

Workload impact on panellists

As part of an attempt to measure the resource costs of the assessment process, the Executive undertook a survey of the time taken for panellists to review their Expression of Interest (EOI) proposals for the 2024 funding round. From 61 respondents (65% response rate), the mean estimated time to assess each proposal was 27.9 minutes, (median 25.8 minutes, Figure 1:), which is similar to that reported¹⁰ for the combined panel trial in 2018 of 28.8 minutes. Hence, the estimated workload for panellists to assess EOIs has remained consistent over the two data points measured six years apart.

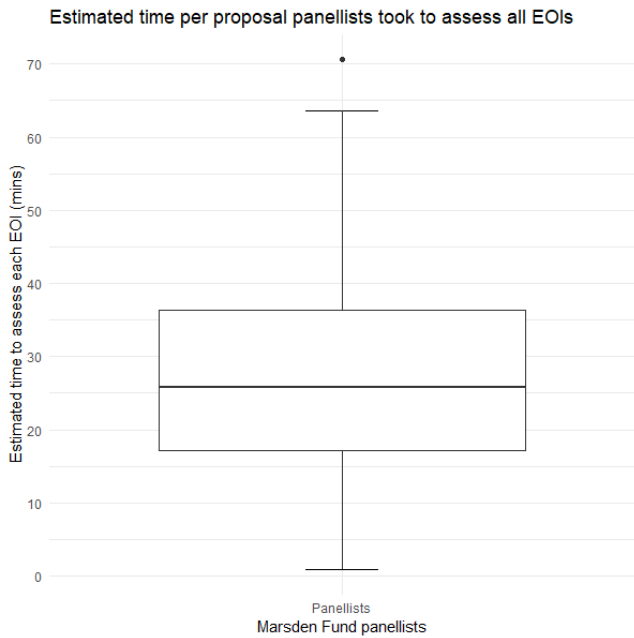


Figure 1: Distribution of mean time taken to assess an Expression of Interest proposal.

Rate of referee acceptance

In collaboration with Marsden panellists and convenors, the Research Funding team seek three referee reports for each Marsden Fund proposal that has been invited to submit for the full round, and five for each Marden Fund Council Award proposal put through to Stage 2. Researchers are processed for major conflicts of interest, then those that are suitable are invited to review. Over the 2019 – 2022 funding rounds, the total number of referees that were processed for conflicts then invited to review fluctuated, however the referee acceptance rate remained relatively steady (38.6% - 40.2%, Table 10:). However, there was a subsequent drop in the acceptance rate to 34.5% in the 2023 funding round. This drop in the referee acceptance rate could be a symptom of international referee fatigue.

Table 10: Rate of referee acceptance for full round proposals for the last five funding rounds (2019 – 2023)

Description	2019	2020	2021	2022	2023
Proposals	260	289	229	223	225
Researchers processed	2654	2998	2443	2404	2660
Potential referees invited	2057	2328	1849	1857	2123
Total referees that agreed to review	795	932	743	732	733
Referee acceptance rate (percentage)	38.6	40.0	40.2%	39.4%	34.5%

Stakeholder perceptions

The two-year follow-up survey of Marsden Fund awardees will gather researchers’ perceptions about the Fund. Participant responses will be presented in the 2024-2025 Progress and Achievement Report.

Interim Review of the Marsden Fund Council Awards

The 2017 Investment Plan introduced some changes to Fund settings. The Council introduced the Marsden Fund Council Award (MFCA) which supports large, interdisciplinary research, from the 2018 round to complement Fast-Start and Standard grants. These larger awards are worth up to \$1 million per year.

Interdisciplinarity of the Awards

One of the goals of the MFCA is to support interdisciplinary research that might otherwise struggle to be picked up through the traditional panel system. Part of the impetus for this goal was research from the Australian Research Council’s Discovery Programme. This showed that increasing interdisciplinarity (as measured through an adaption of the ecological Phylogenetic Species Evenness (PSE) metric applied to ANZSRC Field of Research selections) correlated with lower success.¹¹ The Fund can also use the adapted PSE as a proxy for interdisciplinary distance (IDD) as a reporting measure for the interdisciplinarity of successful MFCAs. As a metric, the IDD has a range from 0.00 up to 1.00, i.e. from a contract with no interdisciplinarity (0.00) to a contract with maximum interdisciplinarity (1.00).

Three of the four awarded Marsden Fund Council Award contracts have calculated IDD measures between 0.83 – 1.00 (Table 11:). Hence, these three MFCA grants are deemed to have high interdisciplinarity. For the contract UOA2131 this IDD measure is lower at 0.67.

Table 11: Fields of Research selections and IDD by Marsden Fund Council Awards. NB: Share of research collected from applicants beginning in the 2020 round; prior to that share estimated as 1/number of codes selected. ANZSRC2020 FOR codes collected beginning in the 2021 round.

Contract	Fields of Research	IDD
UOO1931	060302,110706,111715,060401,060412	0.83
UOW1904	040605,060107,030602,050102,080110	1.00
MAU2010	111705(10%),111706(15%),050202(15%),060599(30%),110203(30%)	0.87
UOA2131	510103(25%),510104(25%),510105(25%),490501(25%)	0.67

The IDD was also calculated for Marsden Fund Standard grants over the six-year time period of 2018-2023. The distribution of these Standard grant IDD values has been plotted against both the four Marsden Fund Council Award contracts, and the proposals seen by the Australian Research Council's Discovery Programme in 2011-2015 (Figure 2:). For the Australian Research Council cohort only about 20% of proposals had an IDD between 0.80-1.00, and there was even more spread across IDD values¹¹ In contrast, about 70% of Marsden Fund Standard contracts had an IDD between 0.80-1.00, corresponding to high interdisciplinarity.

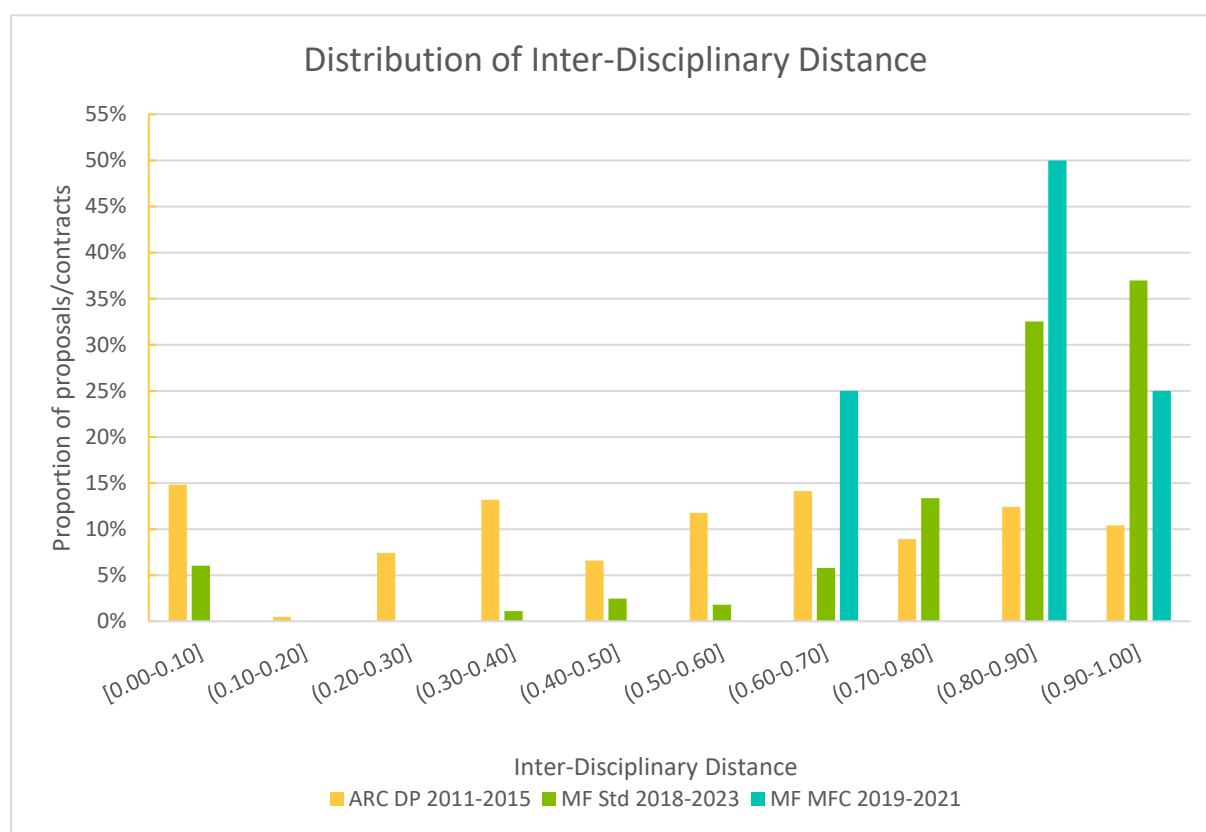


Figure 2: The distribution Inter-Disciplinary Distance (IDD) of proposals seen by the Marsden Fund and the Australian Research Council's Discovery Programme (ARC DP)¹¹. ARC proposal IDD data sourced from "Interdisciplinary research has consistently lower funding success". Marsden Fund contract IDD data calculated as per that publication, for; Standard contracts in 2018-2020; Standard contracts in 2021-2023, and; MFC Awards in 2019-2021.

Conclusion

Approximately 70% of successful Marsden Fund Standard and 75 % of MFCA proposals are highly interdisciplinary using the IDD measure (Figure 2:). Therefore, regardless of the introduction of the Marsden Fund Council Awards, a high proportion of interdisciplinary grants have been successfully funded in Marsden rounds across the six funding rounds measured.

New Research and Researchers Accessing the Fund

The 2017 Investment Plan introduced some changes to Fund settings. These changes included removing the restriction on applying for a second grant on the same research project after the completion of a successful Marsden Fund grant from 2018. The impetus behind this change was to allow researchers to sustain research momentum. The Council is monitoring this change and will adjust the settings for the Fund if the number of follow-on awards made becomes a major hindrance to new research being funded.

Table 12: depicts the percentage of Principal Investigators (PIs) on Standard and MFC Award contracts that are new to the Fund as PIs each year.⁷ The Council will formally review the follow-on grant setting if the percentage of new PIs drops below 35%. Over the previous eight funding rounds, the percentage of new PIs to the Fund on Standard contracts ranges from about 40% to 54%.

Table 12: Proportion of Principal Investigators in Round that were awarded a Standard or MFCA Contract as PI for the first time.

Category	2018	2019	2020	2021	2022	2023
Standard	54%	46%	50%	41%	54%	54%
MFC Awards		67%	100%	0%	N/A	N/A

Table 13: shows that the proportion of self-reported follow-on Standard and MFC Award contracts averages approximately 20% over the last four years.⁷

Table 13: Proportion of Standard and MFC Award contracts that are following-on from earlier Marsden Fund awards.

Round	Follow-On	All-Contracts	Percentage-Following-On
2020	19	75	25%
2021	21	76	28%
2022	11	72	15%
2023	14	76	18%

Conclusion

For Standard contracts the percentage of new PIs to the fund has not decreased after the change to the follow-on grant setting, with an average of 50% over the last 6 years (Table 12:). Moreover, the majority of grants awarded over this time period have been for new research (Table 13:). Therefore, there has not been a detrimental effect on new research and researchers accessing the Fund with the change to allow follow-on grants.

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- ¹ <https://www.royalsociety.org.nz/assets/Uploads/2017-Marsden-Fund-Terms-of-Reference-RF-style.pdf>
- ² https://www.royalsociety.org.nz/assets/Teaching-Learning-Resources/Marsden-Fund-Investment-Plan-May-2021_Updated-Govt-Logo5.pdf
- ³ https://www.royalsociety.org.nz/assets/Teaching-Learning-Resources/Marsden-Fund-Performance-Framework-May-2021_Updated-Govt-Logo2.pdf
- ⁴ <https://www.mbie.govt.nz/assets/9c551e0eb9/marsden-fund-assessment.pdf>
- ⁵ Source SciVal and Scopus last updated 15 August 2024.
- ⁶ Generated from administrative data and provided to MBIE as part of the Data Report series.
- ⁷ All measures generated from Marsden Fund administrative data.
- ⁸ <https://www.mbie.govt.nz/science-and-technology/science-and-innovation/agencies-policies-and-budget-initiatives/vision-matauranga-policy>
- ⁹ <https://www.royalsociety.org.nz/what-we-do/funds-and-opportunities/marsden/about/marsden-fund-process/>
- ¹⁰ <https://www.royalsociety.org.nz/who-we-are/our-reports/evaluation-reports/for-the-combined-panel>
- ¹¹ Bromham, L., Dinnage, R. and Hua, X. Interdisciplinary research has consistently lower funding success. *Nature* **534**, 684–687 (2016). <https://doi.org/10.1038/nature18315>

Appendix A – Follow-up survey questions

Section A: Impact of Marsden Funding

1. Has the Marsden research fed into or changed your other research activities? If so, please explain how.
2. Has Marsden funding had any long-term effects on the size or capabilities of your group? If so, please explain how.
3. Has Marsden funding influenced your career, or the career of others supported by the project? If so, please explain how.
 - *e.g., influence on your personal career trajectory; the number of postdoctoral fellows and/or postgraduate qualifications directly supported by the Marsden award. Alternatively, if you believe this award has not been beneficial to your career we would like to know that too.*
4. Have the results of the research supported by Marsden led to further funding either from Marsden or another funder? Please specify.
5. Has the Marsden funding led to any landmark publications, patents, commercial or other spin-offs, or other major outcomes such as community-based activities? Please elaborate briefly.

Section B: Vision Mātauranga

6. If your research indicated an association with one or more Vision Mātauranga themes, please comment on how these themes have developed since the contract's completion. See the MBIE Vision Mātauranga policy [here](#)
 - *e.g., including strengthening research capability, undertaking communications and consultations, linkages*
7. Have those activities contributed to delivering on the Vision Mātauranga policy, demonstrably unlocking "...the research and innovation potential of Māori knowledge, resources and people"? Please elaborate briefly.

Section C: Long-Term Impacts

8. Has / have the Marsden-funded research or researchers gone on to contribute to economic, environmental, health, social, Mātauranga, cultural and other impacts in the long-term? Please elaborate briefly.

Section D: Other Comments

9. Do you have any other comments?

Appendix B – Research for impact

Ten Years from Fast-Start to Start-Up

(VUW0916; 2009 and VUW1618; 2016; Contact Principal Investigator: Professor Eric Le Ru)

Marama Labs is an excellent example of the economic impact that can stem from Marsden funded research, translating ‘scientific curiosity’ into a multi-million-dollar international start-up. Marama Labs, founded in 2019, spun-out from research at the world-renowned Raman Laboratory at Victoria University of Wellington, and was seeded by two successive Marsden Fund grants led by Professor Eric Le Ru.



Marama Labs co-founders; (L-R) Dr Brendan Darby, Dr Matthias Meyer and Professor Eric Le Ru. Photo supplied.

In 2009, then Dr Eric Le Ru was awarded an early career Marsden Fund Fast-Start grant to investigate how the optical properties of metal nanoparticles can be simulated and experimentally studied. Nanoparticles are particles $\sim 100,000$ times thinner than an individual hair. The results from this Fast-Start grant directly contributed to now Professor Eric Le Ru’s successful Standard Marsden award in 2016. Together these projects not only produced new scientific theories about the optical properties of metallic nanoparticles, but a commercially viable and patented device called CloudSpec™, thanks to extra support from the MacDiarmid Institute and Wellington Univentures. There are many applications for CloudSpec, a device that can determine the amounts of various particles in cloudy liquids from fermenting wines to nanomedicines, without the need for complicated sample preparation or tedious assays.



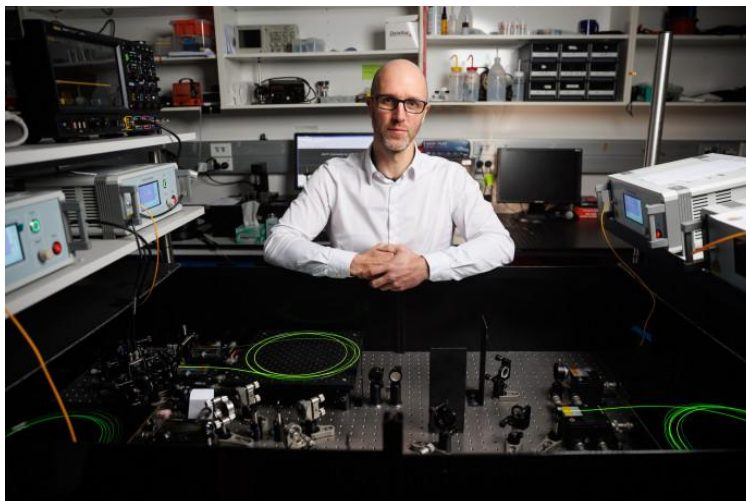
Marama Lab’s patented device, CloudSpec

Today Marama Labs employs 10-12 people across New Zealand and Ireland and works with high value industries like winemaking (domestic and USA) and pharmaceuticals. It helps these companies efficiently tailor their product and optimise production processes. In January 2024 they secured \$3.1 million NZD from Seed Plus funding. This will help Marama Labs scale up hardware manufacturing capacity in New Zealand for its patented CloudSpec and break further into the life-science market.

Designing the Lasers of Tomorrow

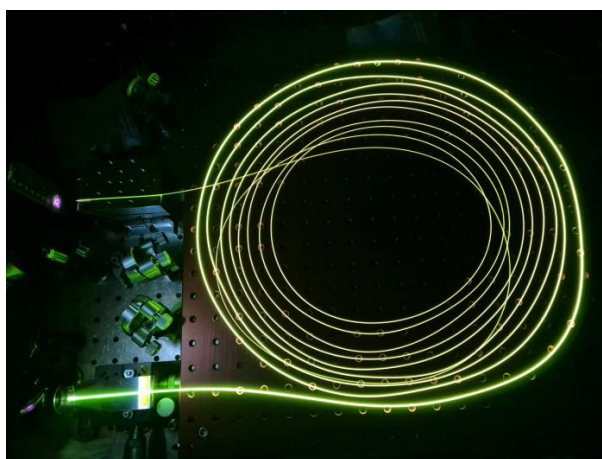
(UOA1919; 2019; Contact Principal Investigator: Dr Claude Aguergaray; Organisation: Waipapa Taumata Rau The University of Auckland)

Lasers are instrumental for a variety of applications in our everyday lives, from fingerprint scanning and fibre optics to precision medicine and pollution monitoring. The capability of a given laser depends on its output power – the rate at which it emits energy – and on its “bandwidth”, the range of wavelengths of light it can produce. Ultrafast “broadband” lasers that can maintain power over a broad range of wavelengths are particularly in demand but technically difficult to produce.



Dr Claude Aguergaray in the lab (photo supplied)

The main objective of this Marsden project is to explore the design and development of novel fibre-based laser source architectures for high-power and broadband beam generation. In collaboration with an international partner, Dr Aguergaray and his team have designed custom fibres that will simultaneously amplify and broaden the spectrum of delivered laser light. The team’s novel laser architecture - which uses a linear cavity seed source and a complex, non-linear amplification system – has set a new benchmark in the field, delivering the highest recorded average power and pulse energy for a single-mode amplifier system (10.2 Watts and 400 nJ, respectively).



Fibre laser amplifier in operation (photo supplied)

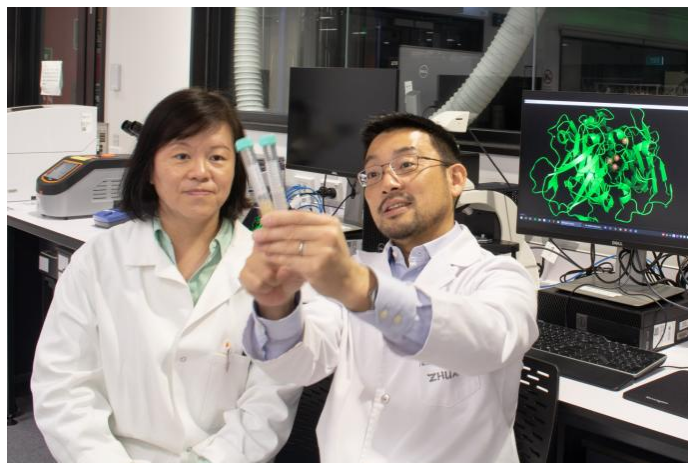
This laser architecture was developed with the aid of a novel numerical model, which allowed the team to investigate the effects of fibre properties (such as its dimensions and chemical composition) and pulse dynamics on laser output performance. This model can be easily adapted to inform the development of other fibre-based lasers. Notably, the model predicts that further improvements in laser power and spectral bandwidth are possible if pulse and fibre inputs are optimised. Specifically, non-linear amplifiers (like the one used in their current architecture) should be capable of delivering

25 Watts of average power over the entire mid-IR spectrum (2.4 – 6 μm), a 10-50 fold improvement over current systems! The team will endeavour to build this system in the coming years. Dr Agueraray and his team hope that their cutting-edge research will seed the development of laser-based products with new and improved applications in fields such as materials processing, environmental monitoring and laser-based surgeries. It's safe to say that the future of this technology is looking bright.

Cleaner and greener solutions for industry: nature's catalysts reimaged through state-of-the-art research

(UOA2219; 2022; Contact Principal Investigator: Dr Wei-Qin Zhuang; Organisation: Waipapa Taumata Rau The University of Auckland)

Oxidation is the chemical reaction that causes iron to rust, cut apples to go brown, and turns wine to vinegar. It also plays a crucial role in various industries, where it is used to transform raw materials into valuable products such as medicines, fuels, and chemicals. While oxidation occurs slowly as materials are exposed to air, it is necessary to speed up this reaction for industrial processes. This is often accomplished by using chemical catalysts, which can include harmful substances like heavy metals.



Principal Investigator Dr Wei-Qin Zhuang and Associate Investigator Dr Shan Yi (The University of Auckland) discussing Laccase overexpression (Supplied)

In this groundbreaking Marsden funded study, Dr Wei-Qin Zhuang of Waipapa Taumata Rau, The University of Auckland, and his team aim to make such industrial processes more sustainable and environmentally friendly by using nature's biological catalysts - enzymes. Laccases are a group of powerful oxidative enzymes used by organisms such as fungi to break down wood.

Although the capabilities of laccases are well-studied, their application in industry is still in its early stages. This is because some natural laccases, such as those extracted from fungi, usually have high oxidative power but are relatively unstable. Other laccases, produced by bacteria, can withstand harsh industrial conditions but usually have a relatively low catalytic ability. This research team plans to bioengineer next-generation laccase-based biocatalysts that combine the desirable attributes of fungal and bacterial laccases for industrial applications.

To achieve this ambitious goal, the research team must first decipher the complex interplay between protein sequence, structural configuration, and catalytic potential of laccases from different organisms. To accomplish this, they are employing the latest technology, including artificial intelligence (AI). "The incorporation of AI in our research is not merely a nod to modern technology but a necessity. The complexity of enzyme structures and the myriad factors that influence their activity render traditional research methods inadequate, slow, and expensive. AI offers a means to sift through vast amounts of data, identifying patterns and connections that might otherwise remain obscured," said environmental biotechnologist and Marsden Fund Principal Investigator Dr Wei-Qin Zhuang.

This research is also supported by state-of-the-art biophysical instrumentation to visualise the structure of different laccases as well as the chemical reactions they catalyse. "The ability to study these biocatalysts with atomic resolution allows us to understand how laccases evolved to perform

their biological functions. This information can then be used to feed the AI algorithm so that we can engineer new biocatalysts that balance between catalytic ability and stability,” as reported by biological chemist and Associate Investigator Dr Ivanhoe Leung, at the University of Melbourne, Australia.



Associate Investigator Dr Ivanhoe Leung and the Nuclear Magnetic Resonance (NMR) machine at the University of Melbourne (Supplied)

The implications of this study extend beyond the confines of laboratories and industrial settings. In a world increasingly burdened by environmental challenges, the ability to harness the power of enzymes such as laccases could be a game-changer. From degrading pollutants to creating more sustainable manufacturing processes, their applications are as diverse as they are impactful. “One immediate application our team is exploring involves using these newly engineered enzymes to upcycle waste products from winemaking into useful chemicals. This is part of a related research project currently funded by Bragato Research Institute, a subsidiary of New Zealand Winegrowers,” explains biochemical engineer and Associate Investigator Dr Shan Yi of the University of Auckland.

The path to understanding and harnessing the power of laccases is fraught with challenges. As we continue to push the boundaries of what’s possible in biotechnology, studies like this remind us of the immense power residing in the smallest niches of nature. In pursuing their quest, these scientists are doing more than just exploring the minutiae of enzyme structures; they are paving the way for a more sustainable future, one tiny biocatalyst at a time.

Two languages in my kete: changes in the New Zealand English lexicon

(UOW2202; 2022; Contact Principal Investigator: Dr Andreea Calude; Organisation: Te Whare Wānanga o Waikato University of Waikato)

Following extensive research investigating the numerous words that New Zealand English (NZE) borrows from te reo Māori, Dr Calude of Te Whare Wānanga o Waikato University of Waikato and her team are studying what the youngest generation of NZE speakers – tamariki – are making of these.

Like nomadic travellers, words wander from one language into another. While most are transient, what happens to those that stick around? It is not uncommon to tune into RNZ or TVNZ and hear Māori words or phrases interspersed among English ones. Words like hui, aroha, kura and kaitiaki are also common in newspaper articles and social media posts.

It's tempting to think that mixing languages in this way is confusing, a barrier to communication, or 'political correctness gone mad'. Maybe you hear your own children using these words and phrases and wonder about it. Mixing languages is neither new, nor unique to NZE, nor a predictor of language demise. It is what most multilingual nations have been doing for centuries, in different places around the world, including Belgium, Switzerland, South Africa, India, Brazil, and Papua New Guinea.



Dr Calude and PhD students Alex Pohl and Jessie Burnette of University of Waikato (the team also includes Professor Hēmi Whaanga, Massey University, Associate Professor Eline Zenner, KU Leuven and Dr Laura Rosseel, Vrije Universiteit Brussel; Photo by S Malik)

Languages are leaky. We like to draw clear boundaries around them and contain them within neatly delineated borders. But this simplistic view of language doesn't account for what speakers actually do. Keeping languages apart has more to do with nationalism than communication. Languages never stand still, and NZE is no exception. As words of Māori origin weave into NZE, children exposed to them are acquiring not just new lexical items and their meanings, but also social and cultural associations about the speakers who use them. Research elsewhere tells us that, between the ages of 8-11, children's journey of cognitive development leads them to increase their awareness of their peer group. Tied in with such awareness comes information linking language use (words and grammar) with social characteristics of the speakers using them (intelligence, friendliness, trustworthiness and prestige). In this project, Dr Calude and team want to find out what Kiwi children in mainstream English language education are making of kupu Māori borrowings entering their variety of English.

Dr Calude states "This work is both exciting and challenging! It is exciting because it allows us to gain a deeper understanding of our own English voice and to make a contribution to the wider research field (developmental sociolinguistics) internationally. The opportunity for innovation arises from the fact that NZE provides a unique case-study of language contact. First, nowhere else do we find a variety of English acquiring so many borrowings from an Indigenous language scaling up its quest for revitalisation. Secondly, the tamariki we intend to talk with are not bilinguals, many (probably most) do not speak Māori themselves. (In contrast, most existing literature on the acquisition of language

attitudes and associations relates to bilingual children.) This mahi is challenging because we cannot elicit attitudes directly from children lest we might be told what they perceive to be the 'right' or 'desirable' answer."

The linguistic crystal ball is impossible to read, but the best clue as to what the future holds for borrowed words in NZE can be gleaned from the attitudes of the most avid drivers of change: our tamariki.