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Foreword

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It is our great pleasure to write the foreword to this special issue of *New Zealand Science Review*, which is the first of two dedicated to *Mātauranga and Science in Practice*. These landmark publications provide a timely contribution to ongoing dialogue about what a distinctively Aotearoa New Zealand science system should look like, informed by the research and experiences of those working at the nexus of mātauranga and science. There is much to learn from them.

Like many other countries, Aotearoa New Zealand is confronted with enormous environmental, societal and technological challenges that require our scientists and researchers to go beyond the ordinary. Māori are often at the pointy end of these challenges but are unlikely to be in positions of power to define and drive responses. This needs to change. We need multiple ways of thinking, knowledge systems and approaches to understand and respond to complex challenges including climate change, food insecurity, biosecurity, health inequities, poverty, and the disruptive impacts of digitalisation. This means investing in our comparative advantages, making the most of the opportunities that they present, and enabling communities to contribute to solutions.

The interface of science and Indigenous knowledge is an obvious area where Aotearoa New Zealand is genuinely unrivalled. Mātauranga Māori – defined as Māori knowledge, Māori methods of knowledge creation, and Māori ways of knowing (Mercier & Jackson, this issue) – is the Indigenous knowledge system of this land. Mātauranga has survived and evolved as a dynamic and generative knowledge system despite extensive efforts to expunge it through legal, social and political means (Simon & Smith 2001; Smith 1999; Ward 1995). The vision, crystallised in this issue, is for mātauranga to flourish again and to create collective benefit in ways that are context-appropriate and acceptable to Māori.

We have solid foundations on which to build. The significance of mātauranga in the Aotearoa New Zealand science system, including through the Vision Mātauranga policy (Ministry of Business, Innovation and Employment 2018), has few parallels in other countries. Thanks largely to the incredible commitment of Māori leaders, there are significant cohorts of Māori PhDs and sufficient Māori Principal Investigators to 'fill an Air New Zealand Airbus A320' compared to a telephone box 20 years ago (Ruru *et al*., this issue). The achievements of Ngā Pae o te Māramatanga in this regard is stellar, with hundreds of Māori PhD graduates emerging from this Centre of Research Excellence. Increasingly, Māori researchers operate comfortably in two or more knowledge systems and are adept at interfacing mātauranga with diverse disciplinary knowledge. Working across knowledge systems requires an intellectual flexibility that provides a space for innovative thinking to 'expand the intellectual scope of our nation' (Walker 2005). The papers in this issue that describe efforts to build capacity and capability are inspiring, emphasising the focus on ensuring veracity and rigour as part of teaching practice. It is a pleasure to see the mātauranga–science interface blossom with a focus on the future. The Prime Minister is personally supportive of this kaupapa and is supporting two internships to undertake a future-focused project centred on Te Tairāwhiti (https://www.pmcsa.ac.nz/2019/10/08/we-are-excited-to-announce-two-new-internships-to-complete-a-tairawhiti-centred-project/).

However, as this issue reminds us, there is still much to do. One of the barriers is an inadequate understanding of mātauranga within the broader science community. The question of whether there is such a thing as 'Māori science' pops up from time to time and the ensuing debate is often less than constructive. The measured account of this debate from Georgina Tuari Stewart and her answer: 'there is no right or wrong answer to the question of Māori science and the question can never, therefore, be considered fully settled' is both insightful and challenging. It challenges readers to be comfortable with incommensurability, provides a useful way of coming to that conclusion and inspires exploration of the interface of orthogonal knowledge systems. Here it is instructive to reflect on Tā/Sir Mason Durie's (2005) observation that, just as Indigenous knowledge cannot be verified by scientific criteria, nor can science be adequately assessed according to the tenets of Indigenous knowledge. Rather, 'Each is built on distinctive philosophies, methodologies and criteria'. Contests about the validities of the two systems distract from 'explorations of the interface', and the 'subsequent opportunities for creating new knowledge that reflects the dual persuasions' (p. 2).

Tuari Stewart's paper underscores the inherent power imbalance between mātauranga and science, and the wrongheaded sentiment that one has to claim features of the other in order to gain legitimacy and resource. It also cautions against a reductionist approach that would view mātauranga solely as an 'input' into science solutions, or as supplementary to 'real' scientific knowledge (Broughton & McBreen 2015), which detracts from the opportunities that solving problems using dual knowledge systems might provide.

This issue also shows how much science has to learn from mātauranga and kaupapa Māori approaches. The latter approach of embedding practice in society and grounding the project in a community of acceptance before it starts, is the very model of ensuring impact and connectivity. Often those trained in Western traditions, however fine, struggle to grasp this until it is perhaps too late. How many technologies will be developed in isolation before we learn that we need to engage our publics sooner, not later, to make sure there is cultural license to proceed? To turn the tide on anti-science sentiment we need to reframe our science as 'here to serve', and 'here to listen'. Science in Aotearoa

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New Zealand, and indeed the world, has much to learn from Māori ways of doing, as well as ways of knowing, to bridge these divides. The Hepburn paper describes this beautifully in their comparison of scientific process and community-led decisions. And this blurring of benefit, participation and knowledge is eloquently described in Ruckstuhl and Marti's piece. Those trained in Western traditions might dismantle this way of working as not 'pure', hypothesis-driven science, but this unpicking presents no advantage for understanding and harnessing a knowledge system that was not designed as such, and has no desire to meet this particular abstract (and yes, undeniably powerful in other contexts) ideal. Why not see what advantages it might bring to the practice of using knowledge to make te ao hurihuri better for all? Why not complement science's great reductionist strength with more holistic thinking, and see what we find at the interfaces? In short, scientists may get further by stepping off their self-appointed pedestal and listening to other views and other ways of knowing in order to retain and regain societies' trust. In so doing, let's make the most of our excellence in 'arguably one of the newest research fields on the block, albeit with ancient veins' (Smith 2018, p. 22).

Finally, we wish to thank the Editors, Ocean Mercier and Anne-Marie Jackson, for the opportunity to reflect on this special issue. As remarkable wāhine Māori working at the mātauranga–science interface, both have worked tirelessly to uphold the mana of mātauranga in a system that has often been less than welcoming. This impressive collection of papers is a testament those efforts.

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Mātauranga and Science – Introduction

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Mātauranga Māori is not like an archive of information but rather is like a tool for thinking, organising information, considering the ethics of knowledge, the appropriateness of it all and informing us about our world and our place in it. (Mead 2003, p. 306)

Māori have become a pivotal force in New Zealand's science system, with the torsion of tikanga Māori inviting the system to open its doors to indigenous values. Increasingly mātauranga Māori – encompassing Māori knowledge, Māori methods of knowledge creation and Māori ways of knowing – is being consulted, aligned with or brought into conversation with science. As the guest editors for *Mātauranga and Science in Practice*, we wanted a space in which people who are engaged at these interfaces could share their experiences of working with mātauranga alongside New Zealand science, bound as it is by inherited norms, practices, institutional traditions, and various Crown policies. The audience for this conversation includes tohunga, philosophers, scientists, kaumātua, researchers, academics, kaiako, communities, public servants, kaimahi, students and anyone else who is interested in science, more broadly, and the unique contribution that an Aotearoa New Zealand science could make to the world.

Public science policies – particularly Vision Mātauranga – present an expectation to researchers and educators that their practice will engage with mātauranga Māori. The research, curriculum and project design that has emerged from this is ground-breaking and world-leading, but may go unremarked, and may have occurred by accident, or trial and error as much as by design. For what purpose is this work done, and what are the outcomes? What are the opportunities and challenges of this work? How are science research projects formulated alongside mātauranga, in practice? Mason Durie (2005) spoke of certain values that ought to drive practice at the interface: are these being realised? Are there genuinely mutual benefits of this work? What capabilities are needed in relationship building (or reframing), understanding other ways of knowing and bridging knowledge systems? This special issue foregrounds the experiences of Māori scientists, researchers and educators, presenting them alongside their Pākehā and tauiwi allies. We present a variety of cases that span institutions, disciplines and domains. We invited submissions on a variety of themes, suggesting that prospective authors consider Vision Mātauranga and other policies, Treaty principles, institutional policy and practice, pūtaiao (science) and mātauranga in Western institutional settings, Indigenous knowledge or traditional ecological knowledge, science-mātauranga interfaces in educational, policy and research settings, and how mātauranga and science produce innovation.

We are delighted that Prof. Juliet Gerrard, as Chief Science Advisor to the Prime Minister, and Prof. Tahu Kukutai, member of the Advisors' Forum, have co-written a foreword for this issue. Gerrard is known for tackling the plastics problem, but she has also shown leadership in prioritising the contribution of mātauranga to science, shaping a more diverse science system and transforming our ideas about who is (and thus can be) a scientist. Kukutai is known for her ground-breaking demographic research with communities and long experience in working at epistemological interfaces. These two wahine toa model productive conversation between mātauranga and science.

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We received many submissions and have split the contributions across two issues. In this, Special Issue I, we present five articles on varied topics. The triple project of: building Māori capability in science; building non-Māori capability in tikanga, kaupapa Māori and mātauranga; and reshaping policy and institutional systems is evident in all of these contributions.

Is there such a thing as Māori science? Can mātauranga Māori be considered a science? These questions have long been debated, polarising opinions on either side. In *Mātauranga and Pūtaiao: the 'Māori science' debate in education*, Georgina Stewart gathers the key arguments on both sides and takes a fresh and clear-eyed look at them. She acknowledges that the question can probably never be resolved, questioning whether it necessarily needs to be. She considers the impact of the political, philosophical and epistemological aspects of the debate in relation to policy, education and public science. School teachers and students encounter these tensions quite early, through Pūtaiao, the Māori language science curriculum. The Māori science debate remains a critical question in the development of rangatahi capability in and across dual knowledge systems, and may be crucial in their decision to continue on as scientists. Engagement in this 'provocation and opportunity for learning' is critical to understanding the broader political, philosophical and epistemological tensions that Māori in New Zealand science must navigate.

Anne-Marie Jackson leads a host of authors engaged in leading or steering Te Koronga, a Māori research excellence mission based at the University of Otago. In their 'thoughtful and constructive' contribution *Towards Building an Indigenous Science Tertiary Curriculum,* they present their experience of building curriculum and capacity in science at Otago University as a case for seeding and growing Indigenous sciences within tertiary institutions more broadly. With a clear goal to lift Māori academic staff numbers at Otago University from 3% to 15% (population parity), their work is a response to the rising crescendo of calls (see McAllister *et al.* 2019; Naepi 2019) for universities, Tertiary Education Commission and associated bodies, to urgently address the dire paucity of Māori and Pasifika academic staff. This submission is presented as a 2-parter, with Part II to appear in Issue II of NZSR's *Mātauranga and Science in Practice*.

In *Whāia ngā pae o te māramatanga: our horizons of pursuit,* we hear from past and present directors of Ngā Pae o te Māramatanga (NPM), New Zealand's Māori Centre of Research Excellence. Jacinta Ruru, Linda Waimarie Nikora, Tracey McIntosh, Tahu Kukutai and Daniel Patrick consider how NPM has, over its 17 year history, built Māori capability and leadership in research, and addressed key challenges and opportunities at the interface between mātauranga and science. As a Māori-led nationwide institution, NPM has built wide networks, providing opportunities for trans-institutional and trans-disciplinary Māori research that produce positive outcomes for communities, as well as ameliorating some of the institutional hostility that Māori researchers experience. A spotlight is thrown on some of their key Māori researchers who credit NPM with making their careers. Indeed, NPM has supported the growth of Māori research capacity to the point that NPM researchers are now bidding for their own Centres of Research Excellence. It is hard to argue that NPM has been anything but a transformative force in not just research, but positive societal change.

We turn the spotlight onto the educational and development needs of scientists next. Chris Hepburn and co-authors seek to better prepare science students for career work in context, alongside and with Māori communities, for example. Key to this is developing students' ethical, social, environmental and cultural capabilities. In *Teaching the next generation of scientists to support communities in their restoration of ecosystems and ways of life*, they discuss a University of Otago 'Field Methods' course, a collaborative endeavour that connects science students with the community at Kāti Huirapa ki Puketeraki, supporting customary fisheries management in a way that provides mutual benefits for all involved.

Finally, in *The high-tech interface,* William John Martin and Katharina Ruckstuhl discuss their involvement in one of the National Science Challenges as Kāhui Māori members. While there are few Māori with science and technological capacity as researchers in their theme, Science for Technological Innovation, Māori are nonetheless involved in contributing and building human relational capacity. Their Te Tihi o te Maunga model is a 3-dimensional guide to mapping projects within the Challenge, identifying strengths within these projects in relation to Māori knowledge, participation and benefit, and identify gaps across the sector. It is a model that could be used to assess Māori or Indigenous participation and benefit within any system.

Special Issue II will be released shortly. Papers in that issue will continue discussing mātauranga in educational and research contexts. The collective experience gathered here forms a resource that helps us all to better understand how this work can advance Aotearoa New Zealand's public knowledge ecosystem.

Ngā mihi ki a koutou katoa
Ocean and Anne-Marie

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