

Interview with Justine Lacey on Responsible Innovation and Future Science in Australia

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Introduction

Dr. Vural Özdemir (Editor-in-Chief, *OMICS*): *OMICS* is an interdisciplinary peer-reviewed journal dedicated, for more than two decades, to integrative biology and systems thinking from “cell to society.” The journal informs a diverse readership in 170 countries.

Responsible innovation (RI) is a new concept and practice that examines not only the contents of science but also the frames and framings of knowledge coproduction, that is, epistemology of, and *how* we do science. RI recognizes that the governance of science and technology is a society-wide endeavor that cannot be limited to governmental control, scientific autonomy, or privatization. RI requires scientific and innovation processes to be continually responsive to a wide variety of societal inputs, signals, and values, and places sociotechnical integration at its epicenter. RI invites us to ponder upon important questions such as “what kind of society we wish to live in” and “how can we make science more democratic, experiential, and broadly relevant?” There is evidence that laboratory research thrives much better upon integration with natural and social sciences, enhancing the creative processes in the laboratory and helping generate novel ideas in scientific practice (<https://doi.org/10.1038/4631018a>).

As a journal of integrative biology that advocates for systems approaches to health care innovation, the ethos and practices of RI and sociotechnical integration are, therefore, of direct relevance to *OMICS* readership.

OMICS is pleased to feature this month an exciting interview with Justine Lacey on the rise of RI in Australian science and innovation ecosystem. This interview is of particular interest to governance of emerging technologies featured in the May issue on digital health, artificial intelligence (AI), and automation. Justine is heading the Responsible Innovation Future Science

Platform at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia. CSIRO’s Future Science Platforms aim to develop the early stage science that underpins disruptive innovation for Australia and internationally. Justine has spent many years studying various national and epistemological approaches to RI and funding of science and innovation in ways attuned to societal values and priorities.

This interview is conducted by Erik Fisher. Erik is associate professor in the School for the Future of Innovation in Society and the Consortium for Science, Policy and Outcomes at Arizona State University. He is also Editor-in-Chief of the *Journal of Responsible Innovation*. *OMICS* readers are already familiar with Erik’s leadership in RI and sociotechnical integration research (<https://doi.org/10.1089/omi.2018.0066>).

OMICS has championed integrative science and building strong bridges between science and society for the past decade as a journal of integrative biology (<http://doi.org/10.1089/omi.2019.0220>). We thank Justine and Erik for sharing their thoughts, vision, and the latest in RI and life sciences interface in Australia with *OMICS* readership.

Dr. Erik Fisher: As readers of *OMICS* are aware, policies and practices for RI have been proliferating for the past two decades, beginning with the U.S. emphasis on the responsible development of nanotechnology, followed by national programs in the Netherlands, Norway, and the United Kingdom, and becoming most visible in the European notion of responsible research and innovation. As its core concepts and principles continue to be adopted and adapted around the world, RI has recently become an emphasis in Australia. Could you please tell us how it is emerging as a policy priority in your country?

Dr. Justine Lacey: Thank you, Erik, for inviting me to participate in this interview. It is a real pleasure to be sharing with

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you and the *OMICS* readership how RI has started to take shape in Australia. Indeed, the focus on RI in Australia seems relatively recent, but it captures issues that are enduring and globally relevant. New applications of science and technologies provide great opportunities to generate public and private benefits, but they can also pose challenges, which, if left unresolved, can hinder the progress and innovation that science and technologies can deliver to society and to future generations.

For these reasons, in late 2017, Australia's national science agency established a new multi-year research program, the Responsible Innovation Future Science Platform, to oversee a targeted investment in this area for Australia. This was a commitment to better understanding the interface of science and society as a pathway for maximizing the positive impacts for society from investment in scientific research. This platform also focuses on embedding RI in areas of future science from synthetic biology and AI through to precision health and digital agriculture. These are areas of cutting-edge science that we anticipate will disrupt our industries and broader society.

However, alongside CSIRO's investment, we have also seen RI used by the Australian Council of Learned Academies as a recommended approach to the development of synthetic biology research and industries in their outlook report to 2030; by the Australian Academy of Sciences as a framework to provide Australian citizens with greater confidence in science; and by the Australian Human Rights Commission in identifying the RI organization needed to guide the development of AI for Australia. In just the past 3 years, this shows how RI has been adopted across significant institutions in this country for a range of areas of scientific innovation, but there is still a need to examine what this means in practice.

Dr. Fisher: It sounds like Australia has embarked on a robust national approach to RI. Could you please tell us what is distinct in your mind about the concept in the Australian context?

Dr. Lacey: We not only have the benefit of looking to and learning from the experience and scholarship of our colleagues in the United States, Europe, and other parts of the world (and we consulted with many of them in designing this research program), but to build on and adapt those foundations of RI to the specific demands and challenges of the Australian context. What immediately springs to mind is how we are starting to explore RI in relation to questions of environmental management—and there are many challenges in this field alone.

For example, in Australia we are currently examining how science and technology is playing an increasingly critical role in protecting some of our most significant environmental assets, such as the Great Barrier Reef, what it means to better prepare and respond to bushfires under a changing climate, and how we can better manage the biodiversity and conservation of our vast natural landscapes. The way we design science and technologies to respond to these issues impacts on communities, industries, the environment, and wildlife, so it is important we get it right. Scientific interventions need to not only be socially and culturally acceptable, they also need to be ecologically sound, ethical, and financially responsible. Increasingly, our major national scientific research programs are reflecting this commitment by incorporating the views and expectations of communities, Traditional Owners, and other key stakeholders in their design. In this way, we can better understand not only how

these groups assess the risks and benefits of proposed scientific and technological interventions for environmental management, but they can also be involved in helping to inform and prioritize how such actions are taken so they meet broader community expectations.

Australian Indigenous knowledge plays a key role in these responses, and some of our colleagues are currently working alongside Traditional Owners and Indigenous rangers in Kakadu National Park in northern Australia to use AI as a complement to Traditional Indigenous knowledge for conservation. Their collaborative approach and willingness to arrange science and technology differently in the landscape are helping to solve complex environmental challenges and pioneering new environmental solutions for northern Australia. It also demonstrates how we can bring RI approaches to all corners of this landscape by thinking and working differently.

In my view, what is common about the Australian approach to RI is that we are committed to adopting an empirically based and data-driven approach so that we can share any insights we develop back to our colleagues in the rest of the world. The challenges I have touched on here—coral bleaching, wildfires, and threatened species—are globally shared.

Dr. Fisher: I am curious as to where the inspiration for all this came from, and what you think explains its uptake among different groups and organizations. In particular, how do the different scientific and stakeholder groups interact with one another around this emerging platform?

Dr. Lacey: I certainly think the phrase RI is intuitively appealing and it transcends the specific interests and language of scientists so that it can be relevant and meaningful to policy makers, industry stakeholders from startups through to established multinationals, and a range of broader-based community interests. However, RI really demands that science and the development and deployment of technology stays focused on the nature and type of impact being created in the world. This includes an awareness of the how, to whom, and when this impact occurs. Yes, innovation is a good thing, but we do not just want innovation (or science for that matter) for its own sake. Science and innovation need to make the world a better place for everyone; in that way, they need to be responsible.

As scientists, identifying this explicitly pushes our scientific practice to be relevant, meaningful, and useful outside of our own professions and research interests. I am very fortunate to work in an applied research environment where it is the norm to have teams of biological, physical, computer, and social scientists working alongside each other, and the real global or grand challenges of our time are rarely the domain of a single discipline anymore. CSIRO is particularly good at defining and mapping its future science investments, requiring clearly articulated impact pathways out to 2030 for each of its future science platforms. These impact pathways identify not only the science we hope to deliver, but also the key partners and stakeholders that are essential to delivering the impact of that science.

The demand for transdisciplinary science that draws on the knowledge and input of a broader range of perspectives is growing and the demand for science that is inclusive of and responsive to wider public interests is certainly increasing in importance for our government and industry

partners. RI allows us to design our science to be responsive to this demand, but in a rigorous and scientific way. The intent from the start has been to create a joined-up and inclusive approach to RI in Australia and bring together interested parties so that we can advance this field collaboratively to create critical mass.

Dr. Fisher: What are some of the main goals, areas, and most pressing issues that the Australian science and innovation community hopes to address through RI? And is there a place for integrative biologists, biomedical scientists, and health professionals?

Dr. Lacey: The omics sciences sit at the heart of much of our new science and innovation, transforming areas such as human health, food security, and environmental sustainability to name just a few. Alongside this, the revolution in our ability to capture and analyze data sets across multiple sectors and at multiple scales using machine learning and AI has unlocked our ability to generate new insights about the world and our place in it. It is at the intersection of these life and digital sciences that we find some of the most pressing questions for RI.

So, the potential for new science and novel insights is great, but there are many questions about not only how we can but also how we should use and analyze these big data sets—and to what end? Some of the richest work that my team is currently engaged with is working alongside our colleagues who are working at the intersection of genomics and bioinformatics, developing the models and insights used by health practitioners. Integrative biologists, biomedical scientists, and health professionals are those grappling with the challenges of data ownership, privacy, and consent, along with the fact that genomic data can never truly be anonymized and this poses specific challenges for security and surveillance of citizens. Through these collaborations we are examining the tradeoffs that come with a pace of advancement that has the potential to create unintended risk in the overall system. The end game, however, is to ensure our scientific innovations always focus on and contribute to a fairer and more prosperous society, and what, if anything, we need to do differently now to ensure that is the case over the longer term.

Dr. Fisher: Thank you very much for sharing your thoughts on RI in Australia with the *OMICS* readership. Your biography is available at the end of this interview for the interested readers who may want to learn more on CSIRO's Responsible Innovation Future Science Platform. Any final thoughts you wish to add?

Dr. Lacey: Thank you, Erik. I will finish by saying that I am genuinely excited by the possibilities for RI in Australia. Honestly, when I first heard the term in Europe, I really did not think it would translate well to the Australian context, but I now think of RI as the sign our scientific and innovation practice is moving beyond the benchmark of research integrity. As scientists, we already occupy roles of great professional responsibility in society and meeting the highest standards of research integrity is a given for all of us. I see RI as allowing us to “level up” our science and innovation and connect that research integrity to the more deliberate delivery

of positive impact from our science and innovation for the world.

Dr. Fisher: The distinct ways in which RI is developing in Australia are indeed exciting. One of the defining features for me is what you have said about the need for a “willingness to arrange science and technology differently.” Although most RI programs around the globe emphasize societal inclusiveness and responsiveness, they rarely acknowledge that explicitly taking societal context into account has been changing—I think for the better—what it means to conduct good science. I also think your emphasis on environmental and social complexity is something we will be seeing more as RI policies continue to evolve. Finally, the various types of sociotechnical integration you have listed—from scientists and social scientists working alongside one another, to the key roles of Indigenous knowledge in designing and implementing projects—are particularly noteworthy. These aspirations require, as you say, deliberately combining scientific rigor with societal responsiveness. I expect that research institutions around the world will want to look to Australia for insight and inspiration when it comes to combining science-based innovation with societal responsibility in a synergistic manner.

Disclaimer

The views expressed are the personal opinions of the authors only.

Author Disclosure Statement

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Abbreviations Used

AI = artificial intelligence
CSIRO = Commonwealth Scientific and Industrial
Research Organisation
RI = responsible innovation

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Dr. Justine Lacey leads Commonwealth Scientific and Industrial Research Organisation (CSIRO)'s Responsible Innovation Future Science Platform; a research program examining the interface between science, technology innovation, and the associated ethical, social, and legal consequences of new and disruptive science and technologies. CSIRO's Future Science Platforms aim to develop the early stage science that underpins disruptive innovation and has the potential to reinvent and create new industries for Australia. Before taking up this role, Justine led a research group of social and economic scientists developing and supporting adaptive solutions for Australian communities and industries. She is trained as a philosopher and her own research has focused on examining the aspects underpinning the minerals industry's social license to operate, and how this concept is used in other contexts, such as forestry, agriculture, conservation, and technology development.