Research Integrity: Perspectives from Korea and the United States

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Abstract

Growth of the research enterprise in Korea and the United States has been accompanied by calls for an increased focus on research integrity. Concerns have grown both because of cases of research misconduct and apparent lapses in the reproducibility of science. Education and training are believed by many to have an important role in helping researchers to meet these challenges. The purpose is to answer the simple question of how should one act, to choose not to lie, cheat, or steal, but also how to handle less clear instances (e.g., who should bear both the credit and responsibility of authorship). While there may well be areas in which Korea and the United States differ substantially, it is clear that basic values such as honesty, objectivity, and responsibility are held in common

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by researchers internationally. The question therefore is not so much whether these values are accepted but how to foster a climate in which it is easier to honor those values than not. One answer to that question is simply to promote a research environment in which both educational programs and researchers advocate for good practices in science (e.g., good data management, giving credit where due, and open discussion).

Introduction

The United States now has nearly 25 years of an intense focus on the challenge of research integrity. As seems to be the case internationally, this began with concerns about cases of research misconduct. However, even the earliest education requirements from the US National Institutes of Health (NIH 1989) shifted the focus more generally to the "responsible conduct of research." In other words, the question was not just how can one decrease the risk that scientists would commit serious misconduct but how can they be empowered to conduct science responsibly? The latter challenge has taken on a new dimension in recent years as the focus has shifted to the problem of reproducibility in science. These "3 Rs" (research misconduct, responsible conduct, and reproducibility) have similarly been of concern in Korea. Although these actions of individual researchers take place in a larger context (e.g., their research institution, government, and society as a whole), the focus for this discussion is very much on the perceptions, understandings, abilities, and actions of individual researchers. The goal of this chapter is to review these issues in the context of personal perspectives of the two authors about the United States and Korea, including summaries of a recent survey of Korean researchers.

What is Research Integrity?

Research integrity can be taken to have many different meanings. For the purpose of this discussion, it is considered inclusive of terms such as research ethics and responsible conduct of research. As the focus on these topics in the United States was stimulated in part by cases of research misconduct (e.g., summarized in Steneck and Bulger 2007; Kalichman 2013), Korea was substantially influenced by a single scandal, the case of Hwang Woo-Suk (Lee 2009; Kim and Park 2013). In 2005, Hwang, a former professor of Seoul National University, committed multiple ethical violations. Because of his high profile as an international stem cell researcher, the case had widespread repercussions for Korean science and the nation (Kim and Park 2013).

Allowing for differences in translation, the Korean focus has to varying degrees included not only research ethics and research integrity but also bioethics. Research ethics is seen as a comprehensive term that includes research integrity. The term "bioethics" has been used since the 2013 enactment of the "Bioethics and Safety

Act" (2013), which requires all research with human subjects to be reviewed by an Institutional Review Board (IRB). Korea has tended to speak of research ethics rather than research integrity in guidelines of government and universities (Ministry of Education of Korea 2007; 2014a). In contrast, at the government and regulatory level in the United States, there is a reliance on terms such as research integrity (e.g., the Office of Research Integrity) and responsible conduct of research (e.g., NIH 1989; NIH 2009; NSF 2009) rather than ethics.

Regardless of the country, these various definitions of "research integrity" are derived from values that are the foundation of credible and useful research: honesty, objectivity, responsibility, etc. The fundamental question is "How should one (a researcher) act?" The "right" and "ethical" way to act is one that serves to promote the integrity of the research. That means that the work is done in a way which is truthful but also in the sense that it is done well. To do so requires consideration of many factors including, but not limited to, ethics; laws, guidelines, and commonly accepted standards of conduct; best practices; and consideration for the highest standards of research, the interests of the subjects of research, obligations to other researchers, and the successful completion of science in the public interest. Taken together, the emphasis is on research as a profession for which there is an expectation that members of the profession will have the knowledge, skills, and attitudes sufficient to carry out their professional obligations.

What Are the Perceived Problems in Research Integrity?

In the United States and Korea, there are two major categories of problems perceived in the domain of research integrity. The first is research misconduct. This clearly exemplifies an extreme lack of integrity: An individual has done something considered to be unequivocally wrong. By the US federal definition of research misconduct, this includes fabrication, falsification, and plagiarism (Office of Science and Technology Policy 2000). More simply, the problem is defined by behaviors that to varying degrees reflect lying, cheating, and stealing, all of which are clear and serious deviations from the goal of integrity. While such behavior is egregious, it is probably not frequent. Most estimates are that few scientists commit research misconduct (Steen 2011), and even when surveyed about research misconduct, individuals are not reporting that they have done so routinely but only that they are willing to do so or they have done so at least once (e.g., Martinson et al. 2005). Regarding Martinson et al. (2005), it should be noted that while approximately one in three scientists reported having committed questionable research practices, these practices are, by definition, ones that might be questioned (i.e., not necessarily research misconduct); reports of clear research misconduct were much less frequent. While it would of course be preferable that all scientists invariably avoided even the possibility of questionable misconduct, that expectation is probably naïve given that scientists are human beings. And while one should of course still aspire to that goal, it is worth keeping in mind that all realistic measures of total fraud have indicated that it is far less frequent in science than in

Table 1 Levels of government regulation for research ethics in Korea

Legislation: Academic Promotion Act (Ministry of Education of Korea 2014b)	With focus on academic promotion, Act charges academic institutions with promoting environment that decreases risk of research misconduct
Presidential decree: comanagement regulations on National Research Development (Ministry of Science, ICT and Future Planning of Korea 2014)	These regulations regarding administration of nationally funded research and development projects explicitly prohibit researchers from committing fabrication, falsification, improper allocation of authorship, plagiarism, or other unethical research behaviors when proposing, performing, reporting, or presenting their research. Further, professional and academic research institutions must provide and administer rules set by the National Science and Technology Commission regarding research ethics
Instructions from the Ministry of Education: guidelines for securing research ethics (No. 60, 2014)	Established in 2007, and revised in March 2014, these guidelines are designed to prevent research misconduct and encourage responsibility in research institutions

many other professions (medicine, law, elected government positions). Taken together with the demonstrated successes of science, the vast majority of science remains credible.

In contrast to the US government-wide definition of research misconduct as fabrication, falsification, and plagiarism (Office of Science and Technology Policy 2000), Korea has three levels of government regulations relevant to research ethics (Table 1). These regulations and guidelines apply to all researchers and universities that are funded by the government. Not surprisingly, fabrication, falsification, and plagiarism are also viewed as research misconduct in Korea. However, research misconduct is additionally defined to include deliberate disruption of a research misconduct investigation, retaliation against a whistleblower, or serious deviation from practices commonly accepted in the academy (Ministry of Education of Korea 2007; 2014a). The definition also includes improper authorship as an example of research misconduct beginning with guidelines established in 2007 (Ministry of Education of Korea 2007). This is consistent with a widespread impression (Lee 2014) that improper authorship occurs frequently among Korean researchers (Fig. 1). Many young researchers recognized this as one of the most serious problems in the domain of research ethics. Ghost authorship (i.e., papers written by someone who is not named as an author) and arbitrary assignment of authorship by academic advisors (e.g., naming individuals as authors despite a lack of contribution to the published work) were perceived as negative factors for research integrity. Researchers, particularly in humanities and social sciences, view not only plagiarism but redundant publication (republishing research that had already been published as if it were a new, independent work) as serious research misconduct.

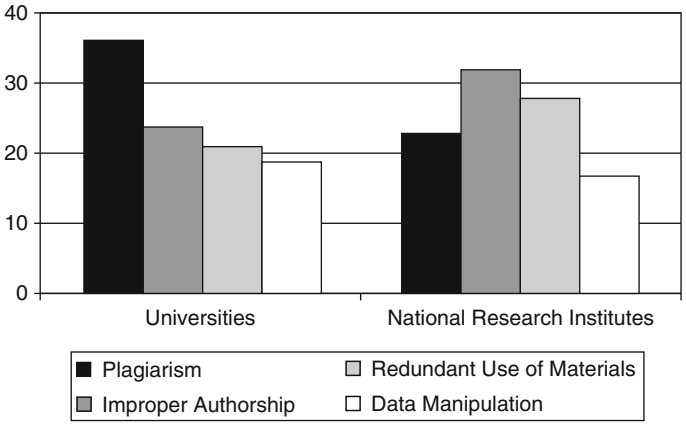

Fig. 1 Percent of respondents identifying each of four items as one of two most serious ethics concerns in Korean research. Total = 100 % for each category (Universities, National Research Institutes) (Lee 2014)

More recently, new Korean guidelines focus on re-use by researchers of their own data or materials (Ministry of Education of Korea 2014a). Article 7 of these guidelines requires that research findings for a graduate dissertation must be novel, the researchers should not report work that duplicates something already reported, and any use of previously reported research must include appropriate citation and permission from the original publisher. Although these deviations aren't explicitly identified as research misconduct, Korean researchers understand redundant publication without proper citation to be an unethical research practice.

Although research misconduct may be relatively infrequent, a second category, deviations from responsible conduct, is probably much more frequent. This presumption is based on anecdote, data, and analysis.

- *Anecdote*: As teachers of research ethics, the authors often hear concerns from trainees about the conduct of other researchers. These are sometimes about potential research misconduct, but more often the issue is a matter of authorship practices, data management, ineffective mentoring, etc. These aren't necessarily matters of research misconduct, but they reflect different standards or approaches, many, but not all, of which might be defensible.
- *Data*: Several recent reports highlight the problem of reproducibility in science (e.g., Begley and Ellis 2012; Prinz et al. 2011). It is certainly possible that a research report will not be reproducible because it is built on a foundation of falsification or fabrication. That argument is supported by the discovery that most retractions occur because of research misconduct (Fang et al. 2012). However, retractions tend to be reserved for the most egregious of problems and almost never because of something such as a "failure to replicate." If the findings of a paper cannot be reproduced, this can be for many other reasons that do not warrant removal from the literature (Ioannidis 2005). For example, it may be that

a research study cannot be replicated because of insufficient attention to statistics, recordkeeping, or publication of research methods. While these failings are arguably inconsistent with the responsible practice of science, they do not necessarily meet the definition of research misconduct nor would they typically be cause for retraction of a paper.

- *Analysis*: Despite considerable attention to the problem of research misconduct, there is much that one does not know and may never know about why such misconduct is committed and how frequently it actually occurs. Instead of focusing on these questions, it might be more useful from a pedagogical point of view to ask what must have gone wrong to allow research misconduct to occur. Framed in these terms, it is noteworthy that cases of research misconduct are characterized frequently, if not always, by multiple failures in the practice of good science. The domains of these failures include, but are not limited to, designing research to minimize the risk of bias, good data management practices, sharing of authorship as a responsibility, not just a matter of credit, attention to detail in data analysis and the preparation of a manuscript, creating an open environment of collaboration and sharing, asking and encouraging the asking of questions, empowering all members of the research team to speak up if something seems wrong and to blow the whistle if necessary, and being part of an environment of ongoing mentoring about the responsible practice of science. In short, a case can be made that research misconduct will be made harder by an environment that promotes the practice of good science (i.e., the responsible conduct of research).

What Factors are Possible Causes of Problems in Research Integrity?

One of the most frequently cited reasons for misbehavior in science is high pressure in an environment in which oversight seems minimal and rewards (continued employment, academic advancement, grants, and other awards) are substantial. In the United States, attention to possible misconduct in research was fueled by a number of cases in the 1970s and 1980s. One of the earliest, in 1974, was that of William Summerlin, who used a black marker to make it appear that he had transplanted black skin onto the backs of white mice (Hixson 1976). In explaining his actions, Summerlin invoked intense pressure. Over the subsequent 40 years, funding and pressure in science have fluctuated, but it is doubtlessly true that researchers risk loss of funding and secure employment when their research does not go well.

In a recent online survey in Korea (Lee 2014), respondents (Table 2) gave three main reasons for committing research misconduct or questionable research practices (Fig. 2). The highest ranking was high stress for advancement, followed by lack of awareness that their practices were considered misconduct and a belief that the gains from committing research misconduct would outweigh any losses. Clearly, if consequences for misconduct are not severe, then the latter belief may be understandable even if not acceptable. It is to be hoped that many, and probably most, do not succumb to academic pressures by committing misconduct. However,

Table 2 Characteristics of respondents to recent online survey of researchers in universities and national research institutes (Lee 2014)

		Universities[a]	National Research Institutes
Status	Professors	2069	0
	Full-time researchers	274	397
	Full-time lecturers	319	0
	Master's or doctoral graduate students	17	1
Research field	Humanities	456	12
	Social science	638	63
	Natural science	290	97
	Engineering	554	189
	Medicine/pharmacy	413	12
	Agriculture/fishery/ oceanography	71	10
	Art/sports	237	9
	Interdisciplinary	20	6
Gender	Male	1921	320
	Female	758	78
Age	20–29	6	0
	30–39	403	84
	40–49	1149	199
	50–59	929	105
	60 and over	192	10
Duration of career	<5 years	173	12
	5–9 years	520	62
	10–14 years	638	115
	15–29 years	452	78
	20–29 years	657	101
	30 years or more	237	29
Total		2679	398

[a]National/public universities, 768; private universities, 1911

the temptation is likely great for those who feel there is little likelihood to be caught. This isn't a sign of a particular failing of scientists; it is an all too human characteristic. Evidence for that is easily found among the vast majority of drivers exceeding freeway speed limits.

Factors influencing research misconduct are likely to vary depending on career stage. In the Korean survey, it was noted that those newer to research were more likely to identify a lack of awareness that certain practices constitute research misconduct as a factor in committing misconduct, while those with longer careers cited high stress to succeed and that gains from research misconduct outweigh the losses. These results suggest that different approaches may be needed to protect against misconduct among early- and late-stage career researchers.

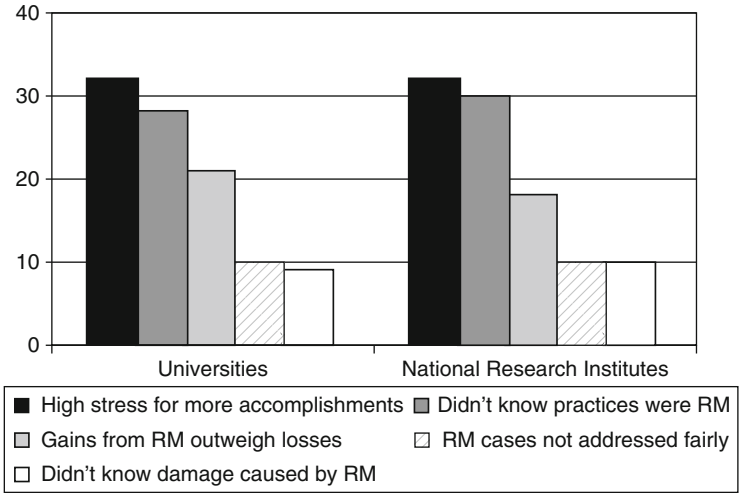

Fig. 2 Percent of respondents identifying each of five different reasons as being one of two most important causes for committing research misconduct in Korea. Total = 100 % for each category (Universities, National Research Institutes) (Lee 2014)

How, If at All, Is Training Used to Mitigate Factors That Impair Research Integrity?

Given that courses in research ethics are not likely to change either the reality of external pressures nor the perception of those pressures, it might seem that education has little role in prevention. However, returning to the discussion above in which it was noted that research misconduct cases are often characterized by failures of various good practices of science, it may be that training in good science (e.g., good practices for data management, authorship, and collaboration) will help promote an environment in which good science is fostered and research misconduct is discouraged. While it remains to be proven that training can either encourage good science or mitigate bad behavior, it is clear that those polled in Korea selected compulsory research ethics education more frequently than any other strategy (Fig. 3).

In both the United States and Korea, there has been disappointingly little initiative on the part of research institutions to promote education in research integrity. As a result, both have been reactive rather than proactive by requiring a "top-down" approach. In the United States, the primary driving force for research ethics education has been requirements from two federal agencies, the NIH and the US National Science Foundation (NIH 1989; NIH 2009; NSF 2009). In Korea, research ethics education has been required by the Ministry of Education of Korea (2014a). According to article 8 of the guidelines, the Minister of Education and the leadership of universities and research institutes share responsibilities to secure the necessary resources for educational programs and other measures that

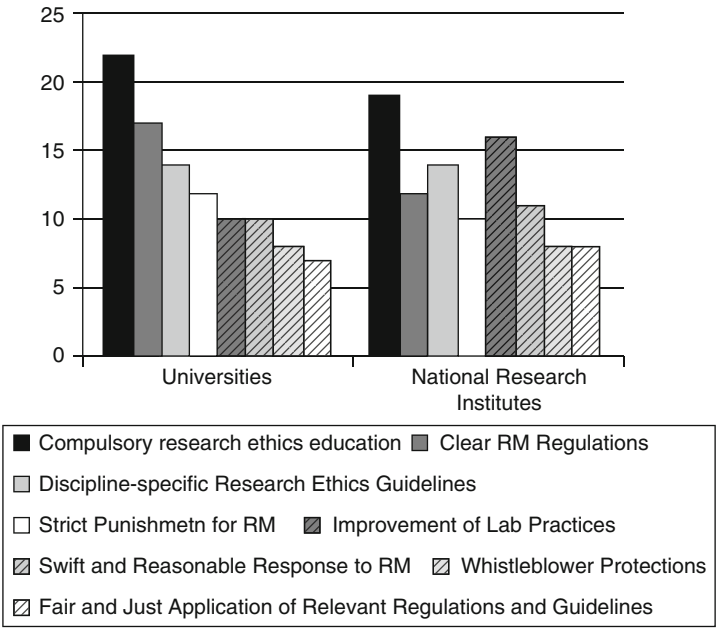

Fig. 3 Percent of respondents identifying each of eight different strategies as being one of two highest priorities for addressing the problem of misconduct in research in Korea. Total = 100 % for each category (Universities, National Research Institutes) (Lee 2014)

will decrease the risk of research misconduct. This has been a useful starting point, but a case can be made that efficacy is severely compromised when researchers respond only to external requirements rather than taking ownership of the creation and delivery of such programs (Lee 2012). In theory, rather than the current limited focus only on current trainees, a more robust system would integrate a focus on ethics in the earliest training of future scientists, at least at the undergraduate level if not earlier. Other areas to be explored might include the use of a publicly sworn oath for researchers, providing easy access to resources setting out high standards and the means to meet those standards, and promoting consistent and clear sanctions for cases of misconduct.

Is There Any Evidence that the Training Works?

To answer whether training works, it is first necessary to be clear about the definition of "works." Because there are many different possible goals for RCR education (Kalichman and Plemmons 2007), it is possible to assess any one of many different outcomes. However, even with clarity about goals and how to measure effectiveness, it is not necessarily the case that anyone teaching any course will be successful. Different instructors, different settings, and different

audiences are all factors that will confound an answer to the question of whether ethical research training works.

Keeping in mind the difficulty in finding a simple answer to whether training works, many investigators have attempted to assess the success of individual courses or programs. The results are not compelling. Even in published studies, the results sometimes indicate no significant impact of training (e.g., Kalichman and Friedman 1992; Drake et al. 2005). Many studies have reported statistically significant outcomes of interest (e.g., Elliott and Stern 1996; Powell et al. 2007), particularly for ethical decision-making, moral reasoning, and sensemaking (Bebeau 2002; Mumford et al. 2008), but in fairness the magnitude of these changes is modest at best (Antes et al. 2009). This begs the question of how much of a change is enough to justify the effort.

In Korea, it is understood that one-time or short-term research education is less likely to nurture positive attitudes and understandings than more substantial, consistent, and systemic programs. At a national level, one part of a proposed solution is to develop an online research ethics program as an option for all graduate students and postdoctoral researchers funded by the government to meet requirements for research ethics training.

While objective, definitive evidence for the effectiveness of research ethics education is not yet available, 72–75 % of respondents to the online survey in Korea responded that research ethics education can promote research ethics consciousness and good research practices (Fig. 4). However, the impact of existing

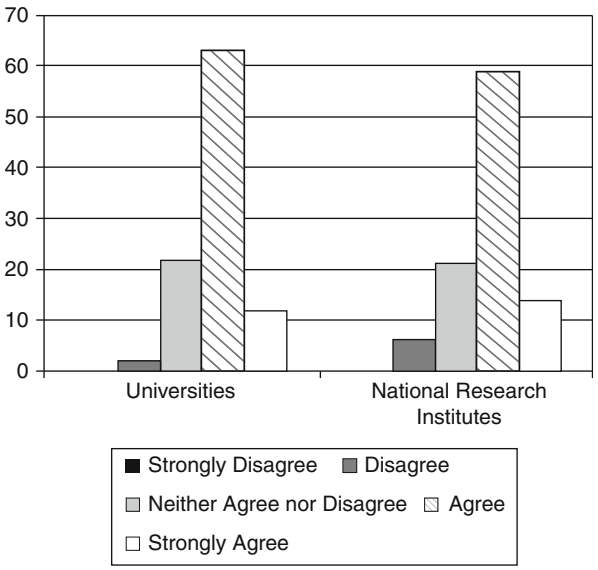

Fig. 4 Percent of respondents in Korea agreeing or disagreeing with the importance of research ethics education in nurturing awareness about research ethics and the responsible conduct of research (Lee 2014)

training in addressing actual concerns of researchers was ranked somewhat lower. This suggests that the current research ethics education could be improved. One strategy widely accepted is to use a case study–oriented approach, reflecting unique features of each academic field.

Taken together, it might seem best to conclude that the evidence for effectiveness of research ethics training is discouraging. However, there is one other way to look at this question that might be useful. If research ethics training is seen generally as an opportunity for learning more about research ethics rather than for learning any particular skill or knowledge, then perhaps many courses are highly successful. This question has not been examined extensively, but at least two qualitative studies (Plemmons et al. 2006; McGee et al. 2008) reported that an overwhelming majority of students report positive outcomes. The catch is that different people report different benefits of the courses. Not everyone gets the same thing from research ethics education. While this isn't as simple as a single measurable outcome, it is consistent with the spirit of creating opportunities for all researchers, regardless of background or experience, to speak with one another, to learn from one another, and to foster a community of open conversation about the ethical dimensions of the practice of science.

Are There "Best Practices" or Highly Recommended Approaches to Training?

Based on a substantial literature in education (Bransford et al. 2000), and also in adult learning specifically (Knowles 1990), it is widely understood that "active learning" is more likely to promote meaningful change than passive learning. People tend to learn better by doing than by simply being told what to do. In the field of research ethics, this has resulted in widespread calls to use cases (Macrina and Munro 1993; Stern and Elliott 1997; Pimple 2007). Cases can be either summaries of real-world incidents or contrived versions of difficult situations. Whether fictitious or real, cases can give students the opportunity to wrestle with tough problems, articulate possible answers and approaches, hear perspectives of others, and seek common ground through discussion. Clearly, these are all useful outcomes. However, it is important to not mistake the method (using cases) for the goal (active learning).

Depending on how they are used, cases may not engender active learning (e.g., if they are simply cautionary tales of how things might go badly), and active learning can occur with many approaches other than just cases. Some examples that might be considered as variations on the theme of "cases" include current events, role playing, and video. However, other formats (e.g., debates, surveys, published papers, literature, or lectures based on asking questions of the students) are clearly distinct from cases. These other approaches meet the goal of engendering active learning; however, by having a variety of approaches, it is possible to keep things fresh and interesting, rather than simply repeating the same exercise every time. The importance of case discussion and other approaches to active learning are generally accepted by research ethics educators in both Korea and the United States.

Although there is much to be said for classroom teaching and research ethics, there is also some evidence that such teaching is at best of nominal benefit (Kalichman and Friedman 1992; Antes et al. 2009) and at worst counterproductive (Eastwood et al. 1996; Anderson et al. 2007). Instead, a compelling argument can be made for the importance of bringing conversations about research ethics into the research environment (Kalichman 2014). If nothing else, it's worth pointing out that any one course is really a negligible fraction of the research experience for a graduate student. If their experiences in the research environment lack discussions of research ethics or, even worse, are contrary to what is taught in a research ethics course, then it seems hard to imagine a successful outcome. Therefore, there is an argument to be made for including ethics conversations in the research environment as a best or at least good practice.

Summary

On the key points discussed here, Korea and United States are largely similar. Both countries were motivated to focus on research integrity because of research misconduct scandals. Both have developed national standards for identifying and addressing serious research misconduct as well as requirements for training in responsible conduct of research for the next generation of researchers. And both have recognized that much remains to be done in clarifying achievable goals for education, developing best practices, and promoting the widespread adoption of those practices. Based on what is known to date, the authors advocate for approaches that focus on good practices for the conduct of science, engage researchers in learner-centered education, and combine classroom efforts with strategies that will increase conversations about responsible science in the research environment.

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