COMMENTARY

Repairing research integrity

A survey suggests that many research misconduct incidents in the United States go unreported to the Office of Research Integrity. **Sandra L. Titus**, **James A. Wells** and **Lawrence J. Rhoades** say it's time to change that.

Misconduct jeopardizes the good name of any institution. Inevitably, the way in which research misconduct is policed and corrected reflects the integrity of the whole enterprise of science. The US National Academy of Sciences has asserted that scientists share an 'obligation to act' when suspected research misconduct is observed[1]. But it has been unclear how well scientists are meeting that obligation. In the United States, the Office of Research Integrity (ORI) evaluates all the investigation records submitted by institutions and plays an oversight role in determining whether there has been misconduct at institutions that receive support from the Department of Health and Human Services (DHHS). The reported number of investigations submitted to ORI has remained low: on average 24 institutional investigation reports per year[2].

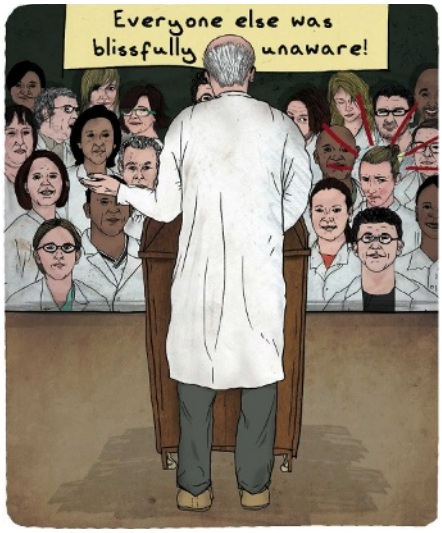
ORI focuses resources, not only on evaluating institutional reports of research misconduct but also on preventing misconduct and promoting research integrity through deterrence and education. To evaluate these initiatives, we investigated whether the low number of misconduct cases reported to ORI is an accurate reflection of misconduct incidence, or the tip of a much larger iceberg. The latter seems to be the case.

The 2,212 researchers we surveyed observed 201 instances of likely misconduct over a three-year period. That's 3 incidents per 100 researchers per year. A conservative extrapolation from our findings to all DHHS-funded researchers predicts that more than 2,300 observations of potential misconduct are made every year. Not all are being reported to universities and few of these are being reported to the ORI.

No regulatory office can hope to catch all research misconduct and we think that the primary deterrent must be at the institutional level. Institutions must establish the culture that promotes safeguards for whistleblowers and establishes zero tolerance both for those who commit misconduct and for those who turn a blind eye to it.

Defining misconduct

A first step in developing that culture is taking stock of misconduct's frequency. Several investigators have addressed research misconduct incidence with limited results because of methodological problems, such as applying inconsistent definitions of misconduct or not accounting for duplicate reports of the same incident[3–5]. So, we used the US federal definition of research misconduct[6] — fabrication, falsification or plagiarism in proposing, performing or reviewing research, or in reporting research results — and verified whether reports accurately fitted that definition. The possibility of duplicate reports was virtually eliminated by selecting only one National Institutes of Health (NIH)-funded researcher in a given department to respond. We asked about events only from the past three academic years to avoid inclusion of distant events and to have a consistent time parameter. We used frequent and varied reminders to secure a high response rate to the survey. Previous research has treated survey reports of misconduct as if the observer could make the determination that they had observed misconduct. Instead, we consider the observations to be 'possible research misconduct' and not all such observations will result in a finding of misconduct. In all we asked 4,298 scientists holding NIH extramural research funds at 605 institutions to respond to the survey so that our findings would be representative of a broad spectrum of research fields as well as varied sizes of institutions.



ILLUSTRATIONS BY J. TAYLOR

"Institutions must establish safeguards for whistleblowers."

What scientists saw

In 2006, we asked participants to indicate the number of times they had observed suspected research misconduct in their own department in the past three academic years (2002–05). 2,212 scientists provided complete responses to questions concerning research misconduct (51% response rate). Of these, 192 scientists (8.7%) indicated that they had observed or had direct evidence of researchers in their own department committing one or more incidents of suspected research misconduct over the past three academic years. The 192 scientists described a total of 265 incidents.

Scientists were asked to indicate how they became aware of the possible misconduct and were told to report observations and not hearsay (see table, page 982). Suspected misconduct was observed at all scientific ranks including postdocs, students, and tenured faculty members. The following are examples of how scientists described such incidents. We used these descriptions to validate whether the observation met the federal definition of research misconduct.

"A post doc changed the numbers in assays in order to 'improve' the data."

"A colleague duplicated results between three different papers but differently labelled data in each paper."

"A co-investigator on a large, interdisciplinary grant application reported that a postdoctoral fellow in his laboratory falsified data submitted as preliminary data in the grant. As principal investigator of the grant, I submitted

supplementary data to correct the application."

"A colleague used Photoshop to eliminate background bands on a western blot to make the data look more specific than they were."

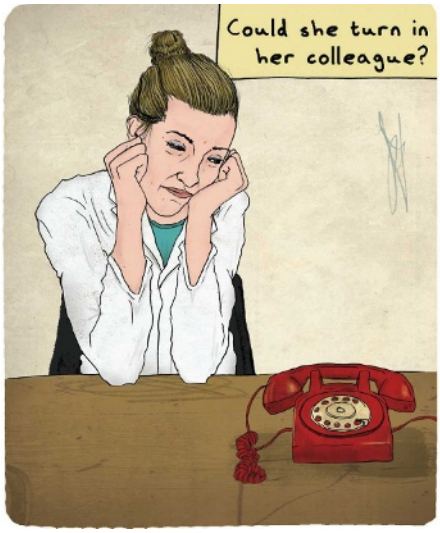
Two people independently coded and evaluated the 265 descriptions to determine whether each met the federal definition of research misconduct. In all, 64 reports (24% of the total) did not meet the threshold of the federal definition — which left 201 observations of potential misconduct made by 164 scientists (7.4%). These 201 misconduct observations included fabrication or falsification (60%) and plagiarism only (36%).

According to our respondents, 58% of the observed incidents had been reported to officials at their institutions. In 24% of incidents it was the survey respondent who reported it and in 33% of the incidents it was someone other than the respondent. Responses indicated that 37% of incidents were not reported by anyone and for 5% of the cases respondents did not know.

Study limitations

Several limitations may have affected the study results. As the sample only includes one observer per department, the number of suspected research-misconduct incidents found in this study is likely to be a very conservative estimate. Because the sample only represented scientists holding research awards given to established researchers, we lack the views of postdoctoral fellows, graduate students, clinical-trial coordinators and lab technicians who might report a different quantity and type of suspected research misconduct. The study is also probably more representative of the biomedical, behavioural and life sciences than it is of the physical and social sciences, reflecting the mission of the NIH.

Although the scientists we sampled were receiving research support from the NIH, we know nothing about the funding of those they suspected to be committing misconduct. This means that the findings do not exclusively apply to NIH investigators. And because of the possibility of human error from respondents, our method of measurement may have failed to elicit all instances of suspected research misconduct or may have included erroneous instances. Some observations, for example, may have occurred outside the time period specified because of 'telescoping' — including salient events that occurred before the period of interest. Still, the questionnaire was careful to specify the period of interest as the past three academic years.



Extrapolating the survey results — even conservatively — projects an alarming picture of under-reporting. NIH extramural research grants in 2007 supported an estimated 155,000 people, which includes principal investigators and other research personnel[7]. In our survey, 201 cases were observed over three years by 2,212 respondents, essentially 3 cases per 100 people per year. Most conservatively, we assumed that non-responders (roughly half of our sample) did not witness any misconduct. Thus, applying 1.5 cases in 100 scientists to 155,000 researchers suggests that there could be, minimally, 2,325 possible research misconduct observations in a year. If 58% of these cases were reported to institutional officials as in our survey, approximately 1,350 would have been reported whereas almost 1,000 could be assumed to go unreported to any official.

" Extrapolating the survey results projects an alarming picture of under-reporting ."

These numbers indicate a sizeable disconnect between what universities are seeing and the 24 investigations evaluated by the ORI annually. Could all the predicted cases be found to lack evidence? Could all the cases be concluded at the inquiry stage? Could the cases be primarily occurring in research that is not funded by the Public Health Service and hence not reportable to the ORI? Can duplicate observations of misconduct account for this disparity?

We doubt that affirmative answers to these questions could sufficiently explain the discrepancy. We recognize that this estimate is not perfect. First we are applying our findings from a defined context to a much larger context and one that also includes the staff of the investigator. Another weakness of the prediction is the fact that scientists in our study would have been narrowly reporting observations restricted to their own experience. A single observer in a department cannot be expected to have been exposed to all instances of misconduct. Thus, our estimate may be off by an order of magnitude in either direction.

On an individual level, many reasons for under-reporting are easy to understand because they involve motivations we might all have experienced. For example, one does not want to accuse falsely. One may also fear that reporting would take time away from research, or have concerns and fears about possible retaliation. One may assume someone else will or should report it. Or one may have sympathy towards a researcher, and might think "it's not too bad", it can be sorted out without a career-damaging investigation. Reporting also necessitates confidence that the issue will be examined carefully and thoroughly.

Keeping it quiet

The leaders of institutions may also have concerns about handling research misconduct. Because public image is important to institutions, some may try to minimize reporting and keep unfavourable information from reaching the ORI and the press. An institution may choose to ignore conducting an investigation and instead they may simply dismiss an accused person or even a whistleblower in the hope that the problem will go away without needing further examination. Additionally, institutional leaders may wish to ignore or minimize allegations of possible research misconduct to protect the revenue that the researcher generates; some may avoid investigations because they are costly in terms of time and money. Administrators may not recognize the significance of evaluating research misconduct and of course they may be poorly equipped to conduct an investigation in an appropriate manner.

Fundamentally all explanations seem to

share a common denominator — the failure to foster a culture of integrity. An analysis commissioned by the ORI found in 2000 that only 29% of institutional misconduct polices explicitly obligate members to report scientific misconduct[8]. Individuals and institutions, not the federal government, are the guardians of research integrity. Therefore, we urge action and recommend six strategies to champion integrity.

Adopt zero tolerance

To create a zero-tolerance culture, we think that it is essential that an institution specifies and implements the requirements that all suspected misconduct must be reported, and all allegations must be thoroughly and fairly investigated. Social responsibility to the academic community and to the public who fund the research will be strengthened when it is apparent that an institution has a real commitment to integrity.

Protect whistleblowers

Careful attention must be paid to the creation and dissemination of measures to protect whistleblowers. Responders to our survey said that reporting would be most likely to improve if institutions and the federal government increased the whistleblower protection. Indeed, more than two-thirds of whistleblowers, in a Research Triangle Institute study, experienced at least one negative outcome as a direct result of their actions[9]. Plus, 43% reported that institutions encouraged them to drop the allegation.

Clarify how to report

Researchers in our study also emphasized what would promote reporting: establishing a reporting system that clearly identifies the individuals to whom allegations should be brought, and establishing clear policies, procedures and guidelines related to misconduct and responsible conduct.

Train the mentors

If we want to build a stronger culture of integrity, then the current generation of researchers has to be educated to pay more attention to how they work with their junior team members. Social science has a long history of describing how group standards affect individual behaviour. Mentors specifically need to become more aware of their roles in establishing and maintaining research rules and minimizing opportunities to commit research misconduct[10]. Only 34% of scientists in a study with 2,206 laboratory directors strongly agreed that their mentor had prepared them to be a good mentor to others[11]. An institutional investment in building better mentors is an important vehicle to promoting research integrity.

SUSPECTED MISCONDUCT: 201 CASES OBSERVED BY 164 SCIENTISTS

	Number of cases
Type of misconduct	
Fabrication or falsification	120 (59.7%)
Plagiarism only	73 (36.3%)
Unknown	8 (4.0%)
Rank of those suspected*	
Professor or senior scientist	44 (21.9%)
Associate professor or scientist	28 (13.9%)
Assistant professor or scientist	34 (16.9%)
Postdoctoral fellow	50 (24.9%)
Graduate student	29 (14.4%)
Other (includes 1 unknown)	24 (11.9%)
How it was discovered	
Directly observed	23 (11.4%)
Observed products	53 (26.4%)
Told first, then observed	60 (29.9%)
Other direct evidence	30 (14.9%)
Other	30 (14.9%)
Don't recall	1 (0.5%)
No answer	4 (2.0%)
Was it reported?	
Yes, reported by responder	49 (24.4%)
Yes, reported by someone else	67 (33.3%)
No, not reported	75 (37.3%)
Don't know	5 (2.5%)
No answer	5 (2.5%)

* Eight cases identified more than one person involved in incident.

Use alternative mechanisms

Institutions must start to use other means to protect the integrity of their studies. The Institute of Medicine recommends that "Universities should not rely upon formal complaints of scientific misconduct as the sole source of monitoring the integrity and quality of the research conducted under their auspices. They need continuing mechanisms to review and evaluate the research and training environment of their institution."[12] Auditing research records would be one such means. Mechanisms of review are needed to reduce deficient record keeping, improper protection of human or animal subjects or the utilization of questionable research behaviour[13].

Model ethical behaviour

People imitate the behaviour of powerful role models. Institutions successfully stop cheating, for example, when they have leaders who communicate what is acceptable behaviour, encourage faculty members and staff to follow the policies, develop fair and appropriate procedures for handling misconduct cases, focus on ways to develop and promote ethical behaviour, and provide clear deterrents that are communicated[14].

Nearly one generation after the effort to reduce misconduct in science began, the responses by NIH scientists suggests that falsified and fabricated research records, publications, dissertations and grant applications are much more prevalent than has been suspected to date. Our study calls into question the effectiveness of self-regulation. We hope it will lead individuals and institutions to evaluate their commitment to research integrity. ■

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A more detailed report discussing this study can be found at http://tinyurl.com/3keo6h.

See Editorial, page 957.