

Perspective: **Research Misconduct: The Search for a Remedy**

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Abstract

Research misconduct—fabrication, falsification, and plagiarism—is an insidious problem in the scientific community today with the capacity to harm science, scientists, and the public. Federal agencies require that research trainees complete a course designed to deter such behavior, but the author could find no evidence to suggest that this effort has been effective. In fact, research shows that most cases of misconduct continue to go unreported.

The author conducted a detailed examination of 146 individual Office of Research Integrity reports from 1992

to 2003 and determined that these acts of misconduct were the results of individual psychological traits and the circumstances in which the researchers found themselves. Therefore, a course in research misconduct, such as is now federally mandated, should not be expected to have a significant effect. However, a course developed specifically for support staff, who currently do not receive such training, might prove effective.

Improving the quality of mentoring is essential to meaningfully deal with this issue. Therefore, the quality of

mentorship should be a factor in the evaluation of training grants for funding. In addition, mentors should share responsibility for their trainees' published work. The whistleblower can also play a significant role in this effort. However, the potential whistleblower is deterred by a realistic fear of retaliation. Therefore, institutions must establish policies that acknowledge the whistleblower's contribution to the integrity of science and provide truly effective protection from retaliation. An increase in whistleblowing activity would provide greater, earlier exposure of misconduct and serve as a deterrent.

The pool of talented, well-trained scientists is growing and increasingly sophisticated technology is becoming available, thus creating the potential to achieve truly significant advances in knowledge. Yet, paradoxically, the funds available to support such efforts are inadequate. The resulting heightened competition for these limited dollars has created an environment that is highly conducive to research misconduct. Therefore, there could be no better time for the academic research community to address this issue.

A Persistent Pernicious Problem

A 2010 *New York Times* headline read, "Expert on morality is on leave after research inquiry."¹ The story described alleged research misconduct by a distinguished investigator at an elite university. Ironically, his area of study? The origins of morality.

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Research misconduct is indeed very much with us but is not just a contemporary concern. In 1830, the mathematician Charles Babbage wrote *Reflections on the Decline of Science in England, and on Some of Its Causes*, in which he noted the problems created by the "frauds of observers."² More recent surveys of scientists and trainees in the United States and Europe have found significant numbers of individuals who acknowledged being personally guilty of misconduct or who were aware of its being committed by others.³⁻¹¹ In 2008, Titus and colleagues¹² estimated that as many as 1,000 instances of research misconduct go unreported annually in the United States.

Nonetheless, science is said to be self-correcting, which in principle is true. However, fraudulent results can persist uncorrected in the literature for many years. For example, it took more than 100 years to establish that Haeckel's illustrations of embryonic development, the basis of his thesis that ontogeny recapitulates phylogeny, had been altered to fit his hypothesis.²

Publications based on fraudulent data may ultimately be detected and retractions published in the journals in which they had appeared. However, unfortunately, flawed research continues

to be cited long after those retractions appear.¹³⁻¹⁸ Therefore, the damage that is inflicted on others in wasted time, effort, funds, and ineffective or dangerous clinical care is incalculable.

In 1991, the federal government established the Office of Research Integrity (ORI), with the responsibility to investigate charges of research misconduct, defined as fabrication and/or falsification of data and plagiarism.¹⁹ (In the 19th century, research misconduct was more colorfully defined as "hoaxing, forging, trimming, and cooking.")²

Under ORI regulations, federally funded research training programs are required to provide instruction in the responsible conduct of research (RCR), with a component devoted specifically to research misconduct.²⁰ However, surveys of trainees and early- and midcourse scientists who have taken such courses have found that although these programs increased the participants' knowledge of ethical issues and their ability to identify them, they were unlikely to affect their future behavior.^{3,21-24} As simply stated by a participant in one of these studies: "In most cases, I believe a person is ethical or not. I feel that if a person chooses to do something unethical it's not because they never took an ethics class."²¹

An Institute of Medicine report similarly acknowledged the limitations of such training, stating, “The scientific community must appeal to the consciences of individual scientists and the scientific community as a whole to invoke the highest possible standards of research behavior.”²⁵

Is that not obvious? Fabrication, falsification, and plagiarism are the academic equivalents of lying, cheating, and stealing. The ethical standards proscribing such behavior are established long before one enters graduate training in science. Therefore, we should not be surprised to find that RCR courses do not influence the behavior of these young adult trainees.

What, then, can be done? I reviewed the 146 individual narratives contained in ORI reports of those found guilty of misconduct (1992–2003). The number of findings of research misconduct reported in 2009 was no different from the average from 1992–2009.²⁶ It was my hope that, as a psychiatrist, I could identify patterns of behavior that could serve as the basis for recommendations to mitigate the problem.

Approximately one-third of the respondents (the accused) were support staff, one-third were postdoctoral fellows and graduate students, and one-third were faculty. Accusations of fabrication represented 45% of the offenses, falsification 66%, and plagiarism 12%. The first two offenses frequently occurred together. Approximately three-quarters of the respondents admitted their guilt or did not provide a defense. None claimed that the offense of which they were accused should not be considered research misconduct. They frequently attributed their behavior to extenuating circumstances.

One hundred twenty-four articles based on faulty data were published in 72 journals. These included *Cell* (5 articles), *Diabetes* (5), *Hypertension* (5), *Proceedings of the National Academy of Sciences* (5), *The Journal of Biological Chemistry* (4), *Nature* (4), *Science* (4), and the *New England Journal of Medicine* (3). Consider the effect that any one of these articles, published in these high-impact journals, might have had on its respective field.

Beyond these statistics, though, are 146 individuals, each with his or her own story to tell. These vignettes provided the data for this study. The patterns of personal characteristics and circumstances, which I identified and the subsequent recommendations are based on 50 years of clinical experience in psychiatry and 19 years as the chairman of two institutional review boards.

Who Were the Respondents?

Support staff

These individuals were usually not members of the scientific community. They were not bound by a standard of professional ethics and usually did not have any personal investment in the validity of the study’s outcome. They were also less likely to understand the significance of their misconduct on the research objectives and the subsequent impact of their actions. They were frequently pressured to increase the intake of new subjects or to generate more data. In some cases, their income was directly based on their productivity. Consider the following examples:

Three individuals were hired to conduct neighborhood interviews. The subjects were to receive cash payments for participating in the follow-up interviews. The signatures on the receipts for the cash payments differed from the consent form signatures obtained at the time of enrollment. The three individuals acknowledged that they had forged the signatures, taken the payments, and fabricated the interview data.

A technician admitted that the times of day he recorded for blood samples were not the actual times that the samples were collected. He said that he could not follow protocol schedules and also provide as many samples as were required. The ORI investigating committee concluded that he had been assigned responsibility for more protocols than he could reasonably have been expected to perform. The technician also stated that he was not made aware of the significance of the timing of the blood sampling to the research objectives.

Postdoctoral fellows and graduate students

These individuals were under great pressure to produce publishable results.

The postdoctoral fellows were competing for faculty positions, and the graduate students for postdoctoral fellowships. They also may have been working under limited supervision. Consider the following examples:

One respondent acknowledged that he had falsified data “to make it fit the hypothesis.” He had recently been notified that he was to be terminated and believed that he needed additional publishable research to get another appointment.

Another respondent acknowledged that she had fabricated data in an article which had been accepted for publication. She stated that she had been under pressure from a superior to generate data and felt that her action was justifiable because she had observed a senior scientist in her laboratory “clean up” data to make them more acceptable for publication.

A third respondent acknowledged that he had manipulated data to yield a desired result. He was described by one superior as “one of the brightest and hardworking students anyone has ever seen.” The student had previously published articles in *Cell* and *Nature* based on legitimate findings. He reported “intense self-imposed pressure” to replicate his early successes and stated: “My behavior has been a heavy burden on me. I can offer no excuse. I cannot begin to express my regrets for my actions.”

Faculty

The need to publish exists at all stages of an academic career. To qualify for tenure, assistant professors must publish and demonstrate that they have the potential to obtain research funding. Associate professors must publish to support their requests for research funding and to justify promotion to professor. Full professors must publish to garner support for their laboratories and to demonstrate that they remain leaders in their fields. Consider the following examples:

Assistant professors. One respondent was the senior author of an article published in *Science*. A senior colleague questioned the validity of his findings. The respondent could not produce the data on which the article was based. He initially claimed that the data had been lost when they were entered into the

computer and that bound data books had not been used. He subsequently acknowledged that the data were fabricated.

Another respondent was asked to provide the data to support the figures that were included in her publications. She stated that she could not provide the data because a mouse had destroyed the tapes.

Associate professors. One respondent was accused of fabricating data in a grant application. He defended his action as “data projection” and not “data falsification.” He acknowledged that he included the “projected data” to increase his chances of securing grant funding.

Another respondent was accused of failing to follow the protocol as stated in the method section of a published article. He acknowledged that certain measurements were based on his personal observations and not on measurements by caliper or ruler as required in the protocol. The review committee did not believe that the respondent was motivated by a desire to enhance results but, rather, by the conviction that his own subjective judgments were as valid as the specific requirements of the protocol’s method.

Full professors. One respondent, the chairman of a medical school basic science department, was found guilty of submitting a grant application that contained the plagiarized text of 11 paragraphs and one-third of the references from a National Institutes of Health (NIH) grant application that he had reviewed while serving as a member of an NIH study section. In his own defense, the respondent submitted a handwritten grant application that he alleged antedated the grant he was accused of plagiarizing. That document, however, was found to have been fabricated.

I also found three similar instances of senior faculty who plagiarized material from grants that they had reviewed as consultants or as members of NIH study sections.

Another respondent was found guilty of encouraging a subordinate who had completed one experiment to inflate the size of the sample by three to provide the number of tests required by the protocol. He explained, “If we had done

it three times, we would have gotten the same result anyway.” He referred to the criticism of his artificially inflating the sample size as “nitpicking.”

Clinical investigators. These individuals were primarily involved in the enrollment of subjects according to a study’s guidelines. They may have held clinical faculty appointments at university-affiliated hospitals but usually had not participated in the design of the protocol.

One respondent was found guilty of falsifying and/or fabricating data in the histories and screening exams of patients recruited for a cancer treatment study. He acknowledged having done so. In his own defense, he stated that he believed that the patients would benefit from participating in the protocol and should not be denied treatment on the basis of “trivial details.”

Why Did the Respondents Violate the Rules?

These acts of research misconduct seemed to be the result of the interaction of psychological traits and/or states and the circumstances in which these individuals found themselves. The respondents could be categorized as follows:

- The desperate, whose fear of failure overcame a personal code of conduct,
- The perfectionist, for whom any failure was a catastrophe,
- The ethically challenged, who succumbed to temptation,
- The grandiose, who believed that his or her superior judgment did not require verification,
- The sociopath, who was totally absent a conscience (and, fortunately, was rare),
- The nonprofessional support staff, who were unconstrained by the ethics of science, unaware of the scientific consequences of their actions, and/or tempted by financial rewards.

In a similar study of comparable ORI reports, researchers scanned the texts and performed multidimensional scaling and cluster analysis. They also found that personal characteristics and the circumstances in which the respondents found themselves were major contributing factors to research misconduct.²⁷

We should also consider the role of our current academic culture. In his book, *The Cheating Culture: Why More Americans Are Doing Wrong to Get Ahead*, Callahan²⁸ noted the high prevalence of cheating found among U.S. high school and college students. Perhaps that change in societal norms has made “cheating” later in a scientific career more acceptable.

What Remedies Are Available?

My observations are not surprising. However, the scientific community has not addressed them realistically. RCR instruction cannot be expected to establish basic ethical standards in a classroom of young adult graduate students. However, variations on such a course might be effective for the nonprofessional staff, for whom such training is not now required. Members of this group might be less likely to fabricate or falsify data if they have a better understanding of the goals of the research in which they are involved. They should know how their findings could contribute to advances in science and/or improved medical care and the serious consequences of publishing fraudulent data.

All potential respondents might be deterred from misconduct by the knowledge that the submission of false information in a government agency grant application is a violation of federal law, punishable by imprisonment.²⁹

However, establishing remedies for the psychological characteristics and the life circumstances of potential respondents poses a much more difficult problem. Grandiosity, perfectionism, and sociopathy cannot be eradicated from the scientific community, or any other, and little can be done to reduce the reality of the need to publish or perish.

Nonetheless, I believe that there are institutional policy initiatives that can have an impact on the prevalence of research misconduct:

1. Improvement in the quality of mentoring in training programs, and
2. A policy that acknowledges the important contributions of whistleblowers and establishes truly effective means of protecting them from retaliation.

Improving the quality of mentoring

Another 2010 *New York Times* headline read, “Three Harvard researchers retract a claim on the aging of stem cells.”³⁰ The article contained the following comment: “It is not clear whether the competitive nature of science puts pressure on [postdoctoral] students to cut corners, or whether the laboratory chief creates an atmosphere that induces cheating.” Unfortunately, either, or both, could be true.

Twenty-five years ago, in an article entitled “The Pathogenesis of Fraud in Medical Science” Petersdorf³¹ spoke of the impact of an era of “big science,” in which trainees were inadequately supervised. Unfortunately, “big science” has become even bigger, yet our mentoring system is essentially unchanged.

A study of mentoring in a series of closed ORI misconduct cases found that 62% of mentors had not established procedural standards (e.g., the need to maintain a laboratory notebook), and 73% had not reviewed the raw data generated by their trainees.³² Another survey of 98 medical schools found that only 23.5% had published guidelines for mentorship.³³ Appropriate mentoring, which establishes high ethical standards for trainees and provides meaningful personal support and supervision, can decrease the likelihood of research trainees engaging in what one study referred to as problematic behavior.³⁴

Effective mentors must be prepared to play many roles. First, they must address their trainees’ intense fear of failure. A study of ORI reports found that over 50% of graduate students and postdoctoral fellows reported stress as a contributing factor to their acts of research misconduct and 62% to a self-imposed need to perform well.³³ Therefore, mentors must redefine the concept of failure for this group of highly competitive individuals, for many of whom anything less than perfection is a catastrophe. For example, mentors could share their own experiences with failed experiments that obviously did not destroy their academic careers. Trainees can benefit for a lifetime if they can learn to put such “failures” in a realistic perspective. Institutions should also make professional counseling services available because supportive mentoring alone may be inadequate to achieve this goal.²⁷

A close mentoring relationship also would provide a model of scientific integrity for trainees to follow. One senior scientist put it well: “Although my graduate students have taken university training re: scientific integrity, I think they learn more from my personal insistence that they do proper controls and ‘tell it like it is.’”³⁵

A close mentoring relationship also would provide an opportunity for mentors to maintain a watchful eye on trainees’ conduct of their research. This would require that a realistic ratio of trainees per mentor be established. Mentors would also pay closer attention to the work of their trainees if they were made to share responsibility for any publications based on a trainee’s research.

Finally, universities would pay greater attention to the quality of mentorship if that were made a significant factor in evaluating training grant applications. For example, the ratio of trainees to mentor should be made a measure of the quality of a program.

I recommend two publications for mentors and mentors-to-be: *Advisor, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering*, a monograph published by the National Academy of Sciences³⁶; and a report from the University of California, San Francisco, on their comprehensive mentor development program.³⁷

Acknowledging and protecting whistleblowers

Because the total prevention of research misconduct is impossible, the scientific community must depend on whistleblowers to minimize the presence and/or persistence of flawed data in the scientific literature.

Research studies have found that the fear of retaliation causes many students and faculty in the United States and abroad to refrain from reporting cases of suspected research misconduct.^{2-7,38,39} Understandably so, because an ORI study found that more than two-thirds of whistleblowers did indeed suffer adverse consequences as a result of their actions,⁴⁰ despite current Public Health Service regulations prohibiting retaliation.⁴¹

Therefore, institutional leaders must acknowledge the whistleblowers’ courage

and their gratitude for the significant contributions that whistleblowers have made to the scientific community and to their institutions’ integrity. It is also essential that institutional leaders deal with the whistleblowers’ realistic fears of retaliation. Whistleblowers should be reassured that their institutions are prepared to take swift and effective action to protect them. Increased reporting by potential whistleblowers will not occur until they are acknowledged for their contributions and convinced that they will receive truly adequate protection from retaliation.

It would be helpful if institutions also provided an experienced administrator to initially receive a whistleblower’s allegations. This individual can serve as an ombudsman with the ability and authority to resolve some problems before a formal inquiry is made.^{42,43} The ability to resolve disputes informally is essential because individuals who are ultimately exonerated of a research misconduct charge, nonetheless can suffer detrimental consequences.⁴⁴ For example, two months after the 2010 *New York Times* front page report cited earlier¹ named a scientist alleged to have committed research misconduct, the newspaper published a follow-up report on page D3 with the following headline: “Difficulties in defining errors in case against Harvard researcher.”⁴⁵ Should this scientist ultimately be exonerated, it would be impossible to fully repair the damage done to his reputation. Therefore, research institutions bear an obligation to establish a mechanism that protects the interests of all parties involved in accusations of research misconduct.

It might appear that the most effective protection for whistleblowers would be for them to remain anonymous.⁴⁶ ORI does accept anonymous allegations that are then referred for investigation to the institutions responsible for the research. However, such investigations are often hampered by the unavailability of the anonymous whistleblower to provide additional information. Some institutions have instituted compliance hotlines to receive anonymous complaints, but there are no data available on their effectiveness.

Lessons Learned

Research misconduct is the product of a combination of individual character

traits, an intense fear of failure, or the lure of academic and/or financial rewards. Character traits do not lend themselves readily to remediation, and the anxiety induced by the reality of publish or perish cannot be abolished. Therefore, to continue to expect any significant impact from RCR courses for trainees is wishful thinking. However, such courses developed specifically for support staff might prove to be effective.

I believe that there are other means to more effectively address the problem. I recommend that institutional policies be instituted to improve the quality of mentorship—e.g., establishing realistic ratios of trainees to mentors. The quality of mentoring should be made a factor in the evaluation of applications for the funding of training grants and mentors made to share responsibility for the published work of their trainees.

The contributions of whistleblowers should be appropriately acknowledged by their institutions, and meaningful protection from retaliation should be provided. Such policies would encourage more individuals to expose fraudulent research and would serve as a deterrent to others. If adopted, these policy changes will not eradicate research misconduct, which is an impossible task. However, I do believe that they can have a significant impact on its prevalence.

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