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ENGINEERING ETHICS

Concepts and Cases

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CASE 9

Fabricating Data[29]

INTRODUCTION

In recent years, the National Science Foundation (NSF), the National Institutes of Health (NIH), the Public Health Services (PHS), the Office of Scientific Integrity, and various scientific organizations such as the National Academy of Sciences have spent considerable time and effort in trying to agree on a definition of *scientific misconduct.* A good definition is needed in developing and implementing policies and regulations concerning appropriate conduct in research, particularly when federal funding is involved. This is an important area of concern because although serious scientific misconduct may be infrequent, the consequences of even a few instances can be widespread.

Those cases that reach the public's attention can cause considerable distrust among both scientists and the public, however infrequent their occurrence. Like lying in general, we may wonder which scientific reports are tainted by misconduct, even though we may be convinced that relatively few are tainted. Furthermore, scientists depend on each other's work in advancing their own. Building one's work on the incorrect or unsubstantiated data of others infects one's own research, and the chain of consequences can be quite lengthy as well as very serious. This is as true of honest or careless mistakes as it is of the intentional distortion of data, which is what *scientific misconduct* is usually restricted to. Finally, of course, the public depends on the reliable expertise of scientists in virtually every area of health, safety, and welfare.

Although exactly what the definition of scientific misconduct should include is a matter of controversy, all proposed definitions include the fabrication and falsification of data and plagiarism. As an instance of fraud, the fabrication of data is a particularly blatant form of misconduct. It lacks the subtlety of questions about interpreting data that pivot around whether the data have been "fudged" or "manipulated." Fabricating data is making it up, or *faking* it. Thus, it is a clear instance of a lie, a deliberate attempt to deceive others.

However, this does not mean that fabrications are easy to detect or handle effectively once they are detected; and this adds considerably to the mischief and harm they can cause. Two well-known cases illustrate this, both of which feature ambitious, and apparently successful, young researchers.

THE DARSEE CASE[30]

Dr. John Darsee was regarded as a brilliant student and medical researcher at the University of Notre Dame (1966–1970), Indiana University (1970–1974), Emory University (1974–1979), and Harvard University (1979–1981). He was regarded by faculty at all four institutions as a potential "all-star" with a great research future ahead of him. At Harvard, he reportedly often worked more than 90 hours a week as a research fellow in the Cardiac Research Laboratory headed by Dr. Eugene Braunwald. In less than 2 years at Harvard, he was first author of seven publications in very good scientific journals. His special area of research concerned the testing of heart drugs on dogs.

All of this came to a sudden halt in May 1981 when three colleagues in the Cardiac Research Laboratory observed Darsee labeling data recordings "24 seconds," "72 hours," "one week," and "two weeks." In reality, only minutes had transpired. Confronted by his mentor Braunwald, Darsee admitted the fabrication, but he insisted that this was the only time he had done this, and that he had been under intense pressure to complete the study quickly. Shocked, Braunwald and Darsee's immediate supervisor, Dr. Robert Kroner, spent the next several months checking other research conducted by Darsee in their lab. Darsee's research fellowships were terminated, and an offer of a faculty position was withdrawn. However, he was allowed to continue his research projects at Harvard for the next several months (during which time Braunwald and Kroner observed his work very closely).

Hopeful that this was an isolated incident, Braunwald and Kroner were shocked again in October. A comparison of results from four different laboratories in a National Heart, Lung, and Blood Institute Models Study revealed an implausibly low degree of invariability in data provided by Darsee. In short, his data looked "too good." Since these data had been submitted in April, there was strong suspicion that Darsee had been fabricating or falsifying data for some time. Subsequent investigations seemed to indicate questionable research practices dating back as far as his undergraduate days.

What were the consequences of John Darsee's misconduct? Darsee, we have seen, lost his research position at Harvard, and his offer of a faculty position was withdrawn. The NIH barred him from NIH funding or serving on NIH committees for 10 years. He left research and went into training as a critical care specialist. However, the cost to others was equally, if not more, severe. Harvard-affiliated Brigham and Women's Hospital became the first institution that NIH ever required to return funds ($122,371) because of research involving fraudulent data. Braunwald and colleagues had to spend several months investigating Darsee's research rather than simply continuing the work of the Cardiac Research Laboratory. Furthermore, they were severely criticized for carrying on their own investigation without informing NIH of their concerns until several months later. The morale and productivity of the laboratory were damaged. A cloud of suspicion hung over all the work with which Darsee was associated. Not only was Darsee's own research discredited but also, insofar as it formed an integral part of collaborative research, a cloud was thrown over published research bearing the names of authors whose work was linked with Darsee's.

The months of outside investigation also took others away from their main tasks and placed them under extreme pressure. Statistician David DeMets played a key role in the NIH investigation. Years later, he recalled the relief his team experienced when their work was completed:[31]

> For the author and the junior statistician, there was relief that the episode was finally over and we could get on with our careers, without the pressures of a highly visible misconduct investigation. It was clear early on that we had no room for error, that any mistakes would destroy the case for improbable data and severely damage our careers. Even without mistakes, being able to convince lay reviewers such as a jury using statistical arguments could still be defeating. Playing the role of the prosecuting statisticians was very demanding of our technical skills but also of our own integrity and ethical standards. Nothing could have adequately prepared us for what we experienced.

Braunwald notes some positive things that have come from the Darsee case. In addition to alerting scientists to the need for providing closer supervision of trainees and taking authorship responsibilities more seriously, the Darsee incident contributed to the development of guidelines and standards concerning research misconduct by PHS, NIH, NSF, medical associations and institutes, and universities and medical schools. However, he cautions that no protective system is able to prevent all research misconduct. In fact, he doubts that current provisions could have prevented Darsee's misconduct, although they might have resulted in earlier detection. Furthermore, he warns that good science does not thrive in an atmosphere of heavy "policing" of one another's work:[32]

> The most creative minds will not thrive in such an environment and the most promising young people might actually be deterred from embarking on a scientific career in an atmosphere of suspicion. Second only to absolute truth, science requires an atmosphere of openness, trust, and collegiality.

Given this, it seems that William F. May is right in urging the need for a closer examination of character and virtue in professional life.[33] He says that an important test of character and virtue is what we do when no one is watching. The Darsee case and Braunwald's reflections seem to confirm this.

Many who are caught having engaged in scientific misconduct plead that they were under extreme pressure, needing to complete their research in order to meet the expectations of their lab supervisor, to meet a grant deadline, to get an article published, or to survive in the increasingly competitive world of scientific research. Although the immediate stakes are different, students sometimes echo related concerns: "I knew how the experiment should have turned out, and I needed to support the right answer"; "I needed to get a good grade"; "I didn't have time to do it right; there's so much pressure." Often these thoughts are accompanied by another—namely that this is only a classroom exercise and that, of course, one will not fabricate data when one becomes a scientist and these pressures are absent. What the Darsee case illustrates is that it is naive to assume such pressures will vanish. Therefore, the time to begin dealing with the ethical challenges they pose is now, not later (when the stakes may be even higher).

THE BRUENING CASE[34]

In December 1983, Dr. Robert Sprague wrote an 8-page letter, with 44 pages of appendices, to the National Institute of Mental Health documenting the fraudulent research of Dr. Stephen Breuning.[35] Breuning fabricated data concerning the effects psychotropic medication has on mentally retarded patients. Despite Breuning's admission of fabricating data only 3 months after Sprague sent his letter, the case was not finally resolved until July 1989. During that 5½-year interval, Sprague was a target of investigation (in fact, he was the first target of investigation), he had his own research endeavors severely curtailed, he was subjected to threats of lawsuits, and he had to testify before a U.S. House of Representatives committee. Most painful of all, Sprague's wife died in 1986 after a lengthy bout with diabetes. In fact, his wife's serious illness was one of the major factors prompting his "whistleblowing" to NIH. Realizing how dependent his diabetic wife was on reliable research and medication, Sprague was particularly sensitive to the dependency that the mentally retarded, clearly a vulnerable population, have on the trustworthiness of not only their caregivers but also those who use them in experimental drug research.

Writing 9 years after the closing of the Bruening case, Sprague obviously has vivid memories of the painful experiences he endured and of the potential harms to participants in Bruening's studies. However, he closes the account of his own experiences by reminding us of other victims of Bruening's misconduct—namely psychologists and other researchers who collaborated with Bruening without being aware that he had fabricated data.

Dr. Alan Poling, one of those psychologists, writes about the consequences of Bruening's misconduct for his collaborators in research. Strikingly, Poling points out that between 1979 and 1983, Bruening was a contributor to 34 percent of all published research on the psychopharmacology of mentally retarded people. For those not involved in the research, initial doubts may, however unfairly, be cast on all these publications. For those involved in the research, efforts need to be made in each case to determine to what extent, if any, the validity of the research was affected by Bruening's role in the study. Even though Bruening was the only researcher to fabricate data, his role could contaminate an entire study. In fact, however, not all of Bruening's research did involve fabrication. Yet, convincing others of this is a time-consuming, demanding task. Finally, those who cited Bruening's publications in their own work may also suffer "guilt by association." As Poling points out, this is especially unfair in those instances in which Bruening collaborations with others involved no fraud at all.

THE ISSUES

The Darsee and Bruening cases raise a host of ethical questions about the nature and consequences of scientific fraud:

- What kinds of reasons are offered for fabricating data?
- Which, if any, of those reasons are *good* reasons—that is, reasons that might *justify* fabricating data?
- Who is likely to be harmed by fabricating data? Does actual harm have to occur in order for fabrication to be ethically wrong?
- What responsibilities does a scientist or engineer have for checking the trustworthiness of the work of other scientists or engineers?
- What should a scientist or engineer do if he or she has reason to believe that another scientist or engineer has fabricated data?
- Why is honesty in research important to the scientific and engineering communities?
- Why is honesty in research important for the public?
- What might be done to diminish the likelihood that research fraud occurs?

READINGS

For readings on scientific integrity, including sections on the fabrication of data and a definition of scientific misconduct, see Nicholas Steneck, *ORI Introduction to Responsible Conduct in Research* (Washington, DC: Office of Research Integrity, 2004); *Integrity and Misconduct in Research* (Washington, DC: U.S.

Department of Health and Human Services, 1995); *On Being a Scientist,* 2nd ed. (Washington, DC: National Academy Press, 1995); and *Honor in Science* (Research Triangle Park, NC: Sigma Xi, The Scientific Research Society, 1991).

CASE 10

Gilbane Gold

The fictional case study presented in the popular videotape *Gilbane Gold* focuses on David Jackson, a young engineer in the environmental affairs department of ZCORP, located in the city of Gilbane.[36] The firm, which manufactures computer parts, discharges lead and arsenic into the sanitary sewer of the city. The city has a lucrative business in processing the sludge into fertilizer, which is used by farmers in the area.

To protect its valuable product, Gilbane Gold, from contamination by toxic discharges from the new high-tech industries, the city has imposed highly restrictive regulations on the amount of arsenic and lead that can be discharged into the sanitary sewer system. However, recent tests indicate that ZCORP may be violating the standards. David believes that ZCORP must invest more money in pollution-control equipment, but management believes the costs will be prohibitive.

David faces a conflict situation that can be characterized by the convergence of four important moral claims. First, David has an obligation as a good employee to promote the interests of his company. He should not take actions that unnecessarily cost the company money or damage its reputation. Second, David has an obligation—based on his personal integrity, his professional integrity as an engineer, and his special role as environmental engineer—to be honest with the city in reporting data on the discharge of the heavy metals. Third, David has an obligation as an engineer to protect the health of the public. Fourth, David has a right, if not an obligation, to protect and promote his own career.

The problem David faces is this: How can he do justice to all of these claims? If they are all morally legitimate, he should try to honor all of them, and yet they appear to conflict in the situation. David's first option should be to attempt to find a creative middle way solution, despite the fact that the claims appear to be incompatible in the situation. What are some of the creative middle way possibilities?[37]

One possibility would be to find a cheap technical way to eliminate the heavy metals. Unfortunately, the video does not directly address this possibility. It begins in the midst of a crisis at ZCORP and focuses almost exclusively on the question of whether David Jackson should blow the whistle on his reluctant company. For a detailed exploration of some creative middle way alternatives, see Michael Pritchard and Mark Holtzapple, "Responsible Engineering: *Gilbane Gold* Revisited," *Science and Engineering,* 3, no. 2, April 1997, pp. 217–231.

Another avenue to explore in *Gilbane Gold* is the attitudes toward responsibility exhibited by the various characters in the story. Prominent, for example, are David Jackson, Phil Port, Diane Collins, Tom Richards, Frank Seeders, and Winslow Massin. Look at the transcript (available at www.niee.org/pd.cfm?pt=Murdough). What important similarities and differences do you find?

CASE 11

Green Power?[38]

The growing consensus among scientists that carbon emissions are contributing to global warming is also beginning to have a significant impact on local energy policies and projects. For example, Fort Collins, Colorado, has a Climate Wise energy program to go with its official motto, "Where renewal is a way of life." Local reduction of carbon emissions is one of the city's global aims.