What is Misconduct in Science?
Author(s): Howard K. Schachman
Source: *Science*, New Series, Vol. 261, No. 5118 (Jul. 9, 1993), pp. 148-149+183
Published by: American Association for the Advancement of Science
Stable URL: https://www.jstor.org/stable/2881792
Accessed: 07-05-2020 14:35 UTC

What Is Misconduct in Science?

Howard K. Schachman

Answering the question posed in the title depends on one's perspective. One could focus on collegial behavior in an academic setting. In that case the discussion would be far-ranging and might include attempts to formulate ethical principles and guidelines for the conduct of research. It would examine complex problems involving the sharing of data and unusual materials, as well as authorship and publication practices. It would certainly include condemnation of egregious actions such as plagiarism and the fabrication and falsification of data and results. From such an examination one could formulate a definition of misconduct in science that would form the basis for governmental action leading potentially to debarment from federal support. Such a sanction, in effect, could lead to the termination of a career in science. For such an outcome a precise, rigorous, and unambiguous definition of misconduct in science is essential. Governmental oversight over the expenditure of taxpayers' money is legally mandated and clearly proper. It is obligatory for the National Science Foundation (NSF) and National Institutes of Health (NIH) to investigate allegations of fraudulent acts and to impose sanctions when guilt is demonstrated. In contrast, it is inappropriate, wasteful, and likely to be destructive to science for government agencies to delve into the styles of scientists and their behavioral patterns.

The definitions of misconduct in science currently used by governmental agencies unfortunately intermix these two different aims (*1*). In defining misconduct as fabrication, falsification, and plagiarism, NSF and NIH also include an open-ended phrase to encompass "other serious deviation from accepted practices in proposing, carrying out and reporting results." Because these definitions are overly broad and vague, it is appropriate to examine the history of congressional investigations of fraud in research and to consider a definition that is consistent with and responsive to the intent of Congress in establishing oversight of federal funds for scientific research.

Many scientists, like others in our society, are ambitious, self-serving, opportunistic, selfish, competitive, contentious, aggressive, and arrogant; but that does not mean they are crooks. It is essential to distinguish between research fraud on the one hand and irritating and careless behavioral patterns of scientists, no matter how objectionable, on the other. We must distinguish between the crooks and the jerks (*2*). For the former we need (i) governmental oversight, (ii) a clear definition of those acts that are proscribed, (iii) adjudicatory machinery, (iv) due process, (v) protection of whistle-blowers, (vi) strong sanctions for the guilty, and (vii) full disclosure of conclusions in order to minimize repetition in other institutions. In contrast, such governmental intervention is inappropriate for concerns regarding errors in collecting and interpreting data, incompetence, poor laboratory procedures, selection of data, authorship practices, and multiple publications. These are matters for explicit dialog and education in universities and research institutions.

If we are to avoid the imposition of guidelines, rules, and regulations that may impede scientific research, it is essential to limit governmental action to fraud in science. A definition of misconduct in science that recognizes the dichotomy of roles and the need to "render, therefore, unto Caesar the things which are Caesar's . . ." will reduce the tension now existing between working scientists and government officials.

How "Fraud in Science" Became "Misconduct in Science"

In 1981 a subcommittee of Congress, under the chairmanship of Congressman Albert Gore, Jr., held hearings on fraud in biomedical research (*3*) in response to widespread reports of scientists falsifying their data. The cases cited dealt with fraud and plagiarism. One witness described how he falsified results of experiments that had not been performed. Another case, as described by the chairman, involved a researcher who "became entangled in a network of fraud and plagiarism, and a possible cover-up." Throughout these hearings the focus was on fabrication, falsification, and plagiarism.

When Congress passed the Health Research Extension Act in 1985, the legislation directed the secretary of the Department of Health and Human Services to

> require institutional applicants for NIH funds to review reports of fraud and report to the Secretary any investigation of suspected fraud which appears substantial.

The language focused on fraud, and the director of NIH was required to establish "a process for the prompt and appropriate response to information provided the Director . . . respecting scientific fraud."

Several years later, following increasing media coverage of several notorious cases of fabrication and falsification of data, the language was altered significantly when the Public Health Service (PHS) issued a proposed rule (*4*) entitled "Responsibilities of PHS Awardee and Applicant Institutions for Dealing with and Reporting Possible Misconduct in Science." In that proposed rule, "misconduct in science" was defined as

> (i) fabrication, falsification, plagiarism, deception or other practices that seriously deviate from those that are commonly accepted within the scientific community for proposing, conducting or reporting research; or (ii) material failure to comply with Federal requirements that uniquely relate to the conduct of research.

Meanwhile, NSF issued final regulations under the title "Misconduct in Science and Engineering Education" that defined misconduct and also provided a safeguard for reprisals against whistle-blowers (*5*).

It was this transition from "fraud in science" to "misconduct in science" that led to apprehension among scientists. Some of the actions described in congressional hearings are labeled appropriately as fraud. Faking data is fraudulent. So is falsifying data. There is little confusion over the meaning of fraud. In contrast, "misconduct in science" means different things to different people. The change to "misconduct" instead of "fraud" was initiated and effected by lawyers and not by scientists. It was because of the legal burden of having to prove intent and injury to persons relying on fraudulent research that counsels for NSF and PHS wanted the change to misconduct (*6*). My concern is over vagueness of the term "misconduct in science" and how people with different orientations interpret various alleged abuses.

In formulations of the term "misconduct in science" there is agreement on fabrication, falsification, and plagiarism. Scientists have emphasized that "misconduct in science" does not include factors intrinsic to the process of science, such as error, conflicts in data, or differences in interpretation or judgments of data or experimental design (*7*). Particularly bothersome was inclusion of the phrase

> other practices that seriously deviate from those that are commonly accepted within the scientific community for proposing, conducting or reporting research.

Not only is this language vague but it invites over-expansive interpretation. Also, its inclusion could discourage unor-

The author is in the Department of Molecular and Cell Biology, W. M. Stanley Hall, University of California, Berkeley, CA 94720.

thodox, highly innovative approaches that lead to major advances in science. Brilliant, creative, pioneering research often deviates from that commonly accepted within the scientific community.

My apprehension over this open-ended, vague section of the definition is best illustrated by a case cited by the Office of Inspector General (OIG) of the NSF (*8*):

In November 1989, OIG received allegations of misconduct against the researcher. Our investigation involved conducting extensive interviews and collecting affidavits. . . .

OIG determined that the researcher had been involved in 16 incidents of sexual misfeasance with female graduate and undergraduate students at the research site; on the way to the site; and in his home, car, and office. Many of these incidents were classifiable as sexual assaults. OIG further determined that these incidents were an integral part of this individual's performance as a researcher and research mentor and represented a serious deviation from accepted research practices. Therefore, they amounted to research misconduct under NSF regulations.

This is a preposterous and appalling application of the definition of scientific misconduct. The individual involved in this case, assuming the allegations were proven, should have been terminated by his institution for moral turpitude and the grant canceled accordingly. All of the grant funds should have been returned to the government by the institution that employed the individual. This case is an example of misconduct for which institutional and legal sanctions should have been imposed. But it is not misconduct in science. Having read the investigative report on this case, I am convinced that charges of sexual harassment as well as sexual abuse should have been filed. Buzzelli (*1*), however, reached an opposite conclusion, stating that "This case was not essentially a sexual harassment case, but sexual offenses were obviously at the heart of it. . . ."

Defining Misconduct in Science

In 1992 a panel convened by the National Academy of Sciences (NAS), National Academy of Engineering, and the Institute of Medicine released a report (*9*) that defined misconduct in science as

fabrication, falsification, or plagiarism, in proposing, performing, or reporting research. Misconduct in science does not include errors of judgment; errors in the recording, selection, or analysis of data; differences in opinions involving the interpretation of data; or misconduct unrelated to the research process.

Fabrication is making up data or results. Falsification is changing data or results. Whereas plagiarism is described in the report as "using the ideas or words of another person without giving appropriate credit," Webster's *Seventh New Collegiate Dictionary* defines "plagiarize" as follows: "to steal and pass off as one's own (the ideas or words of another); to present as one's own an idea or product derived from an existing source." Because of the increasing focus on "intellectual property" in recent years, plagiarism is best defined as "misappropriation of intellectual property." Defined in this way, plagiarism not only encompasses those cases in which sentences or phrases are used without attribution but also includes unauthorized use of ideas, data, and interpretations obtained during the course of the grant review process or the review of scientific papers being considered for publication (*10*).

It is fabrication, falsification, and plagiarism that attracted the attention of the congressional committees, chaired by former Congressman Gore, Congressman John Dingell, and the late Congressman Ted Weiss (*11*). In the two most publicized cases that have dominated news disparaging the scientific community in the past few years, the initial charges were focused on these matters. Was the virus misappropriated? If so, a verdict of misconduct in science is correct. In the other case, it is important to know whether the experiments were done. If they were not, a verdict of misconduct is appropriate. One need not have a vague, open-ended phrase in the definition to adjudicate these cases. Reaching a verdict on grounds of fabrication, falsification, or plagiarism is difficult enough; there is no need to make the adjudication even more complex by considering spurious or vague charges as well.

Risks of an Open-Ended Definition

Those who advocate the desirability of the clause "other serious deviation" have presented a variety of scenarios (*1*). One is tampering with research experiments. This, like sabotaging experiments and destroying animal quarters, is covered by other statutes and is, and should be, subject to sanctions. But we must face the fact that NSF could not impose sanctions on an individual who does not have an NSF grant even though that person tampers with or sabotages an experiment of an individual supported by NSF. Clearly, including such cases as misconduct in science leads to a morass. These are problems for local institutions and statutes dealing with vandalism. Invoking the "seriously deviates" clause to impose sanctions for such actions and labeling them misconduct in science is a great mistake (*12*).

Other examples, such as misrepresentations of one's qualifications and achievements in a grant application, are covered by falsification. The clause "seriously deviates" is also applied to reviewers of grant proposals who violate confidentiality and use materials in the proposals for their own purposes. This doubtless happens, and the cases should be investigated. If guilt is established, sanctions should be imposed. But one does not need an open-ended, vague, unclear phrase in the definition to encompass such egregious behavior. It is amply described as misappropriation of intellectual property and, therefore, encompassed in the definition as plagiarism.

The inclusion of ambiguous terms in the definition of misconduct in science potentially breaches an important principle of due process, the right to know in advance those activities that are proscribed. This principle is certainly violated by the view that ". . . you have to have a definition that covers situations that you can't even now conceive of" (*13*).

Although the word "misconduct" is now used in order to avoid legal ramifications of the word "fraud," it is nonetheless important to retain the original intent of Congress to focus on the role of government in investigating misconduct in science that is equivalent to "fraud which appears substantial." It is encouraging that the PHS Advisory Committee on Scientific Integrity has recently recommended a major change in the definition of misconduct in science now being used by the Office of Research Integrity. This proposal eliminates the phrase "other practices that seriously deviate from those that are commonly accepted within the scientific community" and moves closer to that proposed by the NAS panel (*9*, *14*). Also, the PHS will no longer list in its ALERT system those individuals under investigation. This terrible practice of including names of individuals under investigation for misconduct in science has been abandoned; now names will be listed only if a finding of guilty has been reached. History is full of examples of governmental promulgations of laws expressed in broad, open-ended terms that were elastic enough to be stretched to cover any individual action that irritated some officials. In this century alone it was a major offense in some countries to publish scientific papers that seriously deviated from accepted practice. The enforcement of such strictures virtually destroyed major areas of science in those countries. We should not expose science in this country to similar risks.

(*Continued on page 183*)

valid for an ω^{-3} model [F. A. Dahlen, *Bull. Seismol. Soc. Am.* **64**, 1159 (1974); K. Aki and P. G. Richards, *Quantitative Seismology* (Freeman, San Francisco, 1980), vol. 2, chap. 14]. A small value of $\Delta\dot{u}$ implies that the rise time of the slow precursor must be anomalously long.

33. T. Shimamoto and J. Logan, in *Earthquake Source Mechanics*, S. Das, J. Boatwright, C. Scholz, Eds., vol. 37 of *Geophysical Monographs* (American Geophysical Union, Washington, DC, 1986), pp. 49–63.
34. M. L. Blanpied, T. E. Tullis, J. D. Weeks, *Geophys. Res. Lett.* **14**, 554 (1987).
35. B. D. Kilgore, M. L. Banpied, J. H. Dieterich, *ibid.*, in press.
36. L. A. Reinen, J. D. Weeks, T. E. Tullis, *ibid.* **18**, 1921 (1991); L. A. Reinen, T. E. Tullis, J. D. Weeks, *ibid.* **19**, 1535 (1992).
37. J. Park, *ibid.* **17**, 1005 (1990). Park observed radial mode with amplitudes significantly higher than expected for a pure strike-slip mechanism; he found that although the radial overtones ${}_1S_0$ to ${}_5S_0$ could plausibly be explained by mode coupling, the fundamental mode ${}_0S_0$ could not. He therefore postulated the existence of a dip-slip or isotropic component with a moment of $\sim 1 \times 10^{20}$ Nm centered at 110 ± 50 s before the high-frequency origin time.
38. S. Kedar and T. Tanimoto (personal communication, 1993) have observed amplitude and phase anomalies of certain low-frequency spheriodal modes (${}_0S_4$, ${}_0S_6$, ${}_0S_9$, ${}_5S_3$, and ${}_1S_8$) that are consistent with the existence of a slow precursor.
39. We thank S. Kedar for pointing out the importance of the high-gain CTAO record in constraining the smoothness of the slow precursor and for useful discussions about directivity effects. We are also grateful to P. Puster for providing the synthetic seismograms used to assess the effects of mode coupling, C. Marone for insights about source mechanics, and J. Park and G. Ekström for helpful reviews. This research was sponsored by the National Science Foundation under grant EAR-9018690 and the National Aeronautics and Space Administration under grant NAG5-1905. P.F.I. was partially supported by grants from the Huber-Kudlich Stiftung and Sunburst Fonds.

17 March 1993; accepted 1 June 1993

(*Continued from page 149*)

REFERENCES AND NOTES

1. D. E. Buzzelli, *Science* **259**, 584 (1993).
2. C. K. Gunsalus, paper presented at the annual meeting of the American Association for the Advancement of Science, Chicago, IL, 6 February 1992, Symposium on Integrity and Misconduct in Science.
3. Hearings before the Subcommittee on Investigations and Oversight of the Committee on Science and Technology, U.S. House of Representatives, 97th Congress, 31 March to 1 April 1981.
4. Section 493 of the amended Public Health Service Act constitutes the Enabling Act requiring the secretary of Health and Human Services to issue regulations requiring investigation of "alleged scientific fraud which appears substantial." This language is especially significant in terms of the wide variety of misdeeds now subject to investigation and imposition of sanctions by NSF and NIH. K. D. Hansen and B. C. Hansen [*FASEB J.* **5**, 2512 (1991)], in their critical analysis of "Scientific Fraud and the Public Health Service Act," emphasized that the amendment is clear on its face but there has been a tendency by the agencies to greatly expand the authority granted.
5. The current NSF definition of misconduct in science is: (i) fabrication, falsification, plagiarism, or other serious deviation from accepted practices in proposing, carrying out, or reporting results from activities funded by NSF or (ii) retaliation of any kind against a person who reported or provided information about suspected or alleged misconduct and who has not acted in bad faith (45 C.F.R. §689).
6. R. M. Anderson, *Select Legal Provisions Regulating Scientific Misconduct in Federally Supported Research Papers* (AAAS–American Bar Association National Conference of Lawyers and Scientists Project on Scientific Fraud and Misconduct, Report on Workshop Number Three, American Association for the Advancement of Science, Washington, DC, 1989).
7. Testimony by H. K. Schachman before the Subcommittee on Investigations and Oversight of the Committee on Science, Space, and Technology, U.S. House of Representatives, 101st Congress, 28 June 1989.
8. Semiannual Report of the Office of Inspector General of the National Science Foundation, 1 April to 30 September 1990.
9. *Responsible Science: Ensuring the Integrity of the Research Process* (National Academy Press, Washington, DC, 1992), vol. 1.
10. Many of the cases of misconduct in science are described as plagiarism (First Annual Report of Scientific Misconduct Investigations Reviewed by Office of Scientific Integrity Review, March 1989 to December 1990, of the Public Health Service; Semiannual Report of the Office of Inspector General of the National Science Foundation, No. 6, 1 October 1991 to 31 March 1992, and No. 7, 1 April 1992 to 30 September 1992). A definition of plagiarism as misappropriation of intellectual property would suffice for adjudicating the case at Michigan State University reported by E. Marshall [*Science* **259**, 592 (1993)]. Based on the findings described by the independent panel (as reported in *Science*), the verdict of misconduct of science should have been attributed to plagiarism. There is no need to invoke the clause "a serious deviation from accepted practices."
11. In addition to the hearings in (*3*), a subcommittee of the Committee on Government Operations, House of Representatives, 100th Congress, held hearings on 11 and 12 April 1988 dealing with "Scientific Fraud and Misconduct and the Federal Response" under the chairmanship of the late Congressman Ted Weiss. On 12 April 1988, a hearing on "Fraud in NIH Grant Programs" was held by the Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce, House of Representatives, 100th Congress, under the chairmanship of Congressman John D. Dingell. The Subcommittee on Human Resources and Intergovernmental Relations of the Committee on Government Operations of the U.S. House of Representatives, 100th Congress, held hearings on 29 September 1989, entitled "Federal Response to Misconduct in Science: Are Conflicts of Interest Hazardous to Our Health?" "Scientific Fraud" was the title of hearings of the Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce of the U.S. House of Representatives, 101st Congress, 4 to 9 May 1989 and 30 April and 14 May 1990.
12. One might wonder whether a scientist who uses NSF funds to employ an illegal alien as a technician will be guilty of misconduct in science rather than of violating immigration and, perhaps, tax laws.
13. D. P. Hamilton, *Science* **255**, 1345 (1992).
14. Eliminating this open-ended part of the definition will reduce the burdens on governmental officials, thereby facilitating their concentration on fraud of a substantial nature. Already the staff at ORI numbers about 50 people with an annual budget of $5 million.
15. This paper was presented in part at the 6th Annual Symposium of the Protein Society, San Diego, CA, 28 July 1992, and at the Sigma Xi Forum, "Ethics, Values, and the Promise of Science," San Francisco, CA, 25 to 26 February 1993.