The Definition of Misconduct in Science: A View from NSF

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In April 1992, a panel convened by the National Academy of Sciences issued its report on misconduct in science (*1*). At the end of its analysis, the report made 12 recommendations. Perhaps the most controversial of these recommendations concern the definition of misconduct that research institutions and government agencies should use when they deal with misconduct allegations. Since April, a number of science-related federal bodies and professional societies have been asked to endorse the report's recommendations. Funding agencies like the National Science Foundation (NSF) have been asked to adopt and implement them, especially the recommendations about the definition.

Some of these agencies, including NSF, already had considerable experience in handling misconduct cases. Because the Academy panel did not consult NSF about the definition, officials who work every day on misconduct cases as I do did not have the opportunity to contribute their thoughts and experience. Existing definitions can always be improved, and the report contains some useful ideas in this direction. Nevertheless, the changes the panel proposed in the definition are not helpful and in fact would hamper the ability of research institutions and federal agencies to deal with important cases of misconduct in science. Here, I will discuss the panel's recommendations. I will also try to explain NSF's definition and show how it was applied to an important and controversial case.

The Panel's Recommendation

The panel unanimously recommended the removal of "ambiguous language such as the category 'other serious deviations from accepted research practices' currently included in regulatory definitions adopted by the Public Health Service and the National Science Foundation" (*2*). With less unanimity, it adopted a definition limited to "fabrication, falsification, or plagiarism, in proposing, performing, or reporting research" (*1*, p. 27). In other words, it proposed that nothing should replace the "other serious deviation" phrase (*3*). Finally, it recommended that research institutions and government agencies adopt a single, consistent definition of misconduct in science "based on" fabrication, falsification, and plagiarism (*1*, p. 147).

The panel's reason for proposing removal of the "other serious deviation" phrase was that (*1*, p. 27)

> the vagueness of this category has led to confusion about which actions constitute misconduct in science. In particular, the panel wishes to discourage the possibility that a misconduct complaint could be lodged against scientists based solely on their use of novel or unorthodox research methods.

Below, I will give some reasons for retaining language like "other serious deviation" in the definition of misconduct in science. The report gives no examples to show that confusion has occurred under the NSF definition in an actual case or that any scientists have been accused of misconduct under agency regulations because they were creative or unorthodox. The suggestion that NSF would bring such a case shows no understanding of NSF or of its misconduct procedures. The report does mention two cases in which NSF allegedly misused the "other serious deviation" phrase in a different way, by treating other kinds of misconduct as misconduct in science. These cases seem to be used as additional reasons for removing the "other serious deviation" phrase from the definition. I will take them up after discussing NSF's misconduct cases in general.

NSF's Misconduct Cases

NSF handles allegations of misconduct in science under regulations published in July 1987 and revised in May 1991. The Office of Inspector General (OIG) receives all cases that come to NSF's attention. Program officers are not informed of misconduct allegations that have been made against applicants for funding, and they may not take such allegations into consideration when processing proposals. If a case seems to require a full, formal investigation, OIG will usually allow the institution that employs the accused party to do it. The institution may make a finding of misconduct and impose its own sanction. OIG may accept the institution's investigation in lieu of an OIG investigation, may supplement the institution's investigation, or may even conduct a full investigation itself.

If OIG decides that a case seems to warrant a finding of misconduct and a sanction by NSF, it makes that recommendation to the deputy director of NSF. The deputy director arranges a hearing, if appropriate, and makes the adjudication. OIG investigates cases but cannot make findings of misconduct on behalf of NSF or impose sanctions. This is one of the protections that NSF regulations offer against abusive cases, such as the punishment of creative and unorthodox research as misconduct.

OIG was established in early 1989, so that it has over 3 years of experience in handling misconduct cases. Some numbers can be given to illustrate the case load, the types of cases received, and their resolution, but these numbers have little statistical value (*4*). From the formation of OIG in early 1989 to the end of June 1992, OIG added 124 (*5*) cases to its misconduct files. The number of cases rose rapidly at first but seems to be settling down to about 50 per year. Of the 124, approximately 70 have to do with intellectual property: plagiarism, theft of research ideas, or failure to give credit. One reason why there are so many cases of this type is that NSF program officers sometimes receive misconduct complaints from proposal reviewers and pass them on to OIG. Reviewers are especially likely to notice intellectual property problems. Although most of the misconduct cases that have received media attention involve the fabrication or misrepresentation of data, only about ten of NSF's cases are of this kind.

As of the end of July 1992, 67 of these 124 cases had been closed. Most of these were resolved without a formal investigation and did not lead to a formal finding of misconduct or a sanction. In some cases, preliminary inquiry showed that the allegation was not really about misconduct in science or that the offense that occurred was trivial. For example, a case involving a very small amount of plagiarism in a proposal may be resolved by OIG's clarifying what happened and having the applicant send a corrected proposal to NSF. In other cases, there was too little evidence to justify a full investigation or it was found that no NSF proposal or award was involved so that NSF had no jurisdiction in the matter.

Among the 67 closed cases, there were 8 in which NSF had jurisdiction and in which the university involved performed a formal investigation. Some of these cases began at the university, which then notified NSF. Others were sent to the university by NSF or another agency. Three of these investigations led to findings of misconduct by the institution, and all three were serious pla-

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giarism cases. In a fourth case, involving data falsification, OIG disagreed with the university's finding of no misconduct but did not pursue the matter because the subject of the investigation was a foreign citizen who had permanently left the country and was not likely to apply for federal grant funds in the future. Two major cases were investigated by OIG itself without a university investigation. One case came under the "other serious deviation" provision of the definition and is discussed below; the other involved possible noncompliance with guidelines for recombinant DNA research.

OIG has sent four cases to the Office of the Director of NSF with the recommendation that NSF make its own finding of misconduct and impose its own sanction. One was the "other serious deviation" case and the other three were plagiarism cases that had been investigated at universities. In all four cases, OIG recommended that the individual be debarred from receiving federal or NSF funds for a period of time. The director's office accepted the OIG recommendations, and the cases were resolved by debarment or voluntary agreements equivalent to debarment (6).

The Major "Other Serious Deviation" Case

Most of NSF's major cases have involved plagiarism, but one involved an "other serious deviation from accepted practices." This case deserves full discussion here because it illustrates the need for such a phrase in the definition of misconduct in science and also because the Academy report discusses it in a misleading way.

In late 1989, OIG began receiving complaints from women who had served as graduate teaching assistants in a field research project that had NSF funding. The complaints were against a senior researcher who had been taking teams of undergraduate students to a remote site in southern Mexico as part of a project in which they would observe and report on the behavior of a colony of primates. The project was supported by grants from NSF's Research Experiences for Undergraduates program. This program is intended to give active research experiences to undergraduate students, so that talented students can be attracted to research careers. The program especially tries to increase the participation of women in research.

In carrying out this project, the senior researcher was accused of a range of coercive sexual offenses against various female undergraduate students and teaching assistants, up to and including rape. These offenses occurred at and near the research site, in a private vehicle on the way to the site, and in the researcher's office, home, and car in the United States. He rationed out access to the research data and the computer on which they were stored and analyzed, as well as his own assistance, so that they were more available to those students who accepted his advances. He was also accused of threatening to blackball some of the graduate students in the professional community and to damage their careers if they reported his activities. For various reasons, this case has not been prosecuted under criminal or civil rights statutes.

OIG investigated the case itself instead of sending it to the subject's university because the university was not the grantee institution and had no involvement in the NSF grants under which this project was done. The grantee institution was a very small nonprofit institution that did not have professional staff members who were sufficiently distant from these grants and who had the expertise to conduct a difficult investigation that still had criminal implications. In any case, the researcher was no longer employed there.

The OIG investigation accumulated convincing evidence that the accusations were correct and that the subject showed a pattern of such behavior. OIG sent an investigation report to the Office of the Director of NSF with the recommendation that the subject be debarred from receiving any federal grant funds for 3 years. The case was also presented to other senior NSF management and to key members of the National Science Board, and all concurred in OIG's evaluation of it. The director's office raised the recommended term of debarment to 5 years and proposed that term to the subject. After negotiation, the subject waived his right to a hearing and agreed to a 5-year exclusion from federal support.

This was a genuine instance of misconduct in science. This case illustrates a "serious deviation from accepted practices" that is not falsification, fabrication, or plagiarism. The subject was never accused of any of those offenses. In fact, he was not accused of any kind of deception to a significant degree. For some, the only type of activity over and above falsification, fabrication, and plagiarism that might be considered misconduct in science would be some other kind of misrepresentation or deception (7). I will discuss the view the Academy panel took of the case and then I will try to explain why NSF acted as it did.

The Academy report maintains that this case was not misconduct in science but was rather what it calls "other misconduct" (1, pp. 82–83 and 86). The panel did not address the specifics of this case and perhaps did not know them (8). Instead, it treated the case as a generic instance of "sexual harassment" and argued in general that such cases are not misconduct in science. According to the report, sexual harassment is not misconduct in science because it is "not unique to the conduct of science, although [it] may occur in a laboratory or research environment." Rather, it is "subject to generally applicable legal and social penalties" and "should be handled by officials designated to implement personnel or equal opportunity regulations" (1, p. 29). Furthermore, the report continued, sexual harassment, sexual assault, and professional intimidation are not misconduct in science because they "do not require expert knowledge to resolve complaints" (1, p. 86; 9).

These general arguments have little validity. This case was not essentially a sexual harassment case, but sexual offenses were obviously at the heart of it. Such offenses can be misconduct in science, even though they are "not unique to the conduct of science." Plagiarism is also not unique to science, but it is universally regarded as misconduct in science when it occurs in a scientific setting. Similarly, the fact that there are other laws and regulations against sexual offenses would not always keep them from being misconduct in science: Even if laws were passed against fabricating data, the fabrication of data would still be misconduct in science. With regard to "expert knowledge," the amount required varies considerably from case to case. Thus, the need for expert knowledge in the resolution of misconduct cases is not a useful criterion for what is or is not misconduct in science.

Furthermore, the panel did not consider that NSF had to move to debar the subject. The government could not continue to be in the position of providing the funds and the opportunity for these activities. Even if this case had gone to court, NSF could not expect the courts or anyone else to protect the integrity of federal research funds. NSF had to do this itself, and only the misconduct regulation makes debarment possible in a case like this. Neither "personnel or equal opportunity regulations" nor "generally applicable legal and social penalties" are adequate to safeguard the integrity of federal funds.

The special features of this case distinguish it from a common sexual harassment case. The subject used his position as a research director and mentor to create opportunities to make impermissible sexual demands and even assaults on his students and teaching assistants. The students had to submit to these demands and assaults as a condition of receiving his services as a mentor. They were particularly dependent on him not only because he gave the final grades, but also because he was the only faculty member present at the isolated re-

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search site and the other places where these events occurred. These demands and assaults, plus the professional blackmail mentioned earlier, were an integral part of the subject's performance as a research mentor and director and ethically compromised that performance. Hence, they seriously deviated from the practices accepted in the scientific community.

I have argued that certain actions are misconduct in science whether or not they are subject to other penalties and whether or not they are unique to the conduct of science. I would suggest that the appropriate criterion should be whether those actions tend to do serious harm to science. The Academy report makes a similar point: The distinguishing mark of misconduct in science, as opposed to other offenses, is that such actions "directly damage the integrity of the research process" (*1*, p. 28). The research process includes "the training and supervision of associates and students" (*1*, p. 18).

These considerations further help to explain NSF's treatment of this case. NSF would not treat a common sexual offense as misconduct in science, even if it occurred in a research setting. However, mentorship is an integral part of science, and science can be harmed by other actions besides issuing false data or stealing credit from one's peers: Science is harmed when students in a Research Experiences for Undergraduates project are taught to advance themselves by submitting to a research director's sexual demands.

OIG did not anticipate, much less seek, a case of this kind. There may be no case quite like it in the future. The important thing is that government agencies must not adopt a definition that is limited to the common run of cases so that they prevent themselves in advance from being able to deal with unexpected cases like this one. NSF's definition is "open-ended" for this reason.

Other Examples of "Other Serious Deviation"

Many allegations that come to OIG are about actions that do not fall under falsification, fabrication, or plagiarism. Except for the case just discussed, none of these cases has gone through the full process of investigation and adjudication. Hence, neither OIG nor NSF as a whole has made a decision that actions of these kinds would be genuine "other serious deviations." Still, among the cases OIG has received there are some strong candidates that deserve discussion. These examples again illustrate the need for a definition that goes beyond fabrication, falsification, and plagiarism.

One example of such a case involves tampering with research experiments. This would be another kind of misconduct in science that does not have to involve deception. The Academy panel criticized OIG for considering a case of this kind as misconduct in science. It reasoned that tampering is "other misconduct" rather than misconduct in science. Tampering, the report stated, is a form of vandalism or destruction of property, which again is not unique to the conduct of science and is subject to generally applicable legal and social penalties (*1*, p. 29, and p. 34, note 20).

There is actually a range of offenses that may fall under tampering. In some instances, tampering may consist of making adjustments to a colleague's experiment without that person's knowledge, so that bad data are obtained. It is difficult to see why falsifying one's own data is misconduct in science but falsifying a colleague's data is not. In other cases, the colleague's entire apparatus may be destroyed and removed. This clearly is vandalism, but arguably there would be enough harm to research in such a situation to justify opening a case of misconduct in science. The normal penalties for vandalism would not protect the integrity of federal research funds. Similarly, a colleague's cultures may be maliciously destroyed without the destruction of any equipment. This often could not be prosecuted as vandalism, but again I think scientists would agree that it violates ethical standards and departs from accepted practices in science.

Several other examples of "other serious deviation" can be suggested. Researchers often share cultures or reagents with colleagues in other laboratories. This may be done under an exclusionary agreement—for example, an agreement that the materials not be given to a third party or that they not be used for experiments that the originator wants to perform and publish. Violation of such an agreement arguably would be misconduct in science because such violation tends to discourage a practice of sharing that is fundamental to the process of research.

Another possible "other serious deviation" is misrepresentation in grant proposals or fellowship applications. An applicant may misrepresent his or her own qualifications and achievements or may misrepresent the institution's qualifications and programs. For example, untrue claims may be made about the institution's programs in support of minority students in order to encourage favorable consideration by the agency. This again is unethical and can be a serious deviation from the standards of the scientific community (*10*).

Finally, reviewers of grant proposals are instructed to keep the contents of the proposals and the opinions of other reviewers confidential. They are not supposed to use materials in the proposals for their own purposes. If these conditions are violated, harm is done to the whole process of submitting and reviewing proposals. Applicants may be afraid to write down and send in good ideas, and reviewers may feel they cannot be candid. Hence, violating the confidentiality of peer review seems to be an obvious instance of misconduct in science (*11*).

How to Interpret NSF's Definition

Because the panel misunderstood the NSF definition, it may be useful if I explain my understanding of it. Far from being a worrisome add-on, the "other serious deviation from accepted practices" phrase is central to the NSF definition. This definition says, in effect, that misconduct in science *is* serious deviation from accepted practices. Falsification, fabrication, and plagiarism are mentioned as outstanding examples. Then the definition goes on to say that all "other" actions that similarly deviate from accepted practices are also misconduct in science.

However, I suggest that NSF, unlike the Academy panel, understands "deviation from accepted practices" in an ethical sense. The way to commit misconduct in science is to do something that scientists would recognize as deviating seriously from professional ethical standards. The panel evidently took "accepted practices" to mean accepted ways of doing experiments. Deviating from those does not ordinarily involve any ethical violation and has nothing to do with misconduct. Those who drafted the NSF definition obviously did not contemplate an interpretation that would make it misconduct in science just to do something novel or unorthodox (*12*).

The NSF definition does not attempt to give a full list of the practices that would violate professional standards in science. It might be very hard to draw up an exhaustive list, and standards might be found to vary from one branch of science to another. By referring to "accepted practices," the NSF definition points to the relevant scientific community as the authority for what is or is not misconduct. Such a definition is heuristic rather than vague. It does not say whether each and every practice is or is not misconduct, but it points out where to look for the answer. The assumption is that working scientists, like the members of other professions, can and ought to know the standards of their profession and that in disputed cases representatives of the scientific community can agree on what those standards are. They should be able to do

this without being given a complete list of the types of misconduct. Hence, misconduct can be recognized and dealt with under a heuristic definition like NSF's.

Some scientists may be willing to have their academic colleagues deal with misconduct in this heuristic way but may be less comfortable about a government agency doing so. This is not the place to discuss NSF's competence or public distrust of government. So far, no case has gone to adjudication at NSF that involved disagreement over whether an alleged activity would be misconduct in science. If that were to happen, I expect that a satisfactory method of consultation between the agency and the scientific community could and would be worked out.

Conclusion

NSF uses an open-ended definition that contains the phrase "other serious deviation from accepted practices." To date, this definition has worked successfully. One of its major advantages is that it leaves the agency the possibility of taking action when a case arises that is not on some short list of types of misconduct. It is legitimate to ask how NSF understands this definition, how it was applied in a major case, and what safeguards there are against abuse. If the Academy panel had asked, it might have produced more helpful recommendations and might have advanced the discussion of this subject much more than it did. Those who work on misconduct cases will always need the guidance and insights of their colleagues in the broader scientific community. But those who wish to make useful policy recommendations also need the insights of those with day-to-day experience in this highly controversial area.

REFERENCES AND NOTES

1. National Academy of Sciences, Panel on Scientific Responsibility and the Conduct of Research, Committee on Science, Engineering, and Public Policy, *Responsible Science: Ensuring the Integrity of the Research Process* (National Academy Press, Washington, DC, 1992), vol. 1.

2. The Public Health Service definition is that "Misconduct" or "Misconduct in Science" means fabrication, falsification, plagiarism, or other practices that seriously deviate from those that are commonly accepted within the scientific community for proposing, conducting, or reporting research. It does not include honest error or honest differences in interpretations or judgments of data (45 C.F.R. § 50.102). The NSF definition is that "Misconduct" means (1) fabrication, falsification, plagiarism, or other serious deviation from accepted practices in proposing, carrying out, or reporting results from activities funded by NSF or (2) 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. § 689.1(a)].
3. On the other hand, some panel members—a majority, by some accounts—dissented and wanted to include other actions as misconduct under the Academy's definition. The report lists as examples "misuse of the peer-review system to penalize competitors, deceptive selection of data or statistical analysis, or encouragement of trainees to practice misconduct in science" (*1*, p. 27). It goes on to say that "These issues deserve further consideration by the scientific research community to determine whether the panel's definition of misconduct in science is flexible enough to include all or most actions that directly damage the integrity of the research process and that were undertaken with the intent to deceive" (*1*, p. 28). Since this further discussion has not yet taken place, it seems premature to urge that agencies limit their definition to the three items on which all panel members could agree. By doing this, these agencies would preclude themselves from dealing with other situations, such as the ones just listed.
4. OIG receives complaints of many kinds that may involve various laws or regulations in various combinations. Some complaints are clearly about misconduct in science, but many are harder to classify. Most cases are concluded informally, without full investigation and adjudication, so that there may never be a decision about whether misconduct in science was involved. Universities also may resolve complaints against their students or faculty members without making it clear whether they are employing their misconduct-in-science regulations or some other disciplinary procedure. The result is that OIG's files contain some cases, including closed cases, that are not definitely classified as to whether they involve misconduct in science or not. Furthermore, the closed cases tend to be ones that were resolved quickly because it was easy to show that there was no misconduct. Some serious cases that require full investigation could not be closed quickly and remain open. Therefore, it is premature at this stage to draw any conclusions about what proportion of our cases will eventually lead to findings of misconduct or about what the distribution of those cases by type of misconduct will eventually be.
5. In fact, 131 were received, but 7 have been reclassified and transferred to other offices within OIG.
6. These cases are discussed more fully in OIG's series of semiannual reports to the Congress, which are available to the public. See, for example, OIG, *Semiannual Report to the* Congress, NSF, numbers 3 through 7.
7. This was the view of the Academy panel (*1*, pp. 28–29; *3*). It was also apparently the view of the Public Health Service Advisory Committee on Scientific Integrity, which recommended the following definition at its June 1992 meeting: "Research fraud is defined as plagiarism; fabrication or intentional falsification of data, research procedures, or data analysis; or other deliberate misrepresentation in proposing, conducting, reporting or reviewing research" (Minutes of the Meeting of the Department of Health and Human Services, Public Health Service Advisory Committee on Scientific Integrity, 11–12 June 1992).
8. The available published information was too limited to permit a serious evaluation of this case. Under the Freedom of Information Act, the staff of the Academy panel requested and received a copy of OIG's investigation report, but I have not found any panel member who saw it. In any case, the arguments in the OIG investigation report are not addressed in the panel's report. The staff and panel also did not discuss the case with NSF.
9. A further argument, that these behaviors "should be governed by mechanisms that apply to all institutional members, not just those who receive government research awards" (*1*, p. 86), obviously applies to a grantee institution and not to a federal agency.
10. The fabrication of bibliographic material in research proposals is mentioned in the report, and the claim is made that the proposed definition covers it (*1*, p. 86). However, the proposed definition speaks only of the fabrication of data or results (*1*, pp. 27 and 47).
11. The Academy report characterizes the misuse of privileged information as plagiarism, which it defines as using the words or ideas of another person without giving appropriate credit (*1*, pp. 54–55). However, using privileged material without authorization is much different from using published material and not giving credit. The privileged material is not supposed to be used at all, even if credit is given. NSF grant applicants, for instance, do not expect the ideas in their proposals to be used by everyone who is willing to give an acknowledgment. Hence, plagiarism is not a broad enough notion to cover this kind of misconduct.
12. An explanation of "other serious deviation" has been given by R. M. Anderson, one of the principal drafters of the NSF definition [*J. Law Technol.* **3**, 121 (1988), pp. 129–131].