Are Men More Likely than Women To Commit Scientific Misconduct? Maybe, Maybe Not

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ABSTRACT In their study published in January 2013 in *mBio*, Fang et al. reviewed records from the Office of Research Integrity (ORI) and found more cases of scientific misconduct committed by men than women, particularly by faculty (F. C. Fang, J. W. Bennett, and A. Casadevall, mBio 4:1–3, 2013). Powerful social norms shape the way men and women behave, and implicit gender schemas can lead to different evaluation standards for men and women for tasks stereotypically linked to one gender. It is possible that norms for acceptable male and female behavior could lead to a lower threshold for men than women to engage in the risky behavior of scientific misconduct. It is also possible that women and men commit scientific fraud at the same rate but that, because crime is a male-gendered domain, evaluators require more proof of the criminal "competence" of women for an investigation to rise to the level of an ORI case or that female gender norms for likeability and a lower apology threshold more often prevent escalation of women's fraud beyond a local level. Male scientists also have more opportunity to commit fraud than female scientists because they receive more NIH research funding—a finding that may also be influenced by gender schemas. We cannot conclude from the ORI data that men are more likely than women to risk the consequences of committing scientific misconduct simply because risk taking aligns with male gender stereotypes. Neither can we conclude that because men are more likely than women to commit fraud in other contexts, men are also more likely than women to commit scientific fraud. We can conclude, however, that scientific misconduct, regardless of who commits it, diminishes all who contribute to the scientific enterprise.

In their January 2013 study, Fang et al. reviewed almost 20 years of cases of scientific misconduct reported by the U.S. Office of Research Integrity (ORI) (1). The 228 individuals who had committed misconduct included scientists of all ranks and types. Fang et al. further found that 65% of those who committed misconduct were male and that of the 72 faculty members who committed misconduct, 88% were male. Powerful social norms shape the behavior of men and women. These norms support the possibility that men are more likely than women to commit fraud in the scientific arena, but they also support a willingness to assume that men are more likely to commit scientific fraud in the face of incomplete data.

Being willing to take risks is more strongly associated with the male gender, while being timid is more strongly associated with the female gender (2, 3). It is possible that lifelong reinforcement of these scripts of acceptable male and female behavior, or schemas (4), could lower the bar for men to engage in the risky behavior of scientific misconduct. After all, according to the U.S. Department of Justice, men are about 6 times more likely than women to be arrested for almost all crimes (5).

It is also possible that men and women are equivalent in actually engaging in scientific misconduct but that, as acknowledged by Fang et al., men are more likely to be detected. This would be predicted from the operation of gender schemas affecting evaluative judgments in stereotype congruent activities. When one gender is overrepresented in any role, it leads to an assumption that the activity requires traits stereotypically associated with that gender (6). For example, men are overrepresented in leadership in nearly all domains. The male gender schema includes being independent and directive, which has led to the assumption that effective leadership requires these behaviors (7, 8) in spite of experimental and field evidence to the contrary (9, 10). Most criminals are men, making criminal activity a male-gendered activity and leading to the implicit assumption that stereotypically male qualities are required to commit a crime. When assessing the ability of a woman to perform a task stereotypically associated with males, evaluators consistently require more proof to confirm her competence than they do for a man being evaluated for the same task (11). Extrapolating this body of research to scientific misconduct, one would predict that it requires more evidence to conclude that a female scientist was "competent" at committing fraud than a male scientist. Fang et al. admit that they do not know how many cases were investigated by ORI, but the gender distribution of this group might be revealing, although, even if men are overrepresented in the cases investigated by ORI, the requirement for higher evidentiary proof of fraud for female scientists might have filtered out more women than men before reaching the level of an ORI investigation. Social norms also lead women to apologize more often than men (12) and to the assumption that women are more likeable than men (13, 14). Apology alone can prevent legal action in some situations (15), and greater likeability might prevent escalation of scientific errors to the level of an investigation (16–18).

When presented with partial or ambiguous information, humans fill in cognitive gaps with knowledge from assumptions that may be based on implicit group stereotypes (4, 19). To conclude from the data of Fang et al. that men are more likely than women

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to commit scientific fraud relies on these same cognitive biases because we do not have enough data to support this conclusion. We cannot conclude that, simply because risk taking aligns with male gender stereotypes, men are more likely to risk the consequences of committing scientific misconduct. Neither can we conclude that, because men are more likely than women to commit fraud in other contexts, men are also more likely than women to commit scientific fraud. It is possible that men are overrepresented among ORI scientific misconduct cases, but there are too many assumptions we need to make with the data presented by Fang et al. to reach this conclusion—even if these conclusions comfortably align with cultural stereotypes. The numbers are small, and more certainty with respect to the percentages of males and females in the pool of potential perpetrators is needed. The authors state that "nearly all instances" of misconduct that they cite were in the life sciences, but if even a small percentage were from engineering, the probabilities of males versus females committing fraud might not be significantly different. Figure 1 in the paper by Fang et al. indicates that approximately 45% of graduate students in the life sciences are male (and this aligns with the percentage of male graduate students receiving NIH funding in either individual or institutional grants) (20), while about 70% of all science and engineering graduate students are male. Using exact binomial probabilities, the 58% of male ORI cases (16% of 228 cases = 36 students; 58% of 36 = 21 males) is significantly greater than the percentage of female cases if males comprise 45% of the pool ($P = 0.04$) but not if they comprise 48% ($P = 0.06$) or more. Figure 1 in the paper by Fang et al. shows that approximately 61% of life science postdoctoral students are male (somewhat more than the 50 to 58% of NIH-funded postdoctoral students) (20) whereas approximately 67% of all science and engineering postdoctoral students are male. Exact binomial probabilities indicate that the 69% of male ORI postdoctoral student cases (25% of 228 cases = 57 postdoctoral students; 69% of 57 = 39 males) is significantly greater than the proportion of female cases if males comprise 50 to 58% of the pool ($P < 0.05$) but not 61% or more.

At the faculty level, Fang et al. use as their denominator the proportion of men and women in the scientific workforce to conclude that male scientists are overrepresented among ORI cases of fraud. However, the opportunity to commit fraud may be a more useful denominator. If we use NIH research award dollars as a proxy for the opportunity to commit fraud in the life sciences, we find that men have substantially more opportunity to commit fraud than women. Compared to women, men are more likely to hold multiple simultaneous R01 awards, lead large center grants, and successfully compete when submitting renewals (20–22). On average, men's research awards are approximately $100,000 larger (20). While these gender differences in NIH funding may lead to fewer cases of scientific misconduct by women, they may represent another way in which gender schemas can jeopardize scientific progress. Science, like fraud, is a strongly male-gendered domain (23) in which one would predict that peer reviewers of grant proposals would implicitly adjust evaluative standards to require a higher level of proof of competence from women than men.

There is no arguing with the conclusions by Fang et al. that as a community we need to develop effective ways of ensuring that scientific research is conducted responsibly and ethically. Scientific misconduct, regardless of who commits it, diminishes all who contribute to the scientific enterprise. We must also be wary that, regardless of our commitment to objectivity and meritocratic principles, gender schemas influence decision-making processes in subtle ways that put us all at risk of contributing to the perpetuation of gender bias in science.

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