

POLICY FORUM

DIVERSITY

Increasing gender diversity in the STEM research workforce

Policies must address harassment and bias

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Women experience substantial, gender-specific barriers that can impede their advancement in research careers. These include unconscious biases that negatively influence the perception of women's abilities, as well as social and cultural factors like those that lead to an unequal distribution of domestic labor (1, 2). Additionally, sexual and gender-based harassment is a widespread and pernicious impediment to the retention and advancement of women in many science, technology, engineering, and mathematics (STEM)-related fields (3). Although there is substantial evidence documenting systemic barriers that women face in scientific careers, less is known about how research institutions and funding agencies can best address these problems (see references below and in the supplementary materials). We outline here specific, potentially high-impact policy changes that build upon existing mechanisms for research funding and governance and that can be rapidly implemented to counteract barriers facing women in science. These approaches must be coupled to vigorous and continuous outcomes-based monitoring, so that the most successful strategies can be disseminated and widely implemented. Though our professional focus is primarily academic biomedical research in U.S. institutions, we suggest that some of the approaches that we discuss may be broadly useful across STEM disciplines and outside of academia as well.

ENDING SEXUAL HARASSMENT

Sexual harassment is pervasive in academia, with as many as 58% of women experiencing unwanted sexual attention or advances at some point in their careers (3). This harassment too often is ignored or excused

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and so goes unpunished. As a consequence, harassers are often tacitly empowered to go on and harass others. Harassment takes a major toll, harming women's motivation and drive. Women who have experienced harassment are more likely to leave academia, resulting in a loss of productivity and talent from the scientific workforce (3). Women of color are subjected to particularly high levels of sexual harassment, and the implicit acceptance of harassing behaviors may further contribute to the underrepresentation of racial and ethnic minorities in scientific careers (3, 4).

A wide range of institutional actions may be appropriate responses to someone who commits sexual harassment, from mandatory counseling to suspension to termination of employment (3). Every allegation of harassment will present its own distinct issues, and it is important for all involved that the details of these cases be carefully considered. In some cases where institutional process errors or systematic negligence resulted in harm to the victim, a public apology may be part of the restorative process. Rather than attempting to delineate the correct balance between rehabilitative and punitive responses to harassment, we seek to devise systems to ensure that such decisions are adjudicated in a fair manner, that perpetrators do not escape accountability, and that the careers of the victims are protected. Toward those goals, we have three recommendations.

Treat sexual harassment in a manner parallel to scientific misconduct

A 2018 report by the U.S. National Academies of Sciences, Engineering, and Medicine (NASEM) (3) recommends that sexual misconduct should be treated using the same protocols and with the same serious repercussions as scientific misconduct. We agree. Many funding agencies require



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assurance that grantee institutions have policies allowing research misconduct to be reported, investigated, and punished. In the event that an allegation is substantiated, the funding agency can take independent action, in addition to any consequences that are levied by the home institution. Such actions might be as mild as a censure or as severe as disbarment from funding. The results are then reported through a publicly available database.

We recommend the creation of institutional and government offices to address substantiated claims of sexual misconduct and to educate institutions on sexual harassment policy, using the existing structures for research misconduct investigations as models. For example, U.S. funding agencies should establish an office responsible for collecting and reviewing verified reports of sexual misconduct, based on the model set by the Office of Research Integrity of the Department of Health and Human Services. These offices should offer clear reporting chains, consistent standards of evidence, and defined protocols for adjudicating sexual harassment cases, and should educate institutions on "best practices" for such investigations. Following the current U.S. National Science Foundation

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guidelines for reporting, institutions should be required to disclose when there is a finding of sexual harassment or professional misconduct, and funding agencies should maintain a public database of individuals who are found guilty of sexual misconduct for 10 years after the judgment.

Government guidelines exist that serve to protect scientists who report suspected instances of research misconduct (“whistleblowers”) from personal or professional retaliation. Individuals who report sexual misconduct may be similarly at risk of retaliation, particularly if the accused person is their supervisor or a senior faculty member in the department. Institutions and agencies should ensure that sexual harassment whistleblowers are personally and professionally safeguarded from reprisal. This may involve protecting the anonymity of the accuser or otherwise ensuring that complaints can be made in a confidential manner.

Require investigators to disclose harassment findings and settlements to funding agencies and potential employers

Because funding agencies typically claim to seek to support researchers who are also excellent mentors, they have a vested interest in preventing harassment by their grantees.

However, even when a finding of sexual harassment is made against a scientist, confidential settlement agreements may prevent external funding agencies and other possible employers from learning about this misconduct. Serial harassers may be tolerated by their institutions if they are seen as valuable because they have acquired a very high level of research funding. To break this pernicious cycle, research funding agencies should require applicants to answer two questions on every grant and progress report: (i) Have you been found responsible for professional misconduct, research misconduct, or gender-based harassment at any time in the past 10 years? (ii) Have you been involved in a settlement regarding an allegation of professional misconduct, research misconduct, or gender-based harassment in the past 10 years?

Although the individual applicant must answer these questions, the institutional signing official should verify that the answer is correct. This would parallel the process in place in which institutions check that an applicant has appropriate approval for human subjects or animal research, before they approve the submission of a grant. The answers to these questions should be shared with the fund-

ing agency’s program staff and should not be disclosed to grant review panels. This would offer funding agencies highly relevant information on a scientist’s ability to serve as an effective mentor. Although implementation of these recommendations may result in institutions having to modify existing reporting procedures (e.g., grant-signing officials would need to be able to access information on harassment findings), such process changes could provide needed transparency. In addition, asking these questions would underscore the seriousness with which the funding agencies treat findings of sexual misconduct.

Institutions should also ask these or similar questions on their employment forms. Just as many institutions require a criminal background check, they could also require new employees to affirm that they have not been found responsible for harassment at another institution.

Establish mechanisms to protect the careers of harassment victims

If a researcher loses a grant or their employment because of a finding of harassment, then this could unintentionally penalize the victims of that harassment and other innocent members of the lab by depriving them

of the mechanisms and funding that support their work. To avoid this outcome, we suggest the following approaches.

The funding agency, together with the institution, should identify another researcher with a proven track record of exemplary mentorship to take over the grant, so that the trainees can continue their work with minimal interruption. In the event that no suitable mentor is identified, or if the affected individuals would prefer to change departments or institutions, the funding agency should make bridge funding available for those individuals as they find new laboratories.

In some cases, sexual harassment can cause individuals to leave science entirely. The U.S. National Institutes of Health (NIH) already provides “career reentry” grants for men and women who have left the biomedical workforce. These programs should be expanded to allow individuals who have been pushed out of science to resume their research careers, and to minimize disruptions that arise as a by-product of sexual misconduct.

BREAKING THE POWER OF BIAS

Gender diversity is not hindered solely by outright harassment. Unconscious bias and cultural prejudices also inhibit career progression for many women. A woman’s work is often undervalued relative to her male counterparts, and her qualifications are frequently underrecognized (5). These harms are often particularly pronounced for women of color, who face a “double bind” caused by the convergence of racism and sexism (6, 7). Women devote more time than men to tasks that benefit their institutions, including committee work, mentorship, and teaching (8). At the same time, issues surrounding family life, including fertility treatments, pregnancy, childcare, and the unequal distribution of domestic labor, may disproportionately hinder women’s advancement at crucial career transitions.

Transparency in start-up packages, salaries, and internal grant funding

Many research institutions are controlled by senior male investigators with large labs and influential positions. These labs command space and resources, and these researchers are often able to secure additional institutional funds, like philanthropic support and endowments, that enable them to become even more dominant both within the institution and in their field.

This uneven trajectory begins early in academic careers. Male postdocs tend to receive higher salaries than female postdocs do (9), and male faculty members reportedly receive both larger salaries and start-up packages compared to female faculty members (10). As time goes on, internal funding may also be allocated disproportionately to men, as was alleged to occur with a \$42 million donation made to the Salk Institute. These compound disadvantages can be difficult for women to overcome. This problem stems in part from institutional opacity, as institutional

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funds are often distributed behind closed doors and with little oversight.

To end these gender-specific disparities, institutions should provide greater fairness and transparency in resource allocation. Institutions should devise mechanisms to ensure that faculty and trainees receive fair salaries that are free from gender biases. This could be achieved by providing anonymized salary data to an internal committee or to an external advisory committee to review on a regular basis, and then committing to adjust salaries if biases are found. Though it may not be suitable in all cases, institutions could consider standardizing salaries on the basis of years of experience and institutional service.

In offer letters to potential new hires, institutions should consider providing information on the start-up packages given to assistant professors with similar research needs. In this way, a faculty candidate can learn whether the package that they’ve been offered is commensurate with those given to other investigators. Nonetheless, as different research programs may have distinct needs in terms of space, equipment, or funding, exact resource parity may not always be appropriate. The distribution of start-up packages, endowed chairs, award nominations, and any major internal funding stream should be regularly reviewed by a department or institution’s external advisory committee or by some other independent body. If substantial gender disparities are found, departments should act quickly to address them.

Fostering work-life balance through family-friendly policies

Scientific research requires a tremendous amount of dedication and drive. This dedication is a badge of honor among most scientists, but it can also be prohibitive for scientists who are trying to balance their careers with the demands of raising a family. These familial obligations can affect both men and women, though these burdens tend to disproportionately affect female scientists (11). Acknowledging this imbalance does not excuse it, and we suggest that adoption of family-friendly policies in academic research will greatly benefit both women and men. Although we highlight challenges that new parents face, we recognize that there are also many barriers to women who do not have children. Nevertheless, we believe that the policies we outline below have potential to aid scientists with other external obligations and to help promote work-life balance more broadly.

Many institutions and funding agencies have already taken steps to combat problems that arise as a result of work-life conflicts in academia. For example, many institutions offer increased access to childcare as an employee benefit. Other institutions provide subsidies for childcare when an employee attends out-of-town conferences. Funding agencies could consider classifying childcare as an acceptable expense on federal grants. This can be particularly transformative for trainees who may otherwise find the cost of childcare to be prohibitively expensive. Conferences should strive to adopt family-friendly policies, including providing options for on-site childcare and establishing spaces for lactation.

Much of the academic career path is governed by an invisible clock: Trainees are evaluated by how long they were in their postdoc; how long it has been since they completed their Ph.D.; the amount of time it took for them to get their first grant; or how many papers they published during their time as assistant professor. These clocks are frequently unfair to scientists who must take time off from their careers, often at pivotal moments, for pregnancy, childcare, or other obligations. Some institutions and funding agencies are starting to address this problem. For example, many institutions offer an extra year on the tenure clock for the birth or adoption of a child; institutions could consider granting this extension automatically to all new parents. Though some evidence suggests that

providing tenure extensions to both parents can disproportionately benefit men (12), we believe that such gender-neutral policies are an important mechanism to equalize child-care responsibilities between both parents. We also recommend that funding agencies and institutions allow greater flexibility in the term “early career scientist” to accommodate the birth or adoption of children.

Despite the long hours that are expected of most scientists, academic positions often have the advantage of allowing more flexible work hours than are typically found in other careers. But, the amount of flexibility depends largely on an individual lab or institution’s culture. We recommend that institutions create formalized policies on flexible work arrangements and telecommuting. These might include adjusting schedules to work more hours per day but fewer days per week, or an allowance for telecommuting during periods of grant and manuscript writing. Formalizing this option may allow women to feel more comfortable asking for the accommodations that they need to balance their career and life at home.

Advancing the careers of women

The evaluation of women for grants, promotions, awards, and tenure is fraught with the influence of unconscious bias. Evaluation of candidates on the basis of the quality of their work must be conducted holistically, and not rely on false or superficial markers of career success. Though high-profile publications are often used as proxies for assessing the importance of a scientist’s research, female authors are often underrepresented in high-impact journals (13). Women tend to devote more time to teaching and institutional service (8), the importance of which are typically minimized during promotion decisions. Comprehensive evaluations, focused on a deep analysis of a candidate’s scientific and institutional impact, are crucial for ensuring fair treatment of women. Because all-male panels have been found to be less likely to promote women in academia (14), promotion and award-nomination committees should strive to have representation that is gender-balanced.

The observation that disparities in departmental service currently exist should not be used to justify the continued presence of these disparities in the future. In general, institutions should strive to ensure that committee and teaching responsibilities fall equally on men and women. Although such imbalances exist, programs that reward individuals for departmental service may particularly benefit female scientists. For example, Stanford University recently developed a “time-banking” program, in which time spent teaching or per-

forming service work was rewarded with professional and personal support (e.g., grant editing, website design, meal delivery, etc.) (15). Programs similar to this may provide a mechanism to compensate scientists for their institutional service.

Promoting and ensuring effective mentorship

Mentorship plays a critical role in the success of a trainee, but many researchers have never been formally educated in effective leadership and mentoring skills. Many labs have a sink-or-swim environment where trainees are expected to produce results with little guidance. Researchers may lack skill in resolving conflicts or navigating delicate situations surrounding gender and personal issues. These deficits can create a lab culture that is hostile to women in particular and trainees more broadly.

A number of funding agencies are changing or adapting new policies to improve the training environment, including the Welcome Trust, The Max Planck Institute, Howard Hughes Medical Institute, and the National Science Foundation. In the past year, the NIH has made major revisions in their guidelines for pre- and postdoctoral training grants. Career enhancement and mentorship plans are not just required, they are scorable elements of the grant that must be reviewed. These changes are already having an impact on the research training environment as institutions are increasing the availability of career development programs for trainees and offering faculty increased training in effective mentorship and leadership skills.

Although these efforts are superb for students and postdocs who are funded by training grants, most of the biomedical workforce is funded by other mechanisms. We believe that career enhancement and mentorship should be a scorable criterion on most, if not all, grant applications, particularly research grants that support a major fraction of the biomedical workforce.

To quantify the impact of mentorship and career enhancement efforts, the NIH requires institutions to track the career progression of students and postdocs who have been funded by a training grant. We recommend that institutions collect this information for all trainees and share it publicly. Reporting the gender of previous trainees could help students avoid labs that may be hostile to women, and identify mentors who may be the most helpful in advancing their career. Moreover, as only about 20% of trainees in the life sciences remain in academia, collecting and sharing this information would highlight the reality and the diversity of career outcomes for current

Ph.D.’s. Institutions have a strong interest in promoting healthy training environments within their departments, and we recommend that a researcher’s mentorship abilities be regularly evaluated during annual reviews and promotion decisions.

AN OBLIGATION TO SUPPORT

Institutions and funding agencies have an obligation to ensure that they are supporting the best possible science and minimizing any gender-specific barriers that may hinder the advancement of women in academia. We believe that by ending sexual harassment and breaking the power of unconscious bias, they will make substantial progress toward this crucial goal. Given that many of the policies outlined in this proposal have not been previously implemented, they should be accompanied by outcomes-monitoring, so that the efficacy of each approach can be evaluated in an evidence-based and unbiased manner. We hope that our recommendations will spur additional conversations about diversity in science and our own responsibilities to create a fair and just system. ■

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SUPPLEMENTARY MATERIALS

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