

Increasing Diversity in Science: It Begins With All of Us

Ellen Leibenluft

“The mission of *Biological Psychiatry* is to publish impactful scientific communications. To further that mission, we promote diversity in all aspects of the publication process, including authorship, reviewing, and editing. Our diversity efforts aim to increase participation among individuals of underrepresented racial, ethnic, and gender identities; from underrepresented countries or disadvantaged backgrounds; and those with disabilities. For further information, see [this Editorial].”

The above statement now appears on the *Biological Psychiatry* website (www.sobp.org/journal), in our Guide for Authors, and in our invitation letter to reviewers.

This Editorial has two goals. The first goal is to clarify our purpose in publishing this statement and to inform you of our diversity-promoting actions. The second goal is to increase your motivation to support diversity efforts generally—ours as well as those in your own institution. Specifically, we aim to shape your behavior by presenting data. Thus, the second part of this Editorial highlights recent research on the causes of decreased diversity in science and the implications of that research for action. These data indicate the importance of individual actions as well as institutional actions in shaping environments that foster diversity, thus demonstrating that increased diversity in science really does begin with “us,” i.e., our *Journal* and you.

First, our intent in publishing the statement: The lack of diversity in science, especially in senior positions, is well documented. Recently, an important article by Hart *et al.* (1) and the accompanying commentary by Bearden (2) in *Biological Psychiatry* brought this message home by highlighting gender inequities in authorship (particularly senior authorship) in high-impact psychiatry journals. Mindful of this problem and of the loss of scientific talent that it represents, the Editors considered actions to rectify it. These actions include continued attempts to increase diversity among our Editors and Editorial Board, reviewers, and authors (including invited guest editors, contributors to special issues, and commentators). We invite you to join in that process in the following ways.

To our authors: When submitting a manuscript you are asked to name six recommended reviewers. While your primary goal should be to suggest the most qualified and unbiased reviewers, we ask that you also consider whether your list advances our efforts to increase diversity within our reviewer pool. Indeed, Jordan and Carlezon (3) recently reported that in submissions to *Neuropsychopharmacology* over 6 months in 2018, both male and female authors were more likely to recommend male versus female reviewers.

To our reviewers: It is important to note that our statement supporting diversity in the *Journal* is not a request to take gender, ethnicity, country of origin, etc., into consideration in the review process. Instead, we ask reviewers to focus solely on the merits of the manuscript before them. Gender inequities in authorship of published manuscripts have been documented in multiple scientific fields (4–6). The mechanisms underlying these inequities, and the extent to which they reflect bias in the review process, remain unknown. However, unintended implicit bias may impact many aspects of the scientific enterprise [e.g., hiring decisions, letters of recommendation (7), and salaries], and it is certainly conceivable that such bias might, at times, influence the review process. Our shared goal should be to guard against this.

Finally, to all our readers: We now turn to a discussion of studies suggesting that mechanisms impacting diversity, including diversity in publication, vary from laboratory to laboratory and from subfield to subfield. We present these data because they highlight how our individual efforts can foster a diverse scientific community that contributes actively to all stages of the publication process. Specifically, the published literature suggests that to increase diversity, institutional efforts designed to combat systematic bias must be complemented by individual efforts to ensure that our scientific microenvironments include and support diverse populations participating in research and publication.

First, an important caveat. Our examples below focus on gender inequity, but it is crucial to note that whatever gender inequities exist in science, those related to ethnic, racial, socioeconomic, and disability status are literally orders of magnitude worse (8). Some lessons learned from the study of gender disparities may be applicable to other underrepresented groups, but clearly non-gender-related inequities deserve special consideration and considerably more research attention.

One area where we as individuals may have considerable influence is in the composition of our laboratories. The idea that microenvironments, specifically individual laboratories, may differ in inclusiveness was highlighted in 2014 by Sheltzer and Smith (9) in *Proceedings of the National Academy of Sciences*. In a sample of 2062 faculty, 4904 postdoctoral students, and 4143 graduate students, the authors compared the gender composition of trainees in biology laboratories directed by male versus female and “elite” versus “nonelite” faculty. Elite faculty were defined as those who had been elected to the National Academy of Sciences, those who had received funding from the Howard Hughes Medical Institute, or those

who had won major awards. The authors found that while elite male faculty employed fewer female trainees than did nonelite male faculty, there was no such difference between elite and nonelite female faculty. This inequity had lasting consequences because graduates from elite laboratories were overrepresented among junior faculty.

These findings may indicate that elite male faculty are explicitly or implicitly biased against hiring female trainees. However, data on the number of male and female applicants to each laboratory were not available, leaving open the possibility that disproportionately fewer women were applying to the laboratories led by elite male faculty. Thus, women might be opting out of the elite male-led laboratories but, importantly, not the elite female-led laboratories. Indeed, a current controversy in the literature centers on whether gender inequities exist in science, especially at the highest levels, because women “opt out” of scientific careers, creating a “leaky pipeline” that results in underrepresentation in senior ranks or, alternatively, whether women leave science or fail to advance because of systematic bias against them. Sheltzer and Smith (9) suggest a third possibility, i.e., an opt out \times bias interaction, such that the probability that women will opt out of science varies across scientific environments, possibly because women experience or perceive that some environments, but not others, are biased against them.

An important sidebar on “opting out.” We should support the decision of individuals—male, female, or nonbinary—to leave research careers because they are drawn to education or administration, desire a different lifestyle, wish to pursue a career in business or the arts, or a myriad of other reasons. However, we do not want individuals to leave research careers because they have been discriminated against or because the culture in their scientific environment is not inclusive. In other words, opting in to something other than research is fine; opting out because of bias or an unwelcoming scientific environment is not.

These findings regarding elite laboratories (9) suggest that the culture of individual laboratories may foster or discourage diversity. One important aspect of laboratory culture is how authorship is determined. Hart *et al.* (1) report a remarkably robust finding that psychiatry papers with female versus male last authors are disproportionately likely to have female first authors ($\chi^2_1 = 126.1, p < 2.2 \times 10^{-16}$). For a discussion of this, see Hart *et al.* (1) and Bearden (2); here we simply note that it reminds us that diversity will likely be increased if, within our microenvironments, we all implement a fair and transparent process when deciding who to include as authors on our papers, and in what positions.

Just as individual laboratories vary in diversity, so do scientific subfields, further supporting the contention that the diversity problem is local enough that we can each play an important role in addressing it. Specifically, a recent study found that subfields vary significantly in degree of gender inequities in authorship (6). This study examined 200,000 publications from more than 750,000 authors who had published in the 125 highest-impact psychology journals from 2003 to 2016. As in Hart *et al.* (1), the authors report that the gender gap in last authorship is closing

more slowly than the gap in first authorship. Notably, however, the rate of change varied significantly across psychology subfields. For example, developmental psychology has already closed the gender gap in last authorship, and clinical psychology is on track to close it by 2023, but the projected date for neuroscience is not until 2049. Unlike in Hart *et al.* (1), these data are cross-sectional, so we do not know whether women are opting out of some subfields and not others, or what other mechanisms are at play, e.g., the effect of differing proportions of women in a subfield on female advancement in that subfield (1,2). As leaders in our individual subfields, this again highlights an area where our diversity-promoting actions can have significant impact.

What characteristics make some scientific environments (e.g., laboratories or subfields) more hospitable than others to women and underrepresented minorities? If the findings of Sheltzer and Smith (9) reflect female trainees opting out of laboratories run by elite male, but not elite female, scientists, what motivated those decisions? Studies presented here (1,6,9), along with many others, suggest that women and underrepresented minorities are more likely to succeed (and, specifically, publish) in environments that include senior women and underrepresented minorities who can serve as role models and mentors. Hence, recruitment and retention are central to diversity efforts. However, it is also essential that mentors excel at mentoring trainees who “don’t look like them,” and that laboratory chiefs run laboratories where diverse individuals can feel supported and can build their curricula vitae. Presumably, for junior women, the positive impact of being mentored by senior women stems not solely from shared gender but also from compatible interpersonal styles. Similarly, laboratories, like families, have their own cultures, reflected in characteristic modes of relating, making decisions, and dealing with competition. Regarding the latter, multiple studies show gender differences in affinity toward, and performance during, competition, so this could be a fruitful topic for further consideration and research (10).

In sum, we invite and welcome your support of our efforts to increase diversity in the *Biological Psychiatry* community. We support the work of other institutions that, like us, are working to address this problem. We also encourage your consideration of individual actions that you might take so that one journal, one laboratory, and one mentor–mentee relationship at a time, our field can advance toward our shared goal of fairness and equity.

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Article Information

From the Section on Mood Dysregulation and Neuroscience, Intramural Research Program, National Institute of Mental Health, Bethesda, Maryland.

Address correspondence to Ellen Leibenluft, M.D., National Institute of Mental Health, Reviews Editor Account, Bldg 15K, Rm 210, MSC 2670, Bethesda, MD 20892-2670; E-mail: eleibenluft@sobp.org.

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