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Privilege, Bias, and Graduate School Admissions

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Across clinical, translational, and basic science research, the influence of bias and confounding variables on data collection and analysis are well accepted, and great care is taken to reduce bias and understand any confounds. In much the same way, implicit bias and privilege heavily influence both who applies to graduate school and who gets accepted. But while study designs have evolved, the pervasive influence of privilege on graduate school admissions remains.

One of the first roadblocks to getting into graduate school is the financial burden of applying. It costs over $200 just to take the GRE, and in order to score well, many students invest in study materials and prep courses, which can cost thousands of dollars.[1] Given these financial barriers, it should not be surprising that GRE scores often correlate with students' socioeconomic status. But GRE scores are not only reflective of the privilege inherent in wealth, but also white privilege and male privilege. Studies from the University of Florida, Stanford, University of Missouri, and New York University have found that the GRE underpredicts the graduate school success of minority students and women over 25.[1] While the GRE is often looked to as an "objective" way to measure students' aptitude, it has been shown to be a poor predictor of scientific productivity and only a moderate predictor of first semester graduate school grades by studies from the University of North Carolina and Vanderbilt.[2]

The financial barriers to applying to graduate school extend beyond the GRE, as the costs of application fees and interview travel can quickly compound. Likely as a result of this, on average, those who become scientists come from wealthy backgrounds. In an analysis of National Bureau of Labor Statistics data, NPR found that physical, life, and social scientists' average annual household income during childhood was between $70,000 and $74,999.[3] Scientists came from a higher average income bracket than physicians, dentists, general managers, and even CEOs. Additionally, you are far more likely to become a scientist if your parents are scientists. More specifically, you are 456 times more likely to be a physical scientist if your parents are too.[4] With a large number of those accepted to graduate school coming from wealthy backgrounds, or with family ties enabling more research opportunities, there is a clear need to recruit applicants from outside of these small pools.

In addition to the financial barriers to applying to graduate school, problems within the culture of science may discourage students of color and white women from applying. When deciding what to study as an undergraduate or what career to pursue after graduation, students may avoid STEM despite interest or talent, if they feel they would be unwelcome in the field. When no one looks like you in the portraits of deans and department chairs at an institution, it is hard to feel like you belong. In the United States, a majority of women in STEM fields report having to provide more evidence of competence than others to prove themselves, with rates varying significantly by race, ranging from 63% of white women to 77% of black women.[5] This intersectionality cannot be ignored when considering the level of bias applicants have to overcome.

Even if those from less privileged backgrounds decide to apply to graduate school, the way in which we evaluate applications often biases our evaluations against them. Recommendation letters amplify male privilege, with male applicants more likely to be described as a "brilliant scientist" or "one of the best students I've ever had" than their female counterparts.[6] In addition to being less likely to have an "excellent" letter, female candidates are also more likely to be described in terms of relationship-building, such as "caring" and "nurturing."[6] While these are not negative qualities, they are not as valued within the scientific community as characteristics more common in recommendations for men, like "confident" and "intellectual."

Another important metric for evaluating applicants is the number and quality of research experiences. While exposure to research is important, the large number of unpaid research positions put students who cannot afford to work for free at a distinct disadvantage. The persistence of these unpaid positions are problematic not only because they exploit the labor of students, but also because unpaid positions decrease the number of paid jobs available, as this free labor will "undercut" the cost of paid work.[7] The work students do as unpaid interns may still have significant scientific merit, but how can we reward them for their work without punishing those who are not privileged enough to pursue such opportunities?

So how can we improve the graduate school admissions process to reduce the action of privilege on who goes into science? First, we must ensure that those who sit on graduate school admissions committees are aware of how the traditional ways in which we evaluate candidates preferentially select for candidates who are wealthy, white, and male—independent of aptitude.

Many programs have begun to institute implicit bias training for admissions committee members, which aims to educate committee members about the implicit or "unconscious" biases that we all hold. This is a good first step, but beyond introducing the concept of implicit bias, admissions meetings must be structured in a way that empowers members to call out bias when they see it. As implicit bias is unconscious, even with training it can be difficult to see when we are behaving in biased ways. If admissions committees encourage input from all members independent of institutional hierarchy and work to ensure the membership of the committee is diverse, it may increase the attention given to biases.

But before the admissions committee meeting, graduate school programs could work to improve their admissions process. Many programs offer application fee waivers for low-income students, but the information on fee waiver availability and how to request one is often difficult to find. Eliminating application fees would enable students to apply based on program interest, not ability to pay. It may also prevent low-income students from being discouraged from applying before even beginning the application.

To prevent the exploitation and undue advantage of unpaid research work, when offering research work to undergraduates, institutions nationwide should ban uncompensated research positions. Instead only research positions for pay or course credit should be offered. Should this be too difficult, perhaps graduate admissions committees could decide to not permit the inclusion of unpaid research work on students' CVs, in order to discourage students from pursuing such work and remove the advantage of such experiences.

We also need to reconsider what makes a "strong" application. As those with wealth and/or family connections are more likely to excel in the more traditional admissions metrics (GRE, research experiences, extracurricular activities), we need to expand what we consider worth including in an application. Beyond research experiences, we could suggest including service or labor jobs, hobbies, and unique skills on CVs. Most recommendation letters come from professors and research mentors—what if we similarly encouraged letters from retail employers, coaches, or mentees? While working a service job may not demonstrate pipetting skills, it can certainly show an applicant's work ethic, skill at optimizing a task, and ability to work as part of a team.

Finally, graduate schools should consider changing the way in which candidates are interviewed. Multiple studies have found that unstructured interviews are one of the worst predictors of job performance and are often biased by interviewers looking for candidates like themselves.[8] If interviewer bias skews interview scoring in favor of candidates like themselves, how can we expect to increase diversity in science? The *Harvard Business Review* suggests a few changes to interviews[8]:

1) structure interviews, so candidates are all asked a standard list of questions;
2) have candidates perform a work sample test related to the work they will perform;
3) get rid of group interviews; and
4) compare responses horizontally, that is, across all candidates one question at a time.

In addition to these suggestions, I would encourage graduate schools to offer videoconference interviews for initial interviews. This would make it easier for applicants with disabilities and/or families to interview, as well as saving applicants money on travel expenses.

We in academia need to work to construct a more inclusive pipeline into careers in science that doesn't limit the opportunity to pursue graduate training to a small subset of people. When thinking about who would make a good scientist, we would do well to remember the words of Stephen Jay Gould: "I am somehow less interested in the weight and convolutions of Einstein's brain than in the near certainty that people of equal talent have lived and died in cotton fields and sweatshops."

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Defining success in graduate school

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To the Editor:

As graduates of the University of California–San Francisco (UCSF) Tetrad program from the matriculating classes of 1992–1996, we read with interest a recently published *Perspective* entitled "How Should We Be Selecting Our Graduate Students?," written by fellow alumnus and classmate Orion Weiner (Weiner, 2014). The author, who is now a member of the UCSF Tetrad faculty and cochair of graduate admissions, reported that success in this graduate program over the past 20 years correlated with years of undergraduate research experience and Graduate Record Examination (GRE) subject scores but did not correlate with other commonly used admissions metrics, such as undergraduate grades, general GRE scores, or ranking of the undergraduate institution. We applaud the author for taking on the important challenge of examining predictors of success in graduate school in the life sciences. As alumni of the program, however, we wish to respond to a number of issues, including the design and execution of the study and the implications of its conclusions. Most importantly, we propose a new, broader definition of success in graduate school. Our aim is to promote a discussion about meaningful, reliable, and scientific ways to define, analyze, and evaluate success in bioscience graduate programs.

PROBLEMS WITH USING "SUCCESS" AS AN OUTCOME MEASURE

Graduate programs in the biosciences have used essentially the same metrics to evaluate applicants to graduate school for decades, and we fully support the author's intention to evaluate whether or not these metrics continue to serve as predictors of student success. However, establishing unbiased criteria for graduate student success is a challenging endeavor, as previously recognized (Hartnett and Willingham, 1980; Meade and Fetzer, 2009). A number of attempts have been made to establish and evaluate objective (grades, passing qualifying exams, time to doctorate, number of publications) and subjective (professors' ratings of dissertations or predictions of future success) criteria (Stricker and Rock, 1993; Sternberg and Williams, 1997; Burmeister *et al*., 2014). In this study of the UCSF Tetrad program, past students were classified as "successful" or "underperforming" by a group of 30 current faculty members. Neither the criteria by which students were assigned to these two categories nor the career stage at which the assessment was made were reported. Thus, "successful" students could be those who published multiple first-author papers, were remembered as having worked long hours in the lab, got along well with others in the lab, or went on to academic careers at high-profile institutions. A student identified as "underperforming" might be one who took a long time to graduate, switched labs, was perceived to have a combative personality, or left academia after graduation.

Thus, in the UCSF Tetrad study, the relationship between the subjective and undefined dependent variable (student success) and the quantitative independent variables (admissions metrics) cannot be reliably interpreted. For example, it could be—as suggested by the author—that students who did more research before graduate school were more likely to know what getting a graduate degree would entail and were therefore more likely to be considered successful. However, "successful" students might simply be those who met cultural expectations for graduate students—for example, they needed less instruction in bench skills, were more likely to listen to authority, or came from academic families or privileged economic backgrounds. These examples illustrate both how the binary outcome of "successful or underperforming" simplifies the assessment of a complex process and, furthermore, leaves unaddressed the possible transformative or educational value of the graduate program.

CONFOUNDING FACTORS

1. The UCSF Tetrad study is a post hoc analysis that relies on the recollections of 30 current faculty members, an approach that excludes the many faculty members who left over the past

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