SOCIOLOGY

Weaving a Richer Tapestry in Biomedical Science

NIH leadership discusses the need for renewed efforts to increase diversity in the U.S. biomedical research workforce.

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As much as the U.S. scientific community may wish to view itself as a single garment of many diverse and colorful threads, an unflinching consideration of actual data reminds us that our nation's biomedical research workforce remains nowhere near as rich as it could be. An analysis, performed by a team of researchers primarily supported by the National Institutes of Health (NIH) and published in this issue of *Science*, reveals that from 2000 to 2006, black (*1*) grant applicants were significantly less likely to receive NIH research funding than were white applicants. The gap in success rates amounted to 10 percentage points, even after controlling for education, country of origin, training, employer characteristics, previous research awards, and publication record (*2*). Their analysis also showed a gap of 4.2 percentage points for Asians; however, the differences between Asian and white award probabilities were explained by exclusion of noncitizens from the analysis.

There are several possible explanations for these troubling data, and they are not mutually exclusive. The authors propose a contribution of "cumulative advantage" from experiences of majority applicants that are not equivalently enjoyed by black applicants; potentially, this cumulative difference could reflect the long reach of earlier educational experiences in kindergarten through grade 12 and college training. A related possibility is variability in access to mentoring and other resources.

But as uncomfortable as it makes us, we must acknowledge that the differences observed may reflect biases that are insidiously interwoven into the basic fabric of the merit/reward system of science. The well-described "Matthew effect" in science (*3*) points to disproportional credit being accorded to "elite" scientists. A broader generalization of this phenomenon may operate in our scientific culture to enhance careers of successful white scientists but diminish recognition of the contributions of others. The observations of Ginther *et al*. (*2*) suggest the presence of an "inverse Matthew effect," that is, residual cultural biases may have disproportionate adverse consequences on minority subgroups of our scientific community.

Framework for Change

The NIH mission can only be achieved if the best and brightest biomedical researchers, regardless of race, ethnicity, disability, socioeconomic background, or gender, are recruited and retained in our workforce. However, the findings of Ginther *et al*. and others indicate that NIH's current approaches and those of other stakeholders have not gone far enough to facilitate and encourage the recruitment and advancement of underrepresented minorities in biomedical research. This is unacceptable. Here, the NIH director and principal deputy director outline steps that NIH is taking to seek the causes of this institutional failure and initiate remedies.

Seeking Causes

First, we have explored whether the findings reported by Ginther *et al*. are unique to the 2000 to 2006 cohort of researchers applying for R01 grants, which are the most common type of NIH funding and are considered a major milestone in an independent research career. When we compared the success rates of underrepresented minorities who had previously been recipients of either the National Institute on Minority Health and Health Disparities (NIMHD) Loan Repayment Program (LRP) or an NIH Research Training and Fellowship Award (T and F series) or a Career Development Award (K series), a similar trend was observed for black R01 applicants, indicating that the findings of Ginther *et al*. may indeed be generalizable (*4*). Our data also show that blacks and Hispanics are less likely to reapply after failing to receive funding on their first try, but the reasons for this are not currently known. We have also explored the possibility that underrepresented applicants traditionally apply for support in scientific fields that have lower success rates. Our preliminary analyses indicate that this is not the case; however, more in-depth study is needed.

We also looked to see whether the probability of funding, given a particular priority score, varied by race. As observed by Ginther *et al*., no differences were noted; differential success rates apparently arise during the review process itself, not in subsequent steps.

Taking Action

Service on an NIH review committee was shown by Ginther *et al*. to be one of the factors that correlated with success in grant

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applications. In response, NIH's Center for Scientific Review (CSR) has initiated a new Early Career Reviewer program (*5*), which engages junior faculty to participate in peer-review panels and learn how these groups discuss, evaluate, and score grant applications. The goal is to enable participating scientists to become more competitive as grant applicants and to develop their skills as critical, well-trained reviewers. CSR is making a special effort to inform investigators from underrepresented groups about this program. CSR recently requested nominations of faculty at less research-intensive institutions who have published in high-quality scientific journals but who may not yet have received major peer-reviewed research support. Our aim is to have at least 50 Early Career Reviewers assigned to each of the three rounds of grant review in FY 2012.

We will also assess the value of providing additional technical assistance to applicants in grant preparation and supporting innovative approaches to encourage more extensive and experienced local mentoring of junior faculty. NIH currently conducts many grant outreach workshops around the country (*6*) and provides a series of Web-based tools to assist applicants (*7*). However, we will seek to expand and strengthen those programs.

The well-described and insidious possibility of unconscious bias (*8*) must be assessed. We will run pilot experiments in which identical grant applications are reviewed by two groups: one that sees and evaluates only the scientific merit of the proposal, and another that sees and evaluates the entirety of the grant proposal according to the current review process. Furthermore, we will also assess the presence of hidden bias among reviewers and staff using tests of unconscious racial preferences, such as those pioneered by Project Implicit (*9*).

We will also investigate other parameters that may affect outcomes in the peer-review process, including an assessment of the effect of different levels of diversity representation among NIH leadership, scientific review officers, members of NIH review committees, and Boards of Scientific Counselors.

Building a More Diverse Workforce

In addition to tackling the problem of differential success rates in grant applications, we need to identify effective approaches for encouraging more underrepresented minorities to earn advanced degrees in the biomedical sciences and to pursue appropriate postdoctoral training. Over the course of the past four decades, NIH has made a considerable investment in recruiting members of underrepresented racial and ethnic groups, women, individuals with disabilities, and individuals from disadvantaged backgrounds into biomedical research. Although such efforts have yielded heartening stories of individual success, the scientific evidence still shows that we have a long way to go (*10*). Our workforce remains woefully underrepresented in Hispanics, African-Americans, and Native Americans compared with the U.S. population. The inescapable conclusion is that we are missing critical contributors to our talent pool.

NIH will pursue several approaches to enhancing recruitment. First, we will undertake a thorough evaluation of current training programs to see what has worked and what has not. Programs that have failed to produce results will be phased out. Those that have shown signs of success will be nurtured and expanded. We will seek to learn from the outcomes of several new research programs that are already under way, including the NIH Director's Pathfinder Award to Promote Diversity in the Scientific Workforce program (*11*), the trans-NIH Research on Causal Factors and Interventions that Promote and Support the Careers of Women in Biomedical and Behavioral Science and Engineering program (*12*), and the National Institute of General Medical Sciences (NIGMS) awards for Research to Understand and Inform Interventions that Promote the Research Careers of Students in Biomedical and Behavioral Sciences (*13*).

Conclusion

Troubling data such as these require substantive action. Compelling evidence supports the view that diversification of the research workforce is an imperative for our nation's continued success (*14*). The data presented by Ginther *et al*. document that we are falling short in inclusivity and are thus failing to realize the benefits afforded by a diverse workforce. Although the Ginther *et al*. study analyzed success rates among extramural researchers, we are aware that similar issues related to the career advancement of underrepresented groups exist within the NIH intramural program.

To support these data-driven efforts, the NIH leadership has established high-level internal and external task forces that will report to the NIH director (*15*). We will also need the strong support of academic institutions, where most of the work goes on, to pursue this critical agenda.

We must rapidly move forward with the requisite data analysis and the development of appropriate interventions. NIH has a responsibility to set a strong example for all biomedical research organizations. Consequently, we call upon every institution and scientist supported by NIH to join with us to reinvigorate efforts to diversify our nation's current and future biomedical research workforce. This will take many forms, including local efforts to enhance mentoring, NIH's provision of additional tools to enable such mentoring, and a renewed willingness of institutions to provide their faculty with protected time to pursue research. These varied actions will be united by a common goal: weaving a new, richer, and more beautiful research tapestry from all of the available threads.

References and Notes

1. Because the applications examined were from an equal number of noncitizens and U.S. citizens who self-identified as black or African American, the term "black" is used to describe the group.
2. D. K. Ginther *et al*., *Science* **333**, 1015 (2011).
3. R. K. Merton, *Science* **159**, 56 (1968).
4. R01 application outcomes for all cohorts were examined from FY 2000 to FY 2010. Cohorts studied were 1995 to 1998 for predoctoral (T), 1998 to 2000 for postdoctoral (F), 2001 to 2003 for career development (K), and 2003 to 2005 for NIMHD LRP.
5. Early Career Reviewer Program, http://grants.nih.gov/podcasts/all_about_grants/episodes/Review_Groups_July_%202011.htm.
6. Workshops and Training, Office of Extramural Research, NIH http://grants.nih.gov/grants/outreach.htm.
7. Grants Process Overview, Office of Extramural Research, NIH, http://grants.nih.gov/grants/grants_process.htm.
8. M. Bertrand, S. Mullainathan, *Am. Econ. Rev.* **94**, 991 (2004).
9. Project Implicit, https://implicit.harvard.edu/implicit.
10. National Research Council, *Assessment of NIH Minority Research and Training Programs, Phase 3* (National Academies Press, Washington, DC, 2005).
11. NIH Director's Pathfinder Award to Promote Diversity in the Scientific Workforce, www.nigms.nih.gov/News/Results/20101026.htm.
12. NIH, Research on Causal Factors and Interventions that Promote and Support the Careers of Women in Biomedical and Behavioral Science and Engineering. http://womeninscience.nih.gov/funding/index.asp.
13. NIGMS, NIH, Research to Understand and Inform Interventions that Promote the Research Careers of Students in Biomedical and Behavioral Sciences. www.nigms.nih.gov/Research/FeaturedPrograms/Minority/Interventions.htm.
14. National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads* (National Academies Press, Washington, DC, 2011).
15. Two high-level groups have been established: (i) the NIH Diversity Task Force, made up of senior NIH leaders reporting to the NIH director and focusing on a number of issues relevant to diversity (including race, ethnicity, economic disadvantage, and disability) in the U.S. biomedical research workforce; and (ii) the Advisory Committee to the Director's Diversity in Biomedical Research Working Group, composed of national thought leaders. http://acd.od.nih.gov/DBR.asp.
16. The authors would like to thank numerous colleagues for their helpful input on this commentary.

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