National Institutes of Health

Report on the Progress of Activities

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Executive Summary

Following recommendations issued in 2012 by the ACD Working Group on Diversity (ACD WGD), the NIH Scientific Workforce Diversity office (SWD) led by Dr. Hannah Valantine has since made significant progress addressing identified scientific workforce diversity gaps with innovative, data-driven strategies and programs. Since 2014, SWD has addressed all the 2012 recommendations, as described in this report.

The purpose of this report is twofold. Part I provides an overview of activities and accomplishments in both the NIH-funded extramural and intramural research programs to address the ACD WGDBRW's 13 recommendations (2012). For reference, summaries of these activities include the full text of the ACD WGDBRW recommendation for each activity. Part II outlines the process used by the ACD WGD to develop a new set of recommendations designed to accelerate diversity in the scientific workforce. This process included data-driven analyses of demographic trends among biomedical researchers over time and assessment of NIH funding for investigators during various career phases as well as the overall NIH investment in diversity-focused programs across the career path. These data reveal persistent gaps that pose barriers to achieving scientific workforce diversity and thus provide the rationale for the ACD DWG's new recommendations that will work in tandem with ongoing activities responsive to the 2012 recommendations described in Part I of this report.

Progress to date reflects strategies and outcomes conducted across the NIH-funded workforce, both extramurally and intramurally. NIH's flagship extramural diversity effort, established in 2014, is the Diversity Program Consortium (DPC), consisting of BUilding Infrastructure Leading to Diversity (BUILD), the National Research Mentoring Network (NRMN), and the Coordination and Evaluation Center (CEC). This integrated triad was designed to employ a rigorous, controlled methodological framework. The CEC is evaluating all 10 BUILD programs and NRMN, using clearly defined metrics of success for students, faculty, and institutions. This coordinated strategy to evaluation using a multi-methods approach deployed through the CEC has never before been used to assess diversity programs. The annual evaluation metrics are poised to identify which individually targeted approaches are effective and in what institutional contexts they produce the most impact. In concert with this work at a national level, SWD has developed and is now testing new approaches for outreach and recruitment within the NIH intramural research program (IRP). Importantly, successful strategies from both extramurally and intramurally targeted programs will be shared broadly.

In collaboration with the National Institute of General Medical Sciences (NIGMS) and the NIH Office of Extramural Research (OER), SWD conducted a range of analyses of scientific workforce diversity programming and identified a lack of programs designed specifically to enable seamless transition from training phases into independent careers, including those in academia, industry, science policy and administration, and others. In keeping, the ACD WGD 2017 recommendations outlined below thus convey a new focus on the transition to career independence. In addition, many of SWD's approaches implemented in response to the 2012 recommendations addressed barriers to recruitment, retention, and advancement of students and trainees, and were thus targeted to individuals. Thus, the ACD WGD 2017 recommendations reflect a deliberate pivot toward integrated solutions that effect systems-level

and culture change, as the ACD WGD feels strongly that it is now timely to develop and evaluate a set of strategies that are more specifically targeted to institutional systems and processes.

The 13 ACD WGD 2017 recommendations are distributed among the same three focus areas as were the 2012 recommendations: NIH Institutional Support and Oversight; Mentoring, Career Development, Recruitment, and Retention; and Research and Intervention. Collectively, the new recommendations are intended to leverage institutional systems and processes explicitly, to evoke culture change that supports and sustains diversity in the scientific workforce as an essential element for excellence in biomedical research. The new recommendations aim to: 1) create a culture of transparency and accountability in institutional processes; 2) enhance diversity across the career trajectory by focusing on transition points; and 3) deploy research-based interventions to eliminate systemic bias with the goal of ensuring fairness in peer review and creating inclusive environments.

Part I: Progress Report

Background

Advisory Committee to the NIH Director (ACD) Working Group on Diversity in the Biomedical Research Workforce (WGDBRW)

To ensure that NIH continues to attract the best talent to biomedical research, the agency is committed to enhancing the diversity of its funded workforce. The Advisory Committee to the NIH Director (ACD) Working Group on Diversity in the Biomedical Research Workforce (WGDBRW) deliberated on this issue and provided recommendations that were endorsed by the ACD and provided to the NIH Director in June 2012. The WGDBRW undertook its general charge to examine the factors that contribute to the current state of diversity in the biomedical and biobehavioral research workforce and its specific charge to examine the findings and implications of the report by Donna Ginther, et al., "*Race, Ethnicity, and NIH Research Awards" (2011).*[1]

The NIH-commissioned study by Dr. Ginther and her colleagues examined the funding probability of Ph.D. R01 applicants during fiscal years (FY)[2] 2000-2006 with respect to applicant race and ethnicity, using data from NIH's grants database (IMPAC II) and various other sources. Ginther, et al. found significant disparities in the R01-funding probability for both Asian applicants (5.4 percentage points less likely) and African-American/Black applicants (13.2 percentage points less likely), compared to White applicants. When the researchers restricted the study sample to applicants who were U.S. citizens when they received their Ph.D., the difference observed between Asian and White applicants was no longer statistically significant, whereas the disparity between Black and White applicants persisted. The WGDBRW concluded that the problem is serious and worthy of significant financial and other resource attention. The 2012 report prepared by the Advisory Committee to the Director (ACD) Working Group on Diversity in the Biomedical Research Workforce (WGDBRW) outlined 13 recommendations (Appendix A), aligned below (retaining their original recommendation numbers) in Figure 1 in three general focus areas: NIH Institutional Support and Oversight; Mentoring, Career Development, Recruitment, and Retention; and Research and Intervention.

Figure 1: ACD WGDBRW 13 Recommendations

[1] Ginther, D. K., W. T. Schaffer, J. Schnell, B. Masimore, F. Liu, L. L. Haak & R. Kington (2011). "Race, ethnicity, and NIH research awards." Science 333: 1015-9.

[2] The federal fiscal year begins on October 1 and ends of September 30. The fiscal year is named by the calendar year in which it ends. For example, FY 2000 began on October 1, 1999 and ended on September 30, 2000.

I. NIH Institutional Support and Oversight Recommendations

A key recommendation of the 2012 ACDBRW report was to establish a centralized office to coordinate NIH scientific workforce diversity, led by an established biomedical scientist with expertise in diversity in academic settings. Accordingly, in March 2014, NIH appointed Dr. Hannah Valantine as the inaugural Chief Officer for Scientific Workforce Diversity (COSWD), succeeding acting COSWD Dr. Roderic Pettigrew who served before Dr. Valantine's arrival to NIH. The Scientific Workforce Diversity office (SWD)'s vision is to employ scientific rigor and data-driven processes to enhance and sustain diversity and inclusion at NIH.

Appointment of Chief Officer for Scientific Workforce Diversity (COSWD)

Recommendation #12

As NIH's Chief Officer for Scientific Workforce Diversity (COSWD), Dr. Hannah Valantine serves as a member of the NIH Director's senior leadership team and as the co-chair of the Working Group on Diversity of the Advisory Committee to the NIH Director (ACD WGD) among other responsibilities. Under her leadership and expertise, NIH has addressed all 13 of the ACDBRW recommendations through developing and rigorously testing new programs, policies, and practices designed to evoke cultural change nationally across the U.S. biomedical research workforce. To accomplish the SWD mission and goals, Dr. Valantine works closely with the NIH Office of Equity, Diversity, and Inclusion (EDI), the NIH Office of Human Resources (OHR), the NIH Office of Extramural Research (OER), the NIH Office of Intramural Research (OIR), the NIH Office of Research on Women's Health (ORWH), the National Institute of General Medical Sciences and other Institutes/Centers, and many other stakeholders including professional societies and academic leadership. As specified in the appointment recommendation, Dr. Valantine is an established clinical investigator in the field of cardiovascular science with a focus on heart transplantation. In her current research as a tenured senior investigator in the NHLBI intramural research program, she is assessing the broader clinical utility of cell-free DNA sequencing technology for graft-rejection/infection surveillance in heart- and lung-transplant patients. She has established a prospective, multi-center extramural-intramural research consortium -- the Genome Research Alliance for Transplantation (GRAfT) -- that

Recommendation #12: Appoint a Chief Diversity Officer (CDO) and establish an Office of Diversity with a suitable budget. The CDO should be an established biomedical scientist with considerable expertise in diversity in academic and academic medical settings. The CDO should report directly to the NIH Director and be responsible for ensuring the coordination of diversity-focused efforts across the NIH, including:

- developing diversity training programs for investigators
- providing resources to facilitate the recruitment of URM scientists, women, persons with disabilities, and veteran candidates
- supporting scientific research in diversity as related to STEM professions, health care, the interrelationship of a diverse health care workforce to a diverse scientific community, health care policy, health care delivery, and other related areas
- undertaking a systematic and thorough review of all IRP programs and determining appropriate intervention points
- recruiting and retaining diverse tenure-track scientists
- training post-baccalaureate, postdoctoral, and other levels of scientists at the NIH

leverages the intellectual capacity of extramural clinical centers with genomic approaches that Dr. Valantine has established within her NHLBI Laboratory of Transplantation Genomics laboratory. The GRAfT infrastructure, which is powered by the resources of the NIH clinical center allows the Valantine lab to ask fundamental questions about the mechanisms of chronic allograft injury in thoracic-transplant recipients, as well as how injury induced by infection and rejection triggers the onset and progression to graft loss.

Scientific Workforce Diversity (SWD) Office

Dr. Valantine leads NIH workforce diversity efforts by establishing and staffing the SWD office, co-chairing key internal and external committees, and developing approaches to measure and evaluate diversity-targeted programs. Because of these efforts, SWD is now poised to share evidence-based strategies with the NIH intramural and extramural communities. The SWD office is made up of a team of operations, programmatic, and communications staff members with expertise in biomedical, behavioral, and social science, as well as data analytics. Eight are Ph.D. level. The SWD website serves as a centralized source of information on scientific workforce diversity across the NIH-funded workforce [Figure 2].

Figure 2: The SWD website diversity.nih.gov

Overview of SWD Strategic Goals and Objectives

The overarching responsibility for SWD is to ensure the effective coordination of diversity efforts across NIH extramural and intramural programs, using innovative and data-driven approaches that are designed to enhance diversity in the scientific workforce rapidly and sustainably. To accomplish this charge, Dr. Valantine has articulated a mission for NIH diversity:

> "*Be a model for growing the diverse talent in biomedical research across our nation through research innovations and data-driven interventions in diversity inclusion policies, processes, and programs.*"

In alignment with the WGDBRW 13 recommendations (2012), SWD is achieving its mission through the following strategic goals, published in PNAS and co-authored with the NIH Director:[3]

- Expand scientific workforce diversity as a field of inquiry.
- Build and implement evidence related to diversity outcomes.
- Understand the role of sociocultural factors in biomedical recruitment and retention.
- Sustain nationwide workforce diversity with seamless career transitions.
- Promote the value of scientific workforce diversity.

[3] Valantine, H.A. & F.S. Collins (2015). "National Institutes of Health addresses the science of diversity." PNAS 112: 12240-42.

COSWD Leadership Roles at NIH

COSWD serves as the chair or co-chair of key leadership committees, along with other NIH senior scientific leaders: the Advisory Committee to the Director Working Group on Diversity (ACD WGD), the Subcommittee on Climate and Workplace Harassment, the NIH Steering Committee Diversity Working Group, the NIH African-American/Black R01 Funding Disparities Working Group, and the Addressing Gender Inequality in the NIH Intramural Research Program Action Task Force. In addition, COSWD co-chairs the Diversity Program Consortium Leadership group that was established to provide internal oversight for the Diversity Program Consortium. With strong leadership from COSWD, these groups, described below, have provided input on the development and implementation of the evidenced based, innovative programs described in this report.

External Committees

Advisory Committee to the Director Working Group on Diversity (ACD WGD)

Recommendation #6

A standing working group of the ACD, the Advisory Committee to the Director Working Group on Diversity (ACD WGD), was formed in response to ACD WGDBRW recommendations. The ACD WGD (http://www.acd.od.nih.gov/wgd.htm) is a permanent working group of the ACD and its mission and charge is to provide regular advice to the ACD and, in turn, to the NIH Director on effective strategies to increase the representation of diverse individuals underrepresented nationally in biomedical research, and to reduce disparities in research awards from diverse applicants underrepresented nationally in biomedical research.[4]

Recommendation #6: Establish a working group of the ACD, of racially and ethnically diverse scientists, to provide regular input to the Director of NIH, and the Institutes and Centers, regarding the state-of-the-art in effective programs that overcome or reduce disparities in research awards.

Dr. Valantine and a current member of the ACD, Dr. Elba Serrano, serve as co-chairs of the ACD WGD, which consists of 13 members who provide expertise in advancing SWD goals.

The ACD WGD first met in June 2013 to discuss its charge and the ACD WGDBRW report and recommendations (2012). Thereafter, the ACD WGD has met on a quarterly basis by teleconference and in total, 19 meetings (four times in person and fifteen via video or teleconference). The ACD WGD met most recently in April 2017 for an in-person 1 ½ day meeting in Phoenix to review this report that analyzes NIH's actions and progress towards addressing the ACD WGDBRW 13 recommendations (2012). The ACD WGD plans to submit this report to the full ACD in June 2017.

ACD Working Group Subcommittee on Workplace Climate and Harassment

The NIH Subcommittee on Workplace Climate and Harassment was established in 2016 to help the ACD examine NIH's analysis of how workplace climate and/or harassment may be affecting individual careers and NIH workforce diversity. Its activities include development of an NIH workplace climate and

[4] National Institutes of Health, "Advisory Committee to the Director Working Group on Diversity, Mission and Charge." Accessed March 28, 2016. http://www.acd.od.nih.gov/wgd.htm

harassment survey, including survey design, administration, analysis, and dissemination of results. Survey results will serve as a baseline assessment to measure future workplace climate and harassment improvements at NIH and to create tailored campaigns that raise awareness of workplace harassment, strategies for anti-harassment training, and cohesive programs to reduce harassment and retain talented individuals in science and in the workforce.

Dr. Valantine serves as the chair of a subcommittee of four members (See Appendix B) who are external to NIH and represent four different academic institutions. Each has expertise in workplace climate and harassment issues as well as survey methodology.

The subcommittee has met three times since its inception—once in person and twice via teleconference. During these meetings, the committee reviewed the overall aims of the survey, regarding specific issues the survey should address, and discussed draft versions of a survey prototype.

Intramural Committees

NIH Steering Committee Diversity Working Group

The NIH Steering Committee Diversity Working Group provides advice and recommendations on diversity and inclusion issues affecting the intramural and extramural research communities and the NIH workforce. Dr. Valantine and a current member of the NIH Steering Committee (Dr. Gary Gibbons, NHLBI Director) serve as co-chairs of the NIH Steering Committee Diversity Working Group.

This group has trans-NIH leadership representation including NIH Office of the Director leadership and Institute and Center (IC) leaders and directors. The group meets monthly to review progress and provide COSWD with advice on a number of issues. These have included new analysis of the funding disparity for African-American/Black R01-grant applicants; recommendations for the Addressing Gender Inequality in the NIH Intramural Research Program Action Task Force; as well as extramural diversity-focused program policies and evaluation. The idea for a new IRP program to enhance diversity at the graduate student level (GSOAR) is a direct output of this group's deliberations (see section on diversity in NIH Intramural Research Program in this report).

Addressing Gender Inequality in the NIH Intramural Research Program Action Task Force

Extensive NIH-funded research has documented persistent gender inequality in biomedicine. In a collection of articles supported by ORWH and published in the journal *Academic Medicine* in August 2016,[5] women faculty were reported to have lower salaries, smaller start-up packages, and limited authorship roles. The findings suggest that such factors might be direct contributors to perpetuating the lack of gender diversity in the academic ranks of biomedical research careers. Across the United States, women comprise 45% of tenure-track faculty, 29% of tenured faculty, and even fewer hold leadership positions (department chairs, medical school deans). The situation is even worse for certain racial/ethnic groups who comprise 10% of biomedical Ph.D. recipients but only 4% of research faculty.[6] The

[5] *Academic Medicine*, August 2016 - Volume 91 - Issue 8: http://journals.lww.com/academicmedicine/Pages/toc.aspx?year=2016&issue=08000

[6] AAMC Facts and Figures 2016. Current Trends in Medical Education, Diversity in Medical Education: http://www.aamcdiversityfactsandfigures2016.org/report-section/section-3

underrepresentation of women cannot be explained by an insufficient pool of highly qualified women, because women have exceeded half of Ph.D. graduates in the biological sciences for more than 10 years.[7]

Underrepresentation of women in the NIH IRP among its tenured (22% women) and tenure-track scientists (38% women) is worse than the national data, heightening concerns regarding the appearance of gender inequality in the NIH IRP. Research indicates that issues of gender inequality are part of an unsupportive culture and climate experienced in microenvironments, along with structural issues that negatively influence career advancement of women. NIH Director Dr. Francis Collins issued a charge to this group, which reported to the NIH Steering Committee, to develop specific, actionable, recommendations that should go beyond formal policies and include institutional processes for transparency and accountability.

The task force met eight times between October 2016 and January 2017, leading to the recommendations. It concluded that preventing gender inequality and mitigating its consequences starts at the top and requires leadership action and accountability, and that institutional change is essential for sustainability as leadership positions change over time. Because the task force's recommendations align with general principles of institutional change, and transparency in IC-specific data collection and public dissemination, the recommendations also apply to other underrepresented groups and should provide a general compass for addressing workforce inequality more broadly.[8]

II. Mentoring, Career Development, Recruitment & Retention Recommendations

COSWD has collaborated with several offices, including the NIH Office of Program Coordination, Planning, and Strategic Initiation (DPCPSI), NIGMS and other ICs, OIR, the NIH Office of Intramural Training and Education (OITE), and EDI to lead several efforts within the NIH-funding extramural and intramural research programs. These programs are developing innovative and evidence-based approaches to understanding and overcoming the challenges to enhancing diversity in the scientific workforce and developing recruitment tools.

Diversity Program Consortium

Recommendation #8

In response to the ACD WGDBRW recommendations (2012) to enhance infrastructure and support research experiences for biomedical research trainees, DPCPSI's NIH Common Fund program launched the Enhancing the Diversity of the NIH-Funded Workforce program (also referred to as the Diversity Program Consortium (DPC)) in 2014, in collaboration with SWD. The DPC is managed by NIGMS under the leadership of Dr. Alison Gammie, Director of the Division of Training, Workforce Development, and

[7] National Science Foundation, National Center for Science and Engineering Statistics. 2016. *Doctorate Recipients from U.S. Universities: 2015*. Special Report NSF 17-306. Arlington, VA. Available at www.nsf.gov/statistics/2017/nsf17306/.

[8] Michael Gottesman and Hannah Valantine (2017). Ensuring Gender Equity at NIH. The NIH Catalyst, Volume 25, Issue 2.

Diversity. Dr. Valantine serves a coordinating leadership role, functioning as chair of the DPC Leadership group that includes Dr. Gary Gibbons (NHLBI), Dr. Jon Lorsch (NIGMS), Dr. Eliseo Pérez-Stable (NIMHD), and Dr. Roderick Pettigrew (NIBIB). The group provides internal oversight for the DPC.

The nationwide DPC consists of three integrated initiatives: (1) BUilding Infrastructure Leading to Diversity (BUILD), (2) the National Research Mentoring Network (NRMN), and (3) the Coordination and Evaluation Center (CEC). Collectively, the DPC represents a critical investment in student development; faculty training and mentoring; infrastructure development; and rigorous assessment and evaluation of intervention strategies that are necessary to achieve NIH's goal of enhancing diversity in the biomedical and health professional workforce. The long-term goals of the DPC's three integrated initiatives (BUILD, NMRN, and CEC) [Figure 3] are to enhance diversity in the biomedical research workforce through the development, implementation, assessment, and dissemination of innovative and effective approaches to (a) student outreach, engagement, training and mentoring; (b) faculty development; and (c) institutional research training infrastructure.

Recommendation #8: Under the leadership of NIMHD, and in coordination with other STEM initiatives underway in HHS and across other Federal government agencies, NIH should undertake a bold, well-funded, multi-year, incentive-based, competitive grant process to support infrastructure development in those comparatively under-resourced institutions with a documented track record of producing and supporting URM scientists as well as stimulating creative partnerships among these institutions and, where appropriate, including more resource-rich institutions.

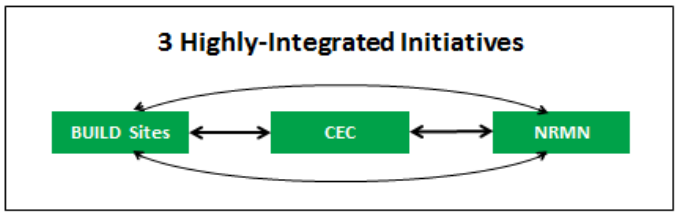


Figure 3: The DPC's three integrated initiatives (BUILD, NMRN, and CEC)

The DPC approach is applying the scientific research paradigm to examine the efficacy and impact of research training and mentoring activities across populations and contexts, collecting data, and sharing information across the consortium in real time. This sets apart the DPC from other training grants in which program analysis is conducted after the grant period ends. In FY2014, NIH awarded 12 five-year awards totaling approximately $250 million. Ten BUILD awards were issued to undergraduate institutions, along with their funded and unfunded research and pipeline partner institutions [Figure 3]. One NRMN award was issued, which includes an administrative core, and four operational cores through which the NRMN goals are implemented, each situated at one of four partner institutions. These cores oversee work with over 100 partner institutions and organizations. One CEC award was issued to the University of California, Los Angeles, to coordinate and evaluate activities across the consortium.

The 10 funded BUILD institutions are partnering with roughly 100 pipeline or research-intensive partner institutions, and the NRMN award includes five core partner institutions and over 100 partner organizations and organizations [Figure 4].

The DPC provides a unique opportunity to understand and address multi-dimensional factors (at the institutional, social, and individual levels) that may strongly influence student success, professional development, and persistence in biomedical research careers. It builds upon and moves beyond existing programs and paradigms to support transformative approaches to student engagement, research training, mentoring, faculty development, and infrastructure development. An expected result is transformation at awardee institutions, but broader transformative impact will occur with dissemination of lessons learned to enable nationwide adoption of evidence-based effective strategies.

The DPC consists of three highly integrated initiatives dedicated to investigating which training experiences are effective in various contexts.

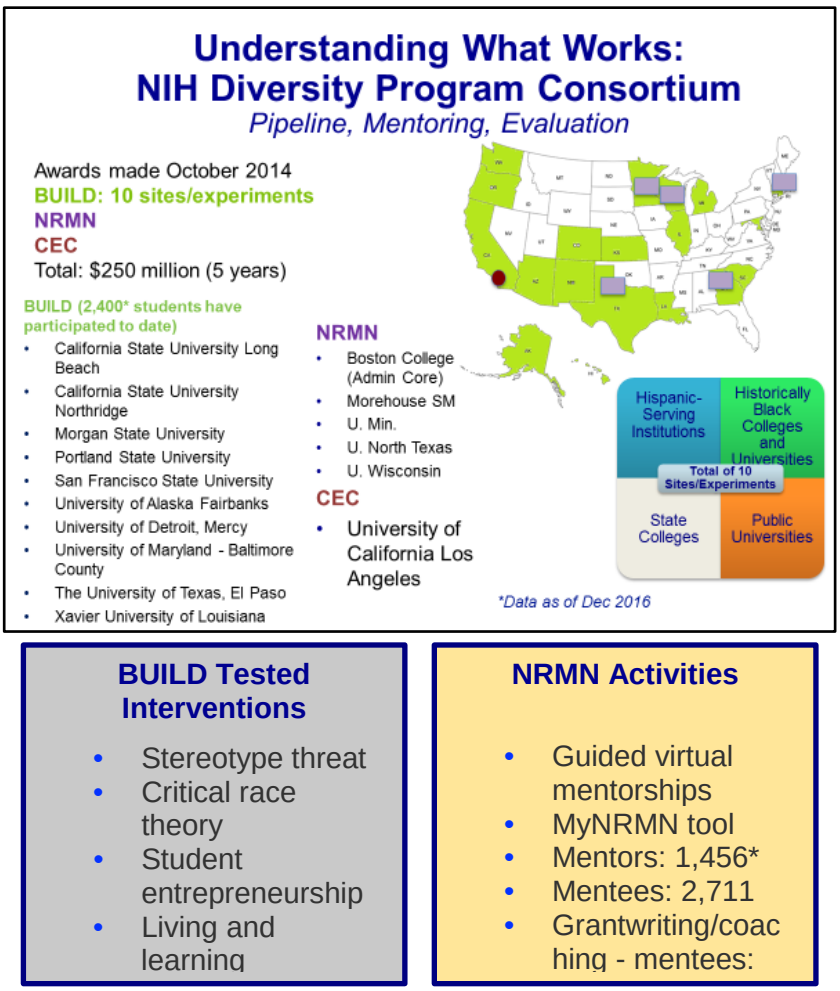


Figure 4: Ten BUILD, one NRMN with four core sites and one CEC awardee listed and displayed geographically. Highlighted in the boxes above are (on the left) the key interventions being tested by BUILD and the key NRMN activities (on the right).

Hallmarks of Success

Developed collaboratively by the CEC and the DPC steering committee, hallmarks of success measure academic achievement as well as psychosocial competencies at each phase of the biomedical career pathway. They are divided into three domains: student/mentee, faculty/mentor, and institutional (See Appendix C). They provide a framework to assess the factors/measures that contribute to the success and retention in a career in biomedical research and are being measured within and across the DPC sites longitudinally. The student/mentee hallmarks are evaluating science identity and scientific self-efficacy, and are focused on retention and persistence in biomedical research training. The faculty/mentor hallmarks are related to increased participation in professional development activities such as improving the quality of mentoring and increased research productivity in publications, grant submissions, and awards. The institutional hallmarks focus on the availability of career-development resources and opportunities for students and faculty such as collaborative environments and financial assistance to enhance student success. The DPC has also developed approaches to enable early-career scientists to

meet the hallmarks, test the efficacy of the approaches, and adjust approaches during the course of the program to maximize impact.

Progress to Date

BUilding Infrastructure Leading to Diversity (BUILD)

Recommendation #8

BUilding Infrastructure Leading to Diversity (BUILD) is a set of experimental training awards designed to learn how to attract students from diverse backgrounds into the biomedical research workforce and encourage them to become future contributors to the NIH-funded research enterprise. Flexibility to innovate is an emphasis of the BUILD initiative. BUILD institutions are encouraged to incorporate additional innovative methods to engage and prepare underrepresented students for competitive success -- including those students who might not otherwise choose biomedical research careers, or who might not qualify for biomedical honors programs or resources.

BUILD institutions, along with partner institutions, broaden the potential pool of participating students and maximize opportunities for research training and faculty and staff development by serving a geographically and racially diverse population.

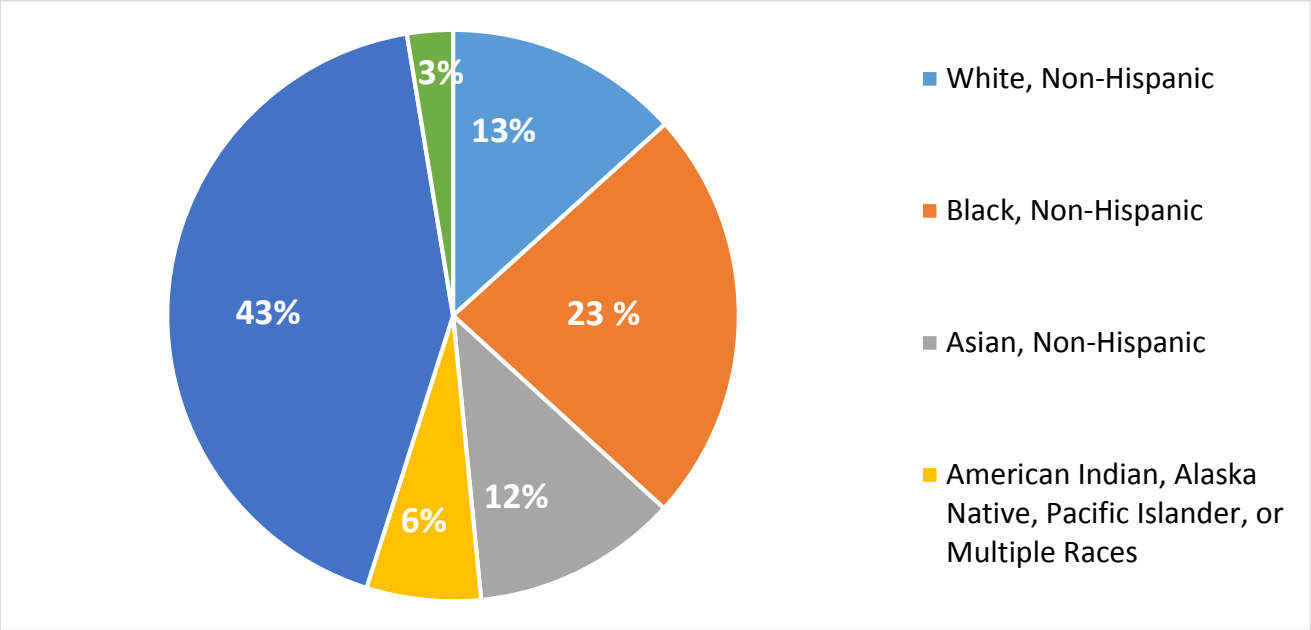


Figure 5: Race/Ethnicity of BUILD-Sponsored NRSA Trainees (2014-April 2017)

BUILD institutions and partners include Historically Black Colleges and Universities (HBCUs) and other schools with a track record of serving students from underrepresented groups (including Hispanics, Asian Americans, Native Americans, Pacific Islanders, Alaska Natives, and students with disabilities).

As of Spring 2017, more than 2,400 students have participated in BUILD-related activities. This includes BUILD-sponsored trainees, students who have taken part in summer research opportunities, and students who have participated in BUILD-related seminars, workshops, and/or career development activities. BUILD-sponsored trainees are those students who received National Research Service Awards

(NRSAs). Figure 5 shows the race/ethnicity of the 541 BUILD-sponsored trainees since 2014. The data show that the trainees are from diverse backgrounds, including those underrepresented in the biomedical sciences. As part of the evaluative aspect of the DPC, all BUILD institutions collect data from participants in all BUILD program activities. The data include voluntary demographic data, surveys about career pathways and educational goals, psychosocial competencies, and other topics relevant to DPC hallmarks of success. Demographic data for BUILD participants will be available in late 2017, as will data on program participation.

Nearly 900 BUILD-associated faculty have served as mentors, developed and delivered novel curricula, and/or participated in professional development activities. Faculty members and researchers have published 54 papers citing DPC-funded grants, and more manuscripts are in varying stages of preparation for publication in 2017.

Through the framework developed by the DPC, BUILD institutions are encouraged to share best practices and lessons learned in real time. This is facilitated by working-group calls, meetings, and engagement with NIH project scientists and program officers. In addition to sharing programmatic information within the DPC, BUILD institutions engage in publicly-facing outreach and dissemination about their programming and success stories. BUILD institutions publish news announcements in local media, contribute to the quarterly DPC newsletter, and maintain a presence on social media. The Diversity Program Consortium News page presents a collection of media produced by sites and by outside sources, including news articles, announcements, and student profiles. Analysis of DPC programming and dissemination of best practices is ongoing and will be a focus in upcoming grant years.

Measuring institutional transformation requires time and an assessment framework. Accordingly, the consortium has developed logic models and hallmarks of success (see Appendix C). In addition to early quantitative measures showing student and faculty engagement across BUILD sites and early institutional changes (such as renovated and improved lab spaces, curriculum development, increased mentoring, and support for faculty research), interviews with students indicate the positive impact of BUILD on student experiences (See Appendix D for excerpts from student testimonials).

National Research Mentoring Network for a Diverse Biomedical Workforce (NRMN) Recommendation #5 and Recommendation #3

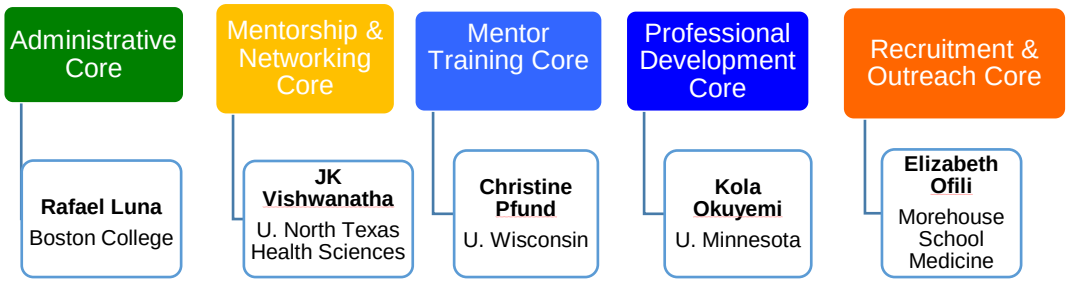


Figure 6: NRMN core structure and their respective principal investigators and institutions

A growing body of evidence demonstrates that effective mentoring increases persistence of trainees in STEM fields. The National Research Mentoring Network (NRMN) initiative was established to develop a highly-networked set of motivated and skilled mentors from various disciplines linked to mentees across the country and to disseminate evidence-based, effective mentoring methods. NRMN is a nationwide consortium to enhance the training and career development of individuals from diverse backgrounds who are pursuing biomedical, behavioral, clinical, and social science research careers through enhanced networking and mentorship experiences. NRMN is also developing best practices for mentoring, providing training opportunities for mentors, and providing networking and professional development opportunities for mentees, including grant writing. Figure 6 shows the NRMN core structure and their respective principal investigators and institutions:

In the first years of implementation:

- NRMN launched the NRMNet.net online portal, which provides mentees with access to mentors across the country and provides mentees and mentors access to various resources. MyNRMN, a web-based platform intended to help biomedical researchers and students connect professionally, was developed in year 2 of the program and has been integrated into NRMNet. MyNRMN includes a CV-builder tool for mentees, personalized calendar functions to set mentoring appointments and trainings, and the ability to browse profiles and invite mentors and mentees from across the country to connect. After connecting, users can share documents and messages with each other through MyNRMN. As of February 28, 2017, 5,242 people have created accounts on NRMNet/MyNRMN (3,091 as mentees, 1,648 as mentors, and 503 were in the process of setting up their account [Figure 7], see Appendix E for testimonials.

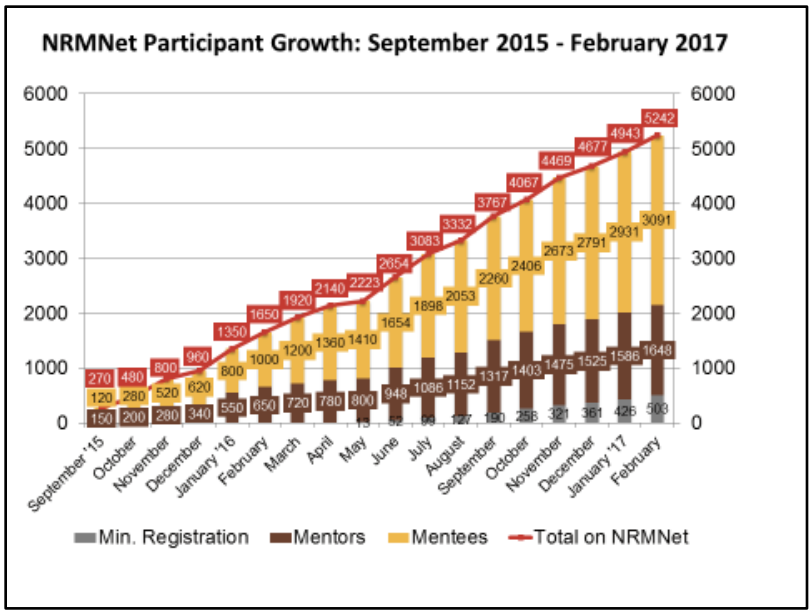


Figure 7: As of February 28, 2017, 5,242 people have created accounts on NRMNet/MyNRMN

- NRMN provides in-person mentor training to faculty and has also developed online mentor training modules for faculty unable to attend in-person trainings. As of February 2017, 40 NRMN Master Facilitators from 20 institutions have trained 3,025 mentors and mentees from over 60 institutions.
- NRMN has launched four unique grant-writing programs at four institutions in different regions of the United States. Two (U. Washington/U. Colorado & U. North Texas Health Science Center) are targeted to applicants with less experience and two are more suited to experienced grant-writing applicants (Northwestern and U. Minnesota). All programs are open to applicants across the NIH-

funded community. Potential mentees apply to workshops depending on schedule availability and experience level.

- Figure 8 demonstrates the timeline of the coaching process. Two models are designed for those individuals who will be working on a grant proposal within the next year: the NRMN Steps Towards Academic Research (STAR) fellowship program runs for 12 months, and the Grantwriting Uncovered: Maximize Strategies, Help, Opportunities, Experience (GUMSHOE) program runs for 8 months. Both models focus on writing skills and grant-proposal basics. The second two models are for those researchers who are currently working on a grant proposal: the Northwestern University (NU) Model Grant Writers Coaching Group runs for 3-4 months, and the NRMN P^3 (Proposal Preparation Program) runs for 4 months. (Link for more detail about each workshop: https://nrmnet.net/grantwriting-coaching-groups/coaches-in-training/#NRMN%20STAR)

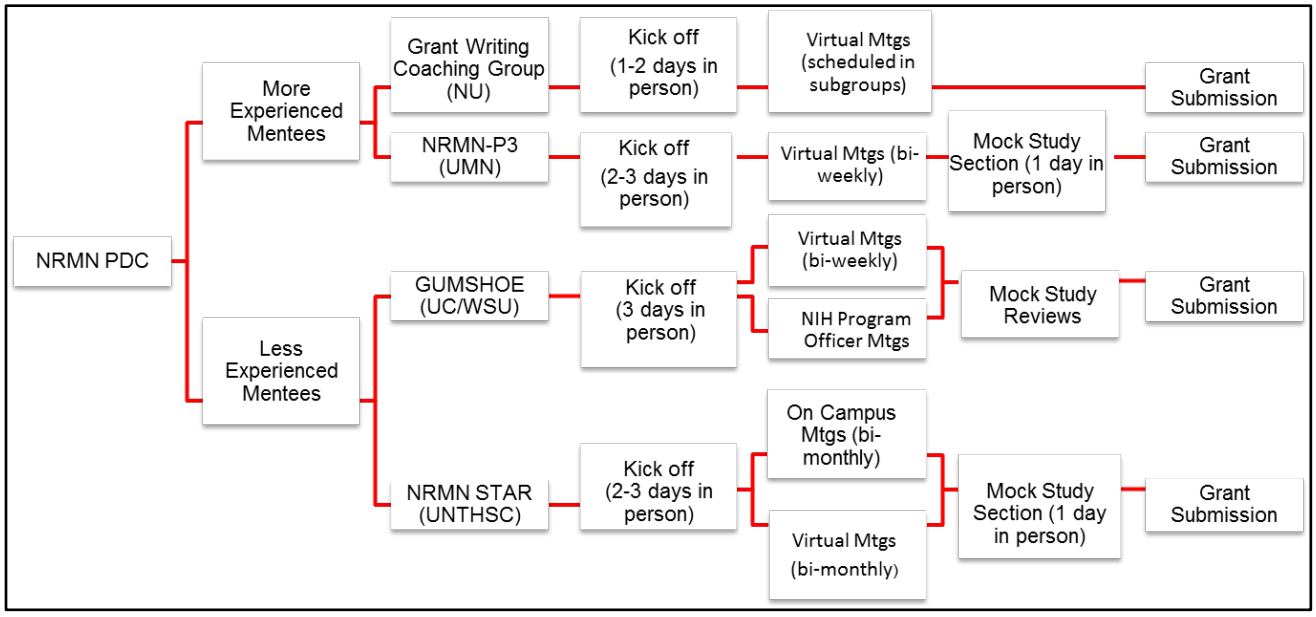


Figure 8: Timeline of the NRMN Grant Writing Coaching Process

- As of February 2017, 351 mentees have taken part or were currently enrolled in grant-writing coaching groups. Out of 221 participants who had completed a grant-writing/coaching experience as of February 2017, 66 diverse participants had submitted grant proposals [Figure 9], see Appendix D for participant testimonials. Ten have been awarded grants (R01, R03, U01, K, and others), 16 had not yet received funding, and 22 were still awaiting responses.

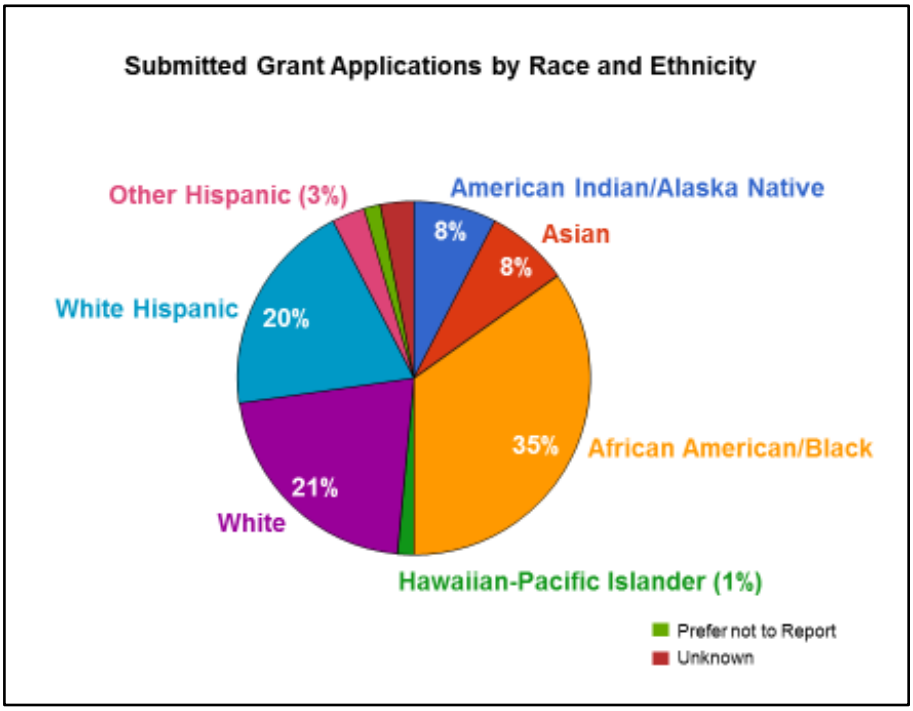


Figure 9: Demographics of the applicants that submitted grant applications from NRMN Grantsmanship Coaching Group

- NRMN has awarded five pilot projects and five supplement project awards to enhance the reach and scope of NRMN.
- NRMN partners with approximately 40 professional and scientific societies [Figure 10]. This improves their networking potential and resource-sharing abilities, while also increasing access to NRMN resources at campuses and academic sites nationwide.
- NRMN's website presents background information, testimonial videos, and information about upcoming events. They publish a monthly online newsletter with updates about events and features on NRMN participants, and use social media (Twitter, Facebook, and YouTube) to share news, information about workshops and mentoring-related articles and videos.

By facilitating long-term, culturally responsive interactions among mentees and mentors, NRMN is working to enhance the diversity of the biomedical workforce. A primary goal of NRMN is to establish a sustainable process whereby diverse mentees successfully progress in their research careers -- becoming the effective mentors, scientific leaders and research team members of tomorrow.

Figure 10: NRMN partners with approximately 40 professional and scientific societies

Coordination and Evaluation Center (CEC)

Recommendation #1

The ongoing evaluation of DPC program implementation and impact at multiple levels is one of the innovative aspects of this grant and training program. The Coordination and Evaluation Center (CEC) was designed to provide operations and data collection support for the longitudinal evaluation of BUILD and NRMN program outcomes, and to promote collaboration between the BUILD sites, NRMN, and NIH. The CEC consists of an administrative core, a data-coordination core, and an evaluation core; all work closely with the consortium Executive Steering Committee.

To ensure that data are collected across all sites as uniformly as possible, the CEC has assisted each BUILD site and NRMN with developing site-level evaluation plans and developed an overarching consortium-wide evaluation plan, which delineates the data collection and analysis of the impact of BUILD and NRMN activities. The CEC worked with other members of the DPC to develop a consortium-wide data-sharing agreement and created guidelines for collaborative publications. During the OMB clearance process, the CEC could not collect data and instead provided guidance to sites. The CEC was actively involved in securing OMB clearance, which was awarded in November 2016. Since then, the CEC has taken a more active role in DPC data collection, storage, and preliminary analysis.

Recommendation #1: The NIH must ensure that appropriate resources are allocated for the systematic tracking, reporting, and evaluation of the immediate and long-term outcomes of all trainees, including those supported on all research project grants.

The NIH should assign a unique identifier to every individual at the time of his/her first NIH-funded training experience to permit tracking of undergraduates engaged in summer research through graduate and postdoctoral training through later career development. Monitoring should include those individuals supported on research project grants and other mechanisms.

Given the lack of data regarding sub-populations of Hispanic researchers, the lack of data regarding people with disabilities, and the suspected substantial differences between socially and educationally advantaged groups and those who are disadvantaged and marginalized, the NIH should immediately begin to enhance its data collection capabilities for these populations.

All programs should undergo systematic review and evaluation every 5 years. Those programs and activities found to be particularly effective in increasing the participation of minorities in the biomedical sciences should be used as models for other programs that are not as effective, and the effective ones should be considered for expansion.

To collect and track longitudinal data for each site, the CEC developed a data-tracking tool and data warehouse. Currently, the CEC is organizing site visits to meet with BUILD students, faculty and institutional leadership to collect qualitative data about student and faculty outcomes, institutional impact, and transformation. The CEC launched the publicly-facing DiversityProgramConsortium.org website and quarterly newsletter for outreach and dissemination among DPC sites and the public. For consortium use, the CEC developed and now maintains an intranet, which includes a DPC calendar, archived meeting notes/ recordings, contact information, and more. Additional CEC consortium activities include coordination of the Executive Steering Committee meetings, three working groups (Implementation, Communications, Recruitment and Retention), and one subcommittee (Publications and Presentations). The Publications and Presentations subcommittee is leading a consortium-wide effort to publish a Special Issue of *BMC*

Proceedings, a peer-reviewed open-access journal, about DPC-related interventions. The Special Issue is scheduled for publication in 2017, and the CEC has worked with sites to revise and edit submissions.

In addition to the systematic approach to evaluation and tracking of the DPC outcomes, efforts to evaluate existing NIH diversity programs have begun at several institutes. These evaluation approaches and results are presented in the Evaluation and Tracking section of this report.

DPC Challenges

NIH oversight of the DPC shifted from NIMHD and SWD to NIGMS in the first year of the award, creating operational complexity. In year 3, the DPC has made significant progress toward achieving goals; yet challenges remain. It has taken more time than expected to issue funding to BUILD sites, in part due to lack of institutional experience and infrastructure to administer grants. Creating a newly research-infused environment has limited progress at some sites, but a best-practices "summit' has helped to overcome these difficulties. Change of the NRMN administrative core PI in year 2, staff turnover, and extensive NRMN PI workload have contributed to delayed synergy among the NRMN cores. A complicated algorithm for matching mentees and mentors has slowed mentor recruitment and led to suboptimal community confidence in the program. The Outreach Core is working to address these issues. Finally, regarding the CEC, governmental requirements presented unforeseen obstacles in development of an evaluation plan and data warehouse. Once these hurdles were cleared, in early 2017, progress on data collection has been swift

NIH Intramural Research Program Workforce Diversity

SDW has lead several innovative efforts within the NIH IRP that serve as a test-bed for diversity-program prototyping that can be scaled and disseminated nationally. These include the development of tools to expand diversity in applicant pools for scientific and leadership positions; enhanced recruitment and outreach programming targeted at various career levels; and implicit-bias education platforms (see page 39 for a description) to support search committees charged with filling positions for tenure-track and tenured-investigator positions.

Recommendation #13: Using the trans-NIH Earl Stadtman Investigator search process as a model, and learning from its experience, the NIH should institute a more comprehensive search process for tenure-track investigators to ensure the identification of a diverse pool of candidates.

Diversifying the Applicant Pool of Tenure-Track and Tenured Scientists

Recommendation #13

SWD is supporting the efforts of the Earl Stadtman Tenure-Track Investigators[9] (Stadtman) search committees through two major

[9] Under the leadership of the NIH Deputy Director for Intramural Research and staff, a pilot recruitment initiative was established called the Earl Stadtman NIH Tenure Track Program. Key recruitment policy and practice for Tenured and Tenure Track positions in the intramural scientific program was reviewed to identify barriers that could impede top talent from securing employment. There are approximately thirty hires per year for Tenure Track jobs at the NIH. An Earl Stadtman pilot initiative was developed in 2009 to provide NIH scientific leadership with a diverse group of high caliber talent to hire into tenure-track positions for the NIH intramural research program.

Barriers identified were the lack of access to role models, mentors and advocates, lack of information about career options and limited interactions between NIH scientists, students, faculty and potential diverse talent. Diversity interventions since the program began include: broadening the marketing to diverse top talent using social media, professional organizations and networks, training scientists on the value of

efforts: 1) development of an internal recruiting tool that identifies potential candidates from diverse backgrounds who have demonstrated a trajectory toward significant scientific contribution, and 2) an implicit-bias education module for search-committee members. These activities intend to increase the diversity of the applicant pool and objectify hiring decision-making processes of the committees. SWD also provided input on language for the Stadtman job postings and selection criteria, toward ensuring a diverse applicant pool. Six of the promising researchers identified by SWD applied to the Stadtman search (including four who participated in the Future Research Leaders Conference, See page 25). Of these, three were selected for interviews, and one was hired, validating the ability to identify competitive candidates. SWD is conducting further analyses to understand the nature of outreach that is needed to optimize application rates once potential applicants are identified.

NIH Internal Tool for Outreach to Potential Applicants of Highly Qualified Scientists

Recommendation #13

SWD has developed an internal recruitment tool to identify diverse talent. The purpose of this tool is to help search committees identify highly qualified scientists from diverse backgrounds for scientific positions at the NIH IRP for their outreach efforts. SWD staff generate a list of highly qualified early-career scientists with a trajectory for tenure-track research positions, as well as senior scientists for senior leadership positions, by mining external and internal data sources. Potential applicants are identified through several mechanisms: (1) personal outreach to external networks of leaders across the country; (2) a systematic approach using bibliometric analyses to identify highly accomplished scientific leaders in specific fields; (3) identification of scientists with a track record of leadership; (4) access to external and internal databases of diverse scholars (DiverseScholar Doctoral Directory, UNCF-Merck

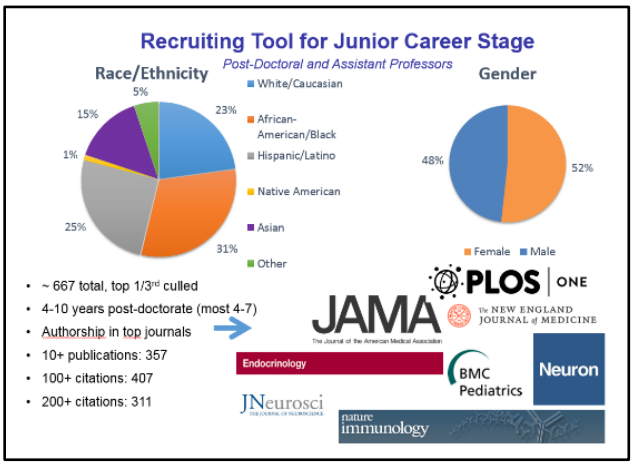


Figure 11: Profile of Junior Scientists identified during our recruitment searches

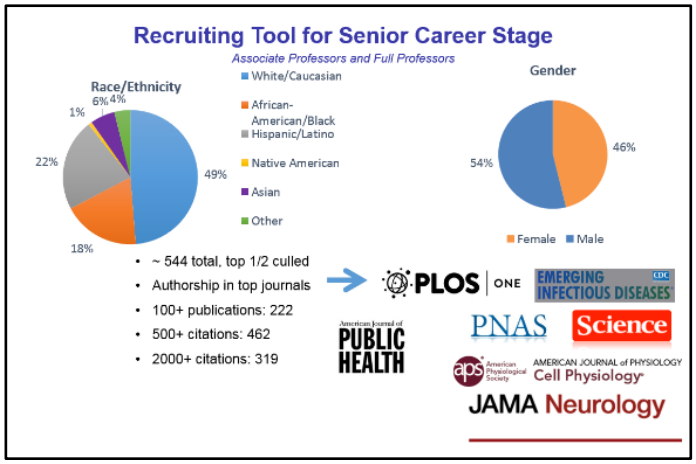


Figure 12: Profile of Senior Scientists and Leadership identified during our recruitment searches

diversity and inclusion, training leadership on unconscious bias and the recruiting process, and developing mentoring networks for diverse talent.

The tracking of applicant and hiring demographics have been part of the Stadtman search, since its inception in 2009. As of April 1, 2016 the percentages of women, and Black and Hispanic scientists hired through the Stadtman search are greater than those for traditional IC-based searches.

Fellows and NIH's IMPAC II system; and (5) use of existing aggregate-level data such as AAMC faculty data in the top 25 schools of medicine.

Since 2015, SWD has supported 45 search committees to identify highly qualified candidates from diverse backgrounds and has provided information of more than 540 highly qualified women and individuals from underrepresented groups to search-committee chairs and hiring managers for various IRP positions ranging from early tenure-track investigators to senior leadership positions (e.g., Director of NIMH; Deputy Scientific Director for NIEHS; Deputy Director for NIBIB) [Figure 11, 12]. Of the 540 highly qualified candidates identified, our records suggest that more 17 candidates have taken part in the application cycle [Figure 13].

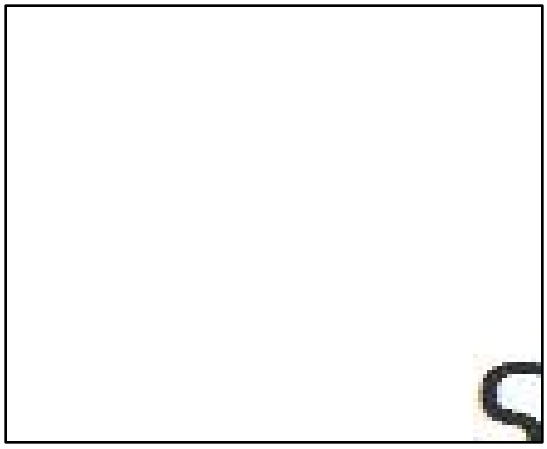


Figure 13: SWD's Recruitment Efforts

The SWD is conducting an evaluation of its recruitment-tool efforts to determine the effectiveness of this outreach method used by the search committees. The SWD implicit-bias educational module, described below, is also key part of the SWD integrated approach to enhancing diversity in the scientific workforce.

Future Research Leaders Conference

The SWD-sponsored NIH Future Research Leaders Conference (FRLC) is a career-development event for talented early-career scientists from diverse backgrounds who are interested in developing an independent research career. The event is held in conjunction with the fall NIH Research Festival to promotes knowledge and awareness about scientific career opportunities in the NIH IRP; thus, FRLC also serves as a trans-NIH outreach model to enhance scientific workforce diversity within NIH. FRLC outreach efforts focus on recipients of NIH extramurally funded programs such as the Diversity Supplement to leverage NIH's investments in diversity from earlier stages in an investigator's career path.

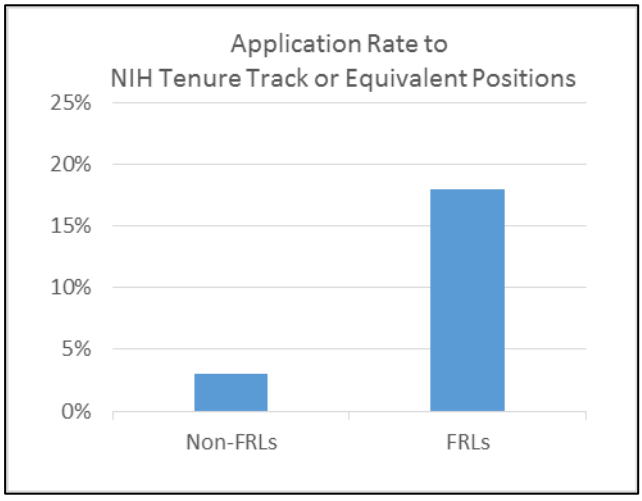


Figure 14: Percentage of conference attendees and non-attendees applied to a NIH Tenure Track or equivalent positions

FRLC has been held in 2015 and 2016 and planning for the 2017 event is underway. Each year, the conference brings approximately 30 early-career scientists from a wide-range of biomedical and behavioral science disciplines to the NIH campus for a 2-day program. During the conference, the visiting scientists attend sessions about IRP career

opportunities and resources, share their own research through oral and poster presentations, and interact with NIH scientific leadership and investigators. In 2016, 120 one-on-one meetings were held between the visiting scientists and NIH scientific investigators and staff, which demonstrates a main focus on creating ample networking and mentoring opportunities for these individuals. To date, there are 57 FRLC participants (63% women, 35% men); 44% are African-American/Black, and 30% are Hispanic. Eighteen percent of the FRLC participants applied to an NIH tenure-track or equivalent position, compared to 3% of those who applied to the conference but did not attend the conference (p = .005, Fisher's exact test) [Figure 14]. This result provides preliminary evidence that the FRLC could be an effective outreach model to increase diversity of the applicant pool of NIH scientific positions.

Graduate Summer Opportunity to Advance Research Program (GSOAR)

In 2016, SWD and the NIH Office of Intramural Training and Education partnered to launch the Graduate Summer Opportunity to Advance Research Program (GSOAR), in response to a recommendation from the NIH Steering Committee Diversity Working Group. The NIH GSOAR Program is an intensive summer research experience for new graduate students in any biomedical discipline aimed at developing communication, critical thinking, career readiness, and leadership skills needed to succeed in graduate school and beyond. One area this program addresses is educating students about resiliency to equip them with the skills and knowledge needed to increase graduate program completion and overall student satisfaction. Topics included building a "resiliency toolkit," fostering a growth mindset, rebutting imposter fears and other "negative head-tapes," staying open to feedback, holistic self-care, and self-awareness and emotional intelligence.

The summer 2016 cohort consisted of a diverse cadre of 19 students [Figure 15] from 16 different institutions (4 HBCUs, 1 HSI), studying nursing, public health, bioinformatics/biostatistics, biomechanics, clinical psychology, speech pathology, as well as more traditional biomedical science fields. Five GSOAR students are now Individual Agreement Graduate Partnership Program students. Three students have on-going collaborations and are considering returning to the NIH IRP. Two master's-level students are considering performing their dissertation research at NIH once they advance to a Ph.D. program. Approximately 53% of the GSOAR students have returned or have plans to return to the NIH IRP.

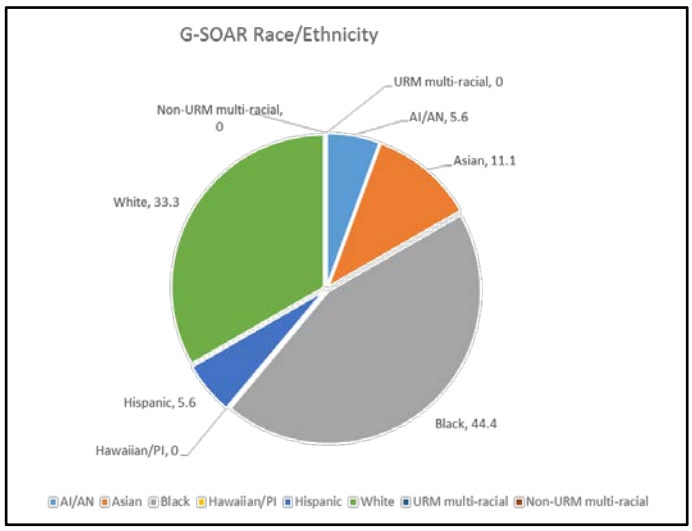


Figure 15: Summer 2016 GSOAR Participants Race/Ethnicity

Overall, the outcomes from the GSOAR students is strongly positive, and participants would highly recommend the program to others [Figure 16] (See Appendix F for program details).

Outcomes

Evaluation Statement	Response Average
Overall Experience	4.74
Research Training	4.47
GSOAR Leadership	4.95
GSOAR Orientation	4.63
Weekly Summer Workshops	4.42

Would you Recommend others to participate in the program?	Responses
Yes	18
Maybe	1

GSOAR Overall Impressions Survey Results; responses based on a Likert scale, 5=strongly agree.

Figure 16: GSOAR Outcomes

Undergraduate Scholarship Program (UGSP)

Recommendation #3

The NIH Undergraduate Scholarship Program (UGSP) offers competitive scholarships to students from disadvantaged backgrounds that are committed to careers in biomedical, behavioral, and social science health-related research. The program offers up to $20,000 per academic year in scholarship support. In exchange for each year of support, awardees are contractually committed to two NIH service obligations: a 10-week summer internship and 1 year of employment at NIH after graduation. Beginning in Fall 2012, the UGSP increased the average total number of scholarship awards to 21 per fiscal year for a total of 65 new awards. This is an average increase of five additional new scholarships each fiscal year relative to the previous five years. While that is less than the doubling recommended by the ACD WGDBRM committee, it represents a 31% increase in the total number of new awards relative to the 3 years prior to 2012. OITE and OIR leadership opted not to double the size of the program because of the substantial administrative burden and cost of appointing scholars as government employees (and not trainees) as mandated by law. UGSP salaries were also evaluated and substantially increased (by 24%) to reflect the difficulty many scholars had with living expenses in the Metro-D.C. area. At that time, OITE and OIR also anticipated the return of a larger number of payback scholars who deferred their service obligation through graduate and professional school. Indeed, since 2012, there was a 35% increase in the size of the payback population. Thus, the program has also supported a total of 57 payback scholars completing their yearlong payback obligations that varied from 1 to 3 years. Two of these UGSP payback scholars completed their obligations in the capacity of an Assistant Clinical Investigator, with one becoming a

Recommendation #3: NIH should increase number of scholarships for undergraduates (building on the NIH intramural Undergraduate Scholarship Program) that include "payback" through participating in a meaningful research experience, and additional fellowships for the anticipated increased numbers of URM graduate students in biomedical research. This needs to be supplemented by enhanced mentoring as highlighted in Recommendation #5.

tenure-track faculty member. OITE and OIR evaluated the payback obligation and realized that inflexibility in providing support beyond the required payback period was a barrier to the success of some UGSP Scholars. Therefore, in 2013, OITE and OIR started providing support for UGSP scholars who needed an additional year of NIH training before embarking on their next career step. Thus far, OITE and OIR have supported five UGSP Scholars for one additional year of training. After this additional preparation and mentoring, three scholars were subsequently accepted into medical school programs and the other was accepted into a M.D./Ph.D. program. OITE and OIR anticipate funding two to three payback scholars for an extended training period in FY2016.

K-12 Research Training: High School Scientific Training and Enrichment Program (HiSTEP)

Recommendation #2

In 2015, OITE and SWD launched the High School Scientific Training and Enrichment Program (HiSTEP) summer program for local high-school students. The goal of HiSTEP is to expand the diversity of students interested in biomedical and health care careers by providing opportunities for high-school students from schools with a large population of financially disadvantaged students. Current high-school sophomores and juniors from the District of Columbia/Maryland/Virginia metro area interested in STEM-M (science, technology, engineering, mathematics, and medically-related) fields are encouraged to apply.

Recommendation #2: The NIH should take a direct leadership role in developing the interest and curiosity of greater numbers of K-12 and undergraduate URM students in biomedical and behavioral sciences through the design and dissemination of NIH-specific activities; providing an increased number of research experiences for high school students and their teachers; and by advocating for and promoting cooperative efforts across Federal agencies and with private and philanthropic organizations.

Two HiSTEP variants have been developed to create formative experiences for college and career readiness for a diverse cadre of students [Figure 16]. HiSTEP is designed for 11th graders and is a learning community based program. HiSTEP 2.0 is designed for 12th graders and is a research-group based program.

HiSTEP students take part in a 6-week, full-time summer internship located on the main NIH campus in Bethesda, MD. HiSTEP students explore the breadth of the scientific enterprise, the importance of biomedical research, and many STEM-M careers. They complete workshops, lectures, and hands-on activities. To ensure the success and sustainable impact on students' college success and career outcomes, OITE has developed long-term relationships with the students and their families to provide mentorship, guidance, and support throughout the summer and beyond.

Analysis of student outcomes from the program indicate the HiSTEP program is a resounding success. Each year, more than 200 applications are received, representing ~20 different high schools in the D.C.-Metro area. The gender and racial/ethnic

High School Programs (% of total)

	HiSTEP (27)	HiSTEP 2.0 (26)	Other HS (230)
AI/AN	0	3.9	0.4
Asian	22.2	15.4	53.9
Black	48.1	57.7	4.8
Hawaiian/PI	0	0	0
Hispanic	11.1	23.1	3.0
White	11.1	0	31.7
URM multi-racial	7.4	0	1.7
Non-URM multi-racial	0	0	4.3
Total URM	66.7	84.6	9.9

Figure 17: HiSTEP Race/Ethnicity

makeup of the HiSTEP students has been diverse, with more than 60% women and more than 65% individuals from STEM-M-underrepresented racial/ethnic groups [Figure 17].

Summary of HiSTEP program outcomes:

- HiSTEP students were highly excited about the program, with 93% indicating they will recommend the program to their peers. The other 7% indicated their reservation due to the following reasons: 1) "don't know any younger friends" and 2) "felt too much like school."
- Aspects of the program most often mentioned by the students as highlights include: the opportunity to visit research groups, hands-on experiments, broadening knowledge of STEM-M careers, developing better communication and leadership skills, boosting confidence, making new connections and friends, and receiving mentoring and support throughout the internship.
- All students successfully completed the program.
- When asked about expectations, 77% responded that the program met their expectations. Note that 15 and 8% disagree and strongly disagree, respectively, when asked about expectations. This is likely due to the fact that they had lower expectations coming into the program, and changed thoughts by the end.
- HiSTEP alumni are currently enrolled in prestigious research-intensive universities across the country [Figure 18] (See Appendix G for program details).
- Student testimonials can be viewed at the following link: https://www.youtube.com/watch?v=hCymLHJrpm0&t=100s

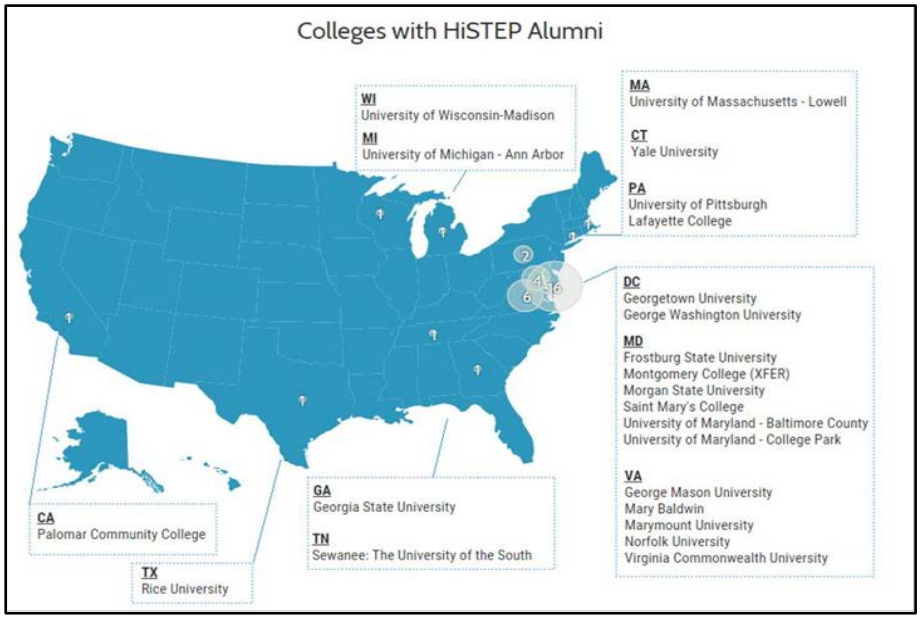


Figure 18: Colleges with HiSTEP Alumni

III. Research and Intervention Recommendations

Dr. Valantine has collaborated with senior leadership and several offices, including NIGMS, OER, and the NIH Center for Scientific Review (CSR) on a number of innovative efforts within the NIH extramural and intramural programs. These include developing measures and evaluation assessment of diversity-targeted programs, addressing the R01 racial funding disparity gap, gender inequality in the IRP, peer review, and implicit-bias interventions.

Evaluating Diversity-Targeted Programs Across NIH

Recommendation #1

To learn about approaches for measuring and evaluating diversity-targeted efforts across multiple ICs, programs and program types, the Acting COSWD provided funding to OER's Office of Extramural Programs (OEP) to develop a set of core metrics (in a diversity logic model) that can be used to evaluate all diversity-targeted programs. A guide developed in February 2014 provided SWD and OEP with recommended core metrics to support enhanced reporting and evaluation efforts. SWD has begun the planning process of implementing the core metrics with ICs who are already familiar with the OEP diversity logic model. The process involves seeking input from ICs and their planning and evaluation officers and from OEP to design guidance, procedures, and tools for data collection.

Recommendation #1: The NIH must ensure that appropriate resources are allocated for the systematic tracking, reporting, and evaluation of the immediate and long-term outcomes of all trainees, including those supported on all research project grants.

The NIH should assign a unique identifier to every individual at the time of his/her first NIH-funded training experience to permit tracking of undergraduates engaged in summer research through graduate and postdoctoral training through later career development. Monitoring should include those individuals supported on research project grants and other mechanisms.

Given the lack of data regarding sub-populations of Hispanic researchers, the lack of data regarding people with disabilities, and the suspected substantial differences between socially and educationally advantaged groups and those who are disadvantaged and marginalized, the NIH should immediately begin to enhance its data collection capabilities for these populations.

All programs should undergo systematic review and evaluation every 5 years. Those programs and activities found to be particularly effective in increasing the participation of minorities in the biomedical sciences should be used as models for other programs that are not as effective, and the effective ones should be considered for expansion.

Data Call

A data call to assess the evaluation and tracking of NIH diversity-targeted programs across NIH is under development. This data call will draw on the recommended core metrics from the above-mentioned guide. ICs will be asked to report information about their evaluation efforts for diversity-targeted and diversity-related programs.

Supplements to Enhance Diversity

As part of a National Institutes of Health (NIH)-wide program, the Research Supplements to Promote Diversity in Health-Related Research, or Diversity Supplements (DS), allows principal investigators holding grants to request supplemental funds to improve the diversity of the research workforce by supporting and recruiting students and postdoctoral fellows, including those from

underrepresented racial and ethnic groups, individuals with disabilities and individuals from disadvantaged backgrounds. Between 1998 and 2014, approximately 1200 students and investigators were supported by the DS each year across NIH. Figure 19 demonstrates the percentage of DS awarded by career stage from 1998 to 2014. The majority of DS were awarded to support trainees at the pre-doctoral, post-doctoral trainees and principal investigators career stage. Figure 20 displays the demographic backgrounds for the DS recipients between 1998 and2014, with the majority of DS recipients being African American and Hispanic.

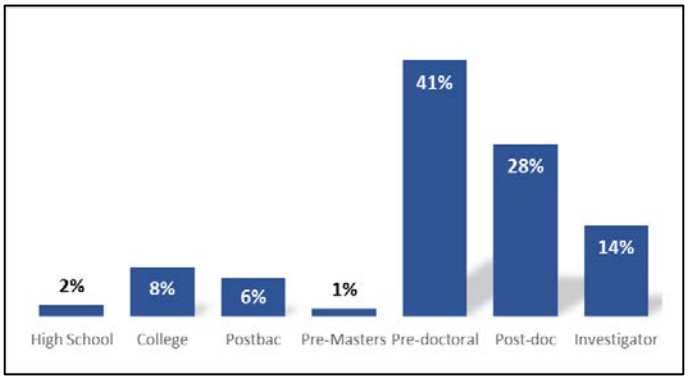


Figure 19: Percentage of DS awards by career stage between FY1998-2014, with the majority of DS given at the mid-to-late career stages

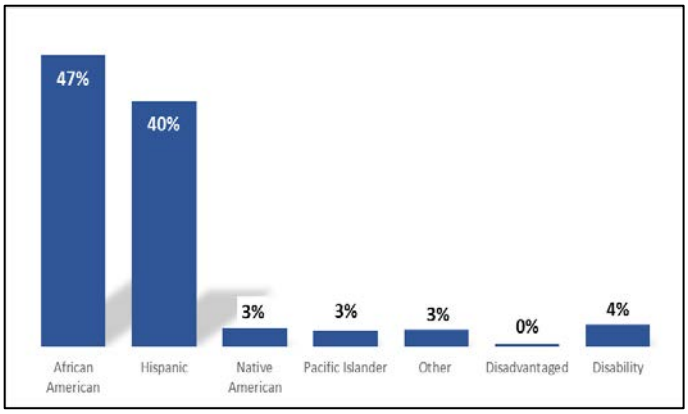


Figure 20: Demographics of DS Recipients between FY1998-2014. The majority of DS Recipients are either African American or Hispanic.

These results, along with assessments conducted on recipients of diversity supplements conducted by the National Institute on Aging (NIA) and NIGMS are informative about how this program is an effective mechanism to promote and sustain diversity in biomedical workforce (See NIA 2011 report and NIGMS 2015 report). Both ICs reported that a majority of the recipients remained in academic research or research-related careers at the time of the evaluation. The NIGMS evaluation revealed that 65% of supplement-supported postdoctoral and pre-doctoral trainees had remained in research careers (academic, industry, and government research). Of the 115 investigators supported by NIA's diversity supplements between 2002 and 2009, 82 of these investigators had submitted grant applications to NIH at some point in their careers, and 24 of them were receiving NIH funding at the time of the evaluation. These analyses demonstrate the success of diversity supplements as a key training program to enhance biomedical research workforce diversity. In light of these results, discussions and workgroups were initiated to promote practices and procedures that would allow systematic assessments in the future.

Survey of NIH Diversity Supplement Points of Contact

In accordance with its coordinating function, SWD has also established a community of practice with the Diversity Supplement (DS) Points of Contact (DPOCs) across ICs to meet regularly for sharing information and practices that are related to diversity-supplement administration, evaluation tools, and efforts as well as training opportunities for supplement recipients. SWD administered a survey to DPOCs in July 2015 to assess each IC's current practice of diversity-supplement application review, and the program's

effectiveness. Eighteen of the 27 (67%) contacted ICs responded to the survey. Of the 18 ICs, 16 supported high-school supplements, and 17 supported individuals along the training continuum from undergraduate to early-stage investigator. The duration of support ranged from less than 1 year to up to 4 years, depending on training levels. While all ICs used the standardized selection criteria stated in the funding opportunity announcement, there was variation in the formality of how applications were reviewed. In terms of evaluation, seven of the 18 ICs reported having some form of assessment to track supplement recipients' career trajectory such as grant-application submission, publications, degree-completion, and other career outcomes, but there is no centralized system or procedure to collect and maintain the data. A few ICs included terms and conditions in the Notice of Award that supplement recipients' progress will be assessed as part of the parent grant progress report, but most ICs do not have specific post-award requirements to ensure adequate mentoring. Quality of mentoring was assessed before award based on the parent grant principal investigator's experience and the quality of the mentoring plan.

Toward Systematic Tracking and Reporting of Diversity Supplement Trainees

The DPOC survey revealed a need for systematic tracking and reporting of trainees who are supported by NIH research grants such as those scientists supported via diversity supplements. The issue of whether or not an NIH-wide retrospective evaluation of the diversity supplement program should be conducted, as well as recommendations for future evaluations efforts, was discussed at the November 2016 NIH Steering Committee Diversity Working Group. The group concluded that a NIH-wide retrospective evaluation is not an ideal approach, since some ICs have already embarked on such projects and because manual tracking of supplement recipients' outcomes is so labor-intensive and potentially inaccurate. However, the group did recommend that SWD and OER identify submission and reporting procedures that could afford more efficient evaluation efforts in the future. The first phase, anticipated for completion in FY2017, requires electronic submissions of all diversity supplement applications such that trainees will be properly registered in the NIH data system, and thus trackable.

Assessment of the Diversity of T32 Training Grants and F32 Fellowships

Recommendation #4

While no specific expansions of the T32 or F32 fellowships have occurred, ICs have continued to emphasize the importance of diversity in both programs. For example, for T32 proposals, applicants are required to provide a Recruitment Plan to Enhance Diversity which is considered during peer review. Peer reviewers are asked to evaluate the recruitment plan to enhance diversity after the overall score has been determined. Reviewers are asked to examine the strategies to be used in the recruitment of individuals from underrepresented groups. The plan is rated as "ACCEPTABLE" or "UNACCEPTABLE," and the consensus of the review committee is included in an administrative note in the summary statement (https://grants.nih.gov/grants/guide/pa-

Recommendation #4: The NIH should assess the reason(s) for the disparity in the frequency of awards to African American applicants for postdoctoral positions on T32 training grants and F32 fellowships, and take appropriate remedial actions once the reason(s) for this disparity have been determined.

files/PA-16-152.html). The grants policy statement includes the following the NIH Grants Policy Statement, section 11.3.3.4:

'If the recruitment plan to enhance diversity is judged to be unacceptable, funding will be withheld until a revised plan (and report) that addresses the deficiencies is received. Staff within the NIH IC, with guidance from its National Advisory Council or Board, will determine whether amended plans and reports submitted after the initial review are acceptable.'

A new extramural diversity website developed by OER provides some information about strategies for recruitment and retention (https://extramural-diversity.nih.gov/building-participation/recruitment-retention).

NIGMS Procedures for Implementation of the NIH Requirement for the Recruitment and Retention Plan to Enhance Diversity outlines the roles played by the NIGMS review committees, the National Advisory General Medical Sciences (NAGMS) Council, and NIGMS staff in the implementation process of the NIH Interest in Diversity requirement. In summary, to enhance diversity in T32 grants, NIGMS considers the study section review of the diversity recruitment and retention plans of all competing T32 grants. Per NIH guidelines, funding is withheld from an application that receives an "UNACCEPTABLE" diversity recruitment and retention designation by the NIGMS staff Committee to Maximize Representation (CMR) until an improved diversity-recruitment plan is approved by CMR. If an improved diversity plan is approved and the application is funded, the progress on diversity recruitment and retention is evaluated by CMR after 3 years, and the level of funding is determined for the remaining duration of the award.

The frequency of awards by race for the past 6 years (FY2010-2015) is currently being analyzed by OER to determine if any change in the level of disparity has occurred. (See Appendix H & I for descriptive statistics of race/ethnicity for awardees, FY 2000-2015, for T32s and F32s).

African-American/Black R01 Funding Disparities Working Group

Recommendation #7

Recommendation #7: Investigators whose applications are unscored should be provided with a more detailed explanation of the factor(s) that led to this determination, thus enabling an applicant to better understand the areas of concern leading to the decision about his or her proposal. Ideally, these comments from the peer reviewers should help the applicant decide whether he or she should "resubmit or rethink" an unscored application.

Recent analyses of NIH award data from FY2010-15 reveal that the AA/B R01 funding disparity reported in 2011 by Ginther et al. (for awards made in FY2000-06) persists. The AA/B Funding Disparity Working Group (WG), consisting of several NIH IC directors and other NIH leaders, gathered new data to further characterize the factors associated with the funding gap. The WG identified a multifactorial and cumulative basis for the disparity manifest at each stage from submission to funding. Overall, AA/B scientists are funded at half the rate as WH scientists, taking into account lower AA/B submission rates.

Based on both the complexity of this multifactorial problem – and the striking differences in sizes of AA/B and WH NIH R01 applicant pools -- the WG employed multiple methods to understand the AA/B funding disparity.

Using a mixed-methods approach to address this multifactorial problem, the WG first computed the award rate for NIH R01 first-time applications (type 1) from AA/B and WH scientists between FY2011 and FY2015 and compared the current relative gap (11% vs. 17%) to the previously reported gap (FY2000-FY2006, 17% vs. 29%) using Cochran-Mantel-Haenszel statistics. The differential success in R01 applications (AA/B:WH) was 0.59 in the 2001 cohort and 0.65 in the 2016 cohort, with the effect of race being 154.40; $p < 0.0001$, and the effect of time-period difference being $\chi 2 = 5.14$; $p<0.023$. Next, the WG analyzed the gap between applications from AA/B and WH scientists at six distinct stages: first-time submission, initial review score, likelihood of an application being discussed (and in turn, likelihood of funding after discussion), re-submission [Figure 22], and choice of study topic (using word2vec, a word-embedding approach that divides the entire NIH grant-application universe into well-defined clusters of research that can assess multiple covariates including applicant race and other metrics). The WG also analyzed any potential impact of final NIH funding decisions on award outcomes (the effect of IC discretionary funding decisions on award outcomes, by race and by topic).

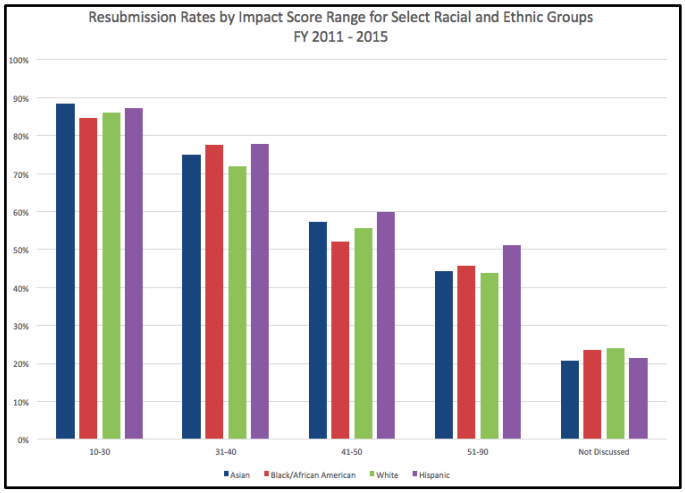


Figure 21: Resubmission rates by impact score and career stage for different racial/ethnic groups (FY2011 – FY2015). AA/B and WH scientists resubmitted applications at approximately the same rate for higher impact score ranges (10-40), but within the 41-50 impact score range, AA/B scientists were slightly less likely to resubmit than scientists of other racial/ethnic groups.

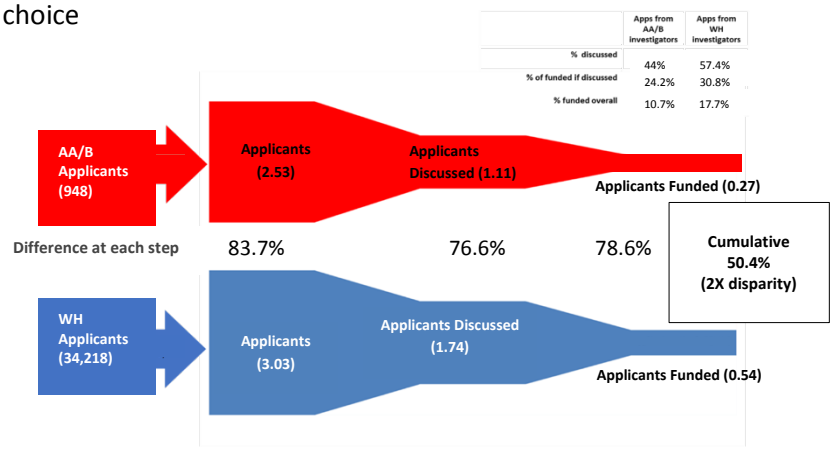


Figure 22: Visualization of the funding disparity throughout the R01 application and review process for applications from AA/B (red) and WH scientists (blue). The number of applications for each group is presented in the arrows on the left. Number of applications per applicant that were submitted, discussed, and funded are presented in the rocket charts. Comparative rates for discussion, funding of discussed applications, and overall funding rates are presented in the summary table on the top right

Compared to WH applicants, AA/B applicants submit 83% the number of NIH R01 initial applications; receive poorer overall priority scores (43.1 vs. 37.8,); less frequently re-submit unfunded applications, especially within the priority score range of 41-50 (51% vs. 62%); and more often propose topics that are less likely to be awarded regardless of applicant race ("lower-success topics" vs. "higher-success topics") [Figure 22]. The WG calculated that choice of study topic accounts for 20% of the overall racial funding disparity and determined that

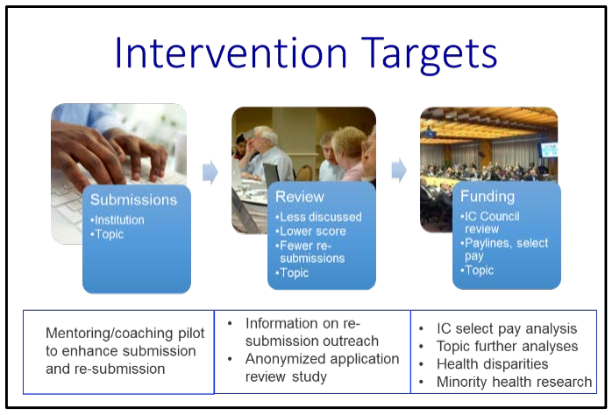


Figure 23: Targeted Intervention Studies

cumulatively, from application submission to eventual funding, AA/B applicants received NIH R01 funding at 50% the rate of WH applicants.

Based on these findings, the WG identified three main contributors to disparate funding outcomes for AA/B scientists: These factors include i) number of application submissions and re-submissions, ii) review outcomes, score in particular and iii) the possibility that choice of application study topic affects outcome.

The WG recommends several interventions aiming to close the funding gap amid continued attention to this critical issue. In keeping with the WG's data-driven approach, all interventions will be evaluated rigorously to monitor impact. The following targeted intervention studies were proposed and in the process of implementation to diminish the gap through boosting resubmission of scored-but-unfunded R01 applications [Figure 23].

The first study is in progress and is testing whether providing new investigators from different racial groups with timely resubmission information would result in higher resubmission rates. The study also includes a new-investigator survey asking applicants about the various grant-writing resources they would likely use for the resubmission as well as factors that contributed to the choice of their research topics.

The second study uses a randomized controlled trial method to test whether or not receiving mentoring and coaching on grant-writing would encourage investigators to resubmit their scored-but-unfunded R01 applications and increase eventual success rates of obtaining funding (A description of the DPC's NRMN grant writing coaching groups is described on page 20).

Recommendation #9: The NIH should expeditiously establish a new Working Group of the ACD comprised of experts in behavioral and social sciences and studies of diversity with a special focus on determining and combating real or perceived biases in the NIH peer review system. In particular, this new Working Group should:

- Oversee the collection and analyses of quantitative and qualitative data relevant to the research project grant review and grant-making decision process.
- If this additional analysis provides evidence of bias, provide guidance and insight on potential actions that the NIH could take to combat bias.
- Provide oversight to an analysis of the discourse content from peer review sessions so as to contribute to the understanding of potential bias.
- Provide expert oversight to a text-based analysis of the commentary on individual grant reviews, including R01s and a subset of applications for those awards (career awards, fellowships, smaller research project grants, and others) most likely to precede an investigator submitting a R01 application.
- Oversee other efforts that investigate potential effects of unconscious bias in peer review.

Advisory Committee to the Director Working Group Subcommittee on Potential Bias In Peer Review

Recommendation #9

The ACD Working Group Subcommittee on Peer Review (managed by CSR) was established to assist the ACD in examining multiple hypotheses, including the role of implicit bias, as it relates to disparities in research awards. This includes experiments to anonymize applications to study implicit bias and

diversity awareness training for both Scientific Research Officers and members of review panels, and to assess expansion of the Early Career Reviewer program.

The ACD Working Group Subcommittee on Peer Review was co-chaired by Dr. Richard Nakamura, CSR Director, Dr. Joan Reede, Harvard Medical School, and Dr. Dana Takagi, University of California-Santa Cruz. The Subcommittee included eight scholars with expertise in social science, implicit bias, stereotyping, and faculty development. The subcommittee met for the first time in April 2013 and met eight times, with its final meeting in July 2016. Below is a summary of the ACD-endorsed recommendations.

Early Career Reviewer Program

The goals of the Early Career Review (ECR) Program are to educate qualified scientists without prior CSR review experience so that they may develop into critical and well-trained reviewers and to enrich the existing pool of NIH reviewers by including scientists from less research-intensive institutions as well as those from traditionally research-intensive institutions. A positive outcome of the ECR Program is that these emerging researchers receive insight into the peer-review process, which may make them more competitive as applicants and help to advance their careers. To date, 1,700 ECR investigators that have served on study sections, with an additional 1,500 reviewers eligible to serve. Of those who have already served on study sections, 48% were female, 9% Hispanic, 9% African American/Black, 24% Asian, less than 1% American Indian/Alaskan Native, and less than 1% Native Hawaiian/Pacific Islander.

America COMPETES Challenges

It was the opinion of the Subcommittee on Peer Review, endorsed by the ACD, that existing methods for the assessment of implicit bias were not valid for evaluating the presence of bias in NIH peer review. Methods for bias-awareness training were beginning to evolve, but no best practices had been established that could be recommended by the members for broad dissemination to NIH reviewers. To address these gaps and to seek stakeholder input, CSR launched two America COMPETES Challenge contests in 2014 – Methods to Detect Bias in Peer Review and Strategies to Strengthen Fairness and Impartiality in Peer Review.[10] Financial awards were given to the best ideas that had potential for implementation by NIH. Funding was not provided to execute the winning projects.

NIH Peer Review Webinars

CSR hosted a series of webinars entitled *Meet the Experts in NIH Peer Review* in 2014 and 2015. A new series was launched in 2016: *8 Ways to Successfully Navigate NIH Peer Review and Get a Grant*. These webinars were designed to give applicants useful insights into application submission and peer-review processes. Outreach for participation in the webinars institutions with a track record of serving individuals from underrepresented groups and those that qualified for AREA grant (R15) funding. While

[10]NIH Center for Scientific Review (CSR) announces Winners of its America COMPETES Challenges to Maximize Fairness in NIH Peer Review, CSR News Flash, September 2, 2014.
http://public.csr.nih.gov/Documents/LearnMoreabouttheWinningIdeas.pdf

the focus of the webinars was on junior faculty, participation also included senior faculty and university staff. In addition, a webinar was developed specifically for participants in the ECR Program. The webinars are archived and available to the public for viewing.

New Investigator Survey and Focus Groups

CSR employed a contract with Social Solutions International, Inc., to conduct focus groups and a survey of new investigators regarding their experiences with the NIH grant application and peer-review process. The purpose of this contract was to gain an understanding of the experiences of new and early-stage investigators who have applied for NIH grant funding and to identify procedures and practices that enable CSR to fulfill its mission successfully to ensure that NIH grant applications receive fair, independent, expert, and timely reviews — free from inappropriate influences — so NIH can fund the most promising research. The survey explored investigators' experiences in preparing, submitting, and receiving feedback on NIH grant applications; perception of fairness of the process; level of support investigators received from their colleagues and institutions; and reasons behind decisions to resubmit applications that did not initially receive awards. Results of the survey showed, among other findings, that race was the best predictor of self-reported R01 funding. A complete summary of the survey and focus group findings was provided to CSR by Social Solutions International, Inc.

The Effect of Anonymization of Peer Review

Recommendation #11

CSR issued a Request for Proposals in May 2016 to test the influence of applicant demographics on reviewer scoring behavior, and the project is underway. The original and fully anonymized versions of 1,200 R01 grant applications will be reviewed by CSR reviewers (400 each from matched black and white PIs and 400 randomly selected from white PIs).

To further explore the role of investigator identity on review outcomes, NIGMS currently supports a transformative R01 grant to the University of Wisconsin-Madison (Carnes, PI) to examine the effect of altering PI gender, race, and institutional affiliation on reviewer scoring behavior, critique writing, and review discussion. Comparisons of overall impact scores will test the influence of perceived investigator identity on reviewer evaluations.

Recommendation #11: NIH should design an experiment to determine the effects of anonymizing applications with respect to applicant identity as well as that of an applicant's institution. The WGDBRW understands that the nature of implicit bias cuts across processes, structures, organizations, and societal groups. The prospect of bias in the NIH peer review process is a serious matter that calls for deliberative action in a timely fashion.

Implicit Bias Intervention

Recommendation #10

SWD has completed a feasibility study for trans-NIH assessment and intervention for implicit bias. Based on documented feasibility that a short educational module on implicit bias regarding gender and race in science can be successfully administered and evaluated, SWD is currently working with CSR to develop a similar pilot for peer review.

Recommendation #10: NIH should first pilot different forms of validated implicit bias/diversity awareness training for NIH scientific review officers and program officers to determine the most efficacious approaches. Once the best training approaches have been identified with NIH staff, pilot these programs with members of study sections to ascertain if their value is sustained. If they are, provide to all study section members.

Since September 2015, SWD developed and tested two implicit-bias education modules with the goal of reducing potential influence of implicit bias on the evaluation of job candidates during the annual trans-NIH Stadtman tenure-track investigators search. The interactive presentations educated scientific directors, branch/division chiefs, chairs of search committees, and search committee members about the science of diversity, the impact of implicit bias, and evidence-based strategies to reduce its influence and improve overall decision-making.

During the 2015 Stadtman search, a feasibility study was completed to gauge interest and engagement in such a bias module, as well as to pilot an assessment procedure for the education effort. Of 24 search committees, 17 committees had at least one of the two chairs volunteer to receive the module, and 8 of the committees agreed to ask their committees members to receive it. In this initial pilot, 59 PIs received the implicit-bias educational intervention, of which 23 (48%) were committee chairs and 36 (32%) were committee members.

In tandem, SWD presented the implicit-bias educational module at a Scientific Director meeting with 24 directors present, since they were also involved in the Stadtman search process. Using a snowballing technique, the scientific directors were asked to encourage leadership (e.g., branch/division chiefs, clinical directors) and investigators within their ICs to receive the educational module. This resulted in additional presentations at 7 NIH ICs, mostly in their IRP programs. The level of engagement and interests in implicit-bias education has been high at NIH, which suggests a fertile ground for further development and testing, as well as scaling of the implicit-bias education modules.

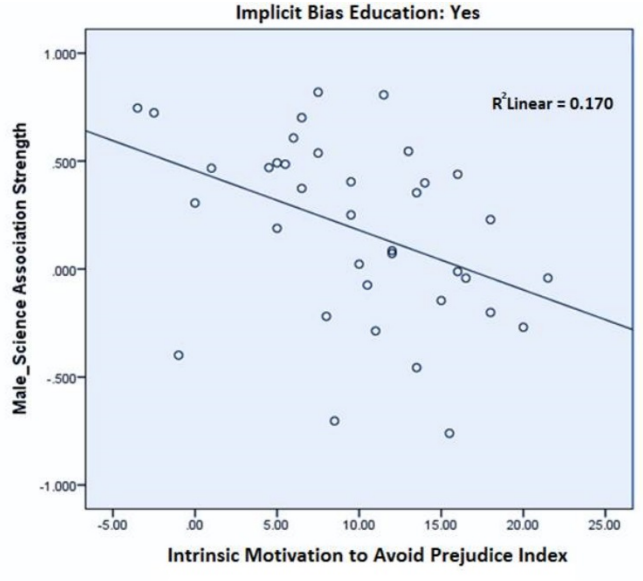


Figure 24: Correlation between gender-science implicit bias and intrinsic motivation to avoid prejudice

As in all work within SWD, the implicit-bias education development is being conducted using a scientific approach. In the feasibility study, a pre- and post- education online assessment was administered to investigators and staff who received the implicit-bias education. The assessments included an anonymous Implicit Association Test (IAT) that measured the strength of respondents' cognitive association between gender and science and a brief questionnaire asked about beliefs regarding implicit bias and motivation to control prejudice. Ongoing analyses suggest that individuals who received the implicit-bias education showed decreased bias association between gender and science than those who did not receive education, but the difference did not reach a statistical significance possibly due to insufficient sample size. SWD also observed that among those who received the implicit-bias education, the more strongly they were motivated to be egalitarian, the lower implicit bias in gender and science they demonstrated (r = .41, p <.05) [Figure 24]. This finding suggests that the impact of educational module will depend on the confluence of personal interests or motivation and knowledge. A revised educational module and improved assessment measures were implemented Fall 2016.

PART II: Looking Forward

While progress has been made to enhance diversity among NIH-funded trainees over the past 10 years, underrepresentation in U.S. biomedicine of scientists from a range of racial/ethnic and gender backgrounds persists. These gaps limit full realization of the NIH mission for excellence and global preeminence in biomedical research innovation. This second section of the report first outlines the process used by the ACD WGD to develop a new set of recommendations designed to accelerate scientific workforce diversity and to build on ongoing activities related to the 2012 ACD WGDBRW recommendations. The process involved in-depth assessment of demographic trends among biomedical researchers over time and assessment of NIH funding for investigators during various career phases as well as NIH's overall investment in diversity-focused programs across the career path. These analyses point to persistent gaps that pose barriers to scientific workforce diversity and thus provide rationale for the ACD DWG's new recommendations that focus on training-to-faculty career transitions among individuals underrepresented in biomedicine.

The ACD WGD 2017 recommendations reflect a deliberate focus on integrated solutions that effect systems-level and culture change, since the ACD WGD feels strongly that it is now timely to develop and evaluate a set of strategies that are more specifically targeted to institutional systems and processes. The ACD WGD 2017 recommendations cluster into three general areas: NIH Institutional Support and Oversight; Mentoring, Career Development, Recruitment, and Retention; and Research and Interventions. Collectively, the new recommendations are intended to 1) leverage institutional systems and processes explicitly, to evoke culture change that supports and sustains diversity in the scientific workforce as an essential element for excellence in biomedical research; 2) rely upon evidence-based programs and data-driven solutions; and 3) have an intentional focus on the transition to career independence, since enhancing diversity among biomedical faculty remains a pressing need toward sustaining diversity nationwide.

The ACD WGD reaffirms its commitment to addressing gaps in recruitment, advancement, and retention of individuals from groups with long-standing underrepresentation in biomedicine. Additionally, the ACD WGD is concerned that similar gaps may exist for other groups for whom basic demographic data has not been collected to date. Rigorous data collection pertaining to these groups is essential: They include military veterans; lesbian, gay, bisexual, and transgender individuals; and non-traditional students.

ACD DWG Data Analysis

Four sets of data indicate persistent gaps that underscore the need for institutional transformation driven by strong leadership engagement, with a focus on enhancing diversity among the pool of scientists transitioning to academic research careers. As detailed below, scientists from traditionally underrepresented groups now comprise more than 10% of PhD recipients in NIH-relevant fields, but fewer than 5% of newly hired assistant professors each year [Figure 25].

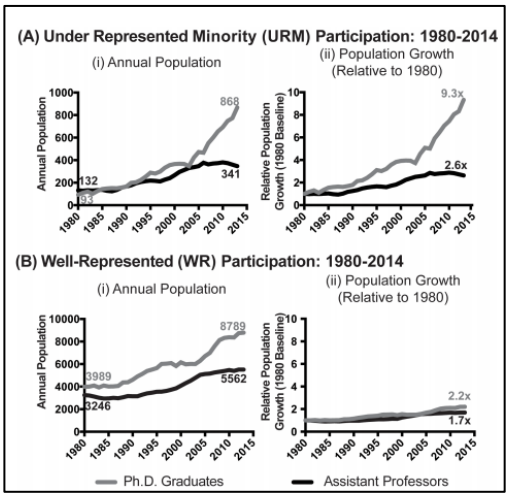


Figure 25. Temporal trends in the populations of URM and WR PhD graduates and assistant professors, 1980-2014. (Gibbs KD Jr. et al. eLife 2016;5:e21393

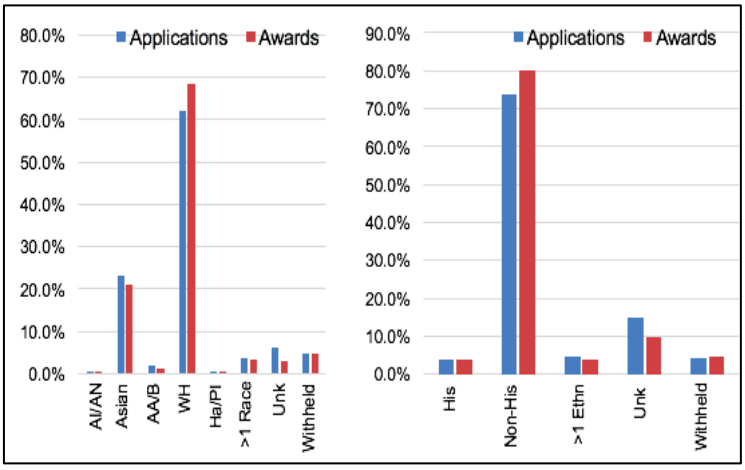


Figure 26. RPG Applicants and Awardees by Percent of Total, All NIH-supported Fields, 2006-2015, by Race (L) and Ethnicity (R)

These groups together comprise less than 5% of the applicant pool for NIH research project grants, and even a lower percentage of those awarded [Figure 26]. This disparity persists even though, over the same time period, the percentage of K awards to individuals from underrepresented groups has remained constant (5.7% for Hispanic applicants [data not shown]) or increased (by 1.3% for AA/B applicants) [Figure 27],

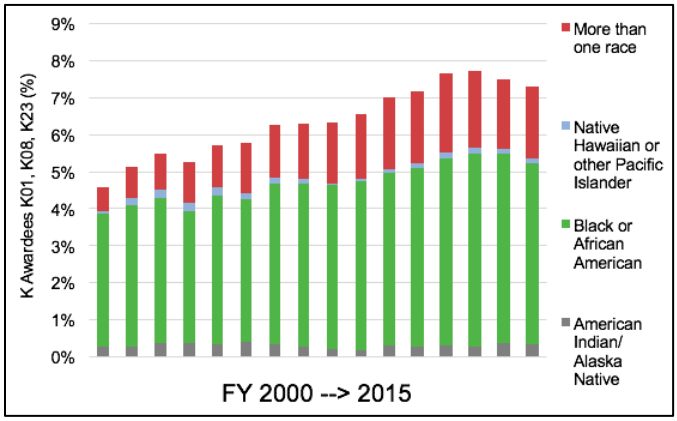


Figure 27. Racial Demographics of Underrepresented Mentored Career Development (K01, K08, K23) Awardees, % (FY2000-FY2015)

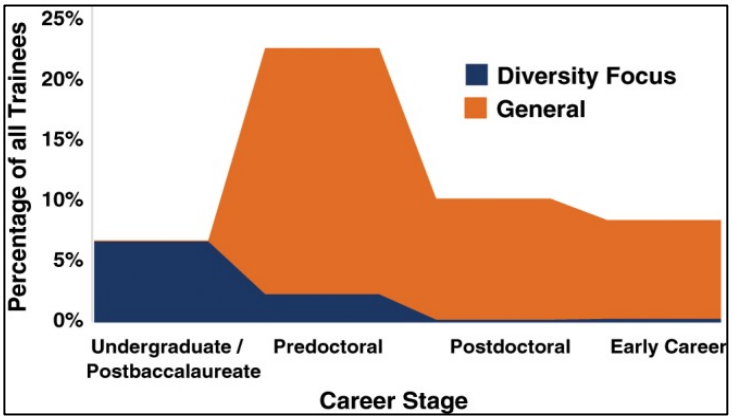


Figure 28. NIH-supported trainees and early-career scientists (2015) in traditional training/career development programs (orange) and diversity-focused training/career development programs (blue). Valantine et al. CBE Life Sci Educ. Fall 2016;15(3). pii:

Collectively, the data indicate a significant attrition in the transition from an already-small pool of PhD recipients to faculty hiring, along with the diminishing NIH investment in diversity-focused programs at this transition point [Figure 28].

Recommendations

I. NIH Institutional Support and Oversight

The overarching goal for the ACD WGD 2017 recommendations is a focus on institutional change and processes that will be effective, efficient, and have broad, transformative impact. Strategies should be informed by programs that have been successful in achieving these goals, such as the National Science Foundation's ADVANCE (Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers) program. Specific activities should include systematic review of hiring, promotion, and tenure policies; development of centralized mentoring criteria and leadership-development resources; and design and implementation of surveys and data collection to evaluate outcomes and to assess institutional climates.

Recommendation #1: SWD should promote systematic review and transparency of hiring and promotion procedures and policies to intramural and extramural research leaders (faculty, department chairs, and deans).

- Important elements include capturing diversity data and making it public; using holistic diversity metrics as one component of retrospective leadership evaluations; and endorsing the value of bias-mitigation education and tactics.
- NIH should recognize publicly institutions that demonstrate improvement in their diversity efforts and should encourage NIH-funded universities to capture and make public diversity metrics related to hiring and promotions.
- SWD should create and conduct an annual, shareable climate-survey mechanism (beginning with the intramural program and expanding to the extramural community) that includes assessment of sexual harassment (addressing all groups, including those from sex/gender minorities) to promote and track progress on institutionally-leveraged change.
- NIH should collect data on IC diversity programs already in place that are successful in enhancing diversity; SWD should create a repository of these programs to be used as models.

Recommendation #2: NIH should be more transparent about the diversity of applicants and recently funded grants and investigators.

- NIH should collect and make public aggregate diversity metrics of NIH applicant-pool data.
- NIH should encourage IC advisory councils to take a holistic approach when making grant-funding decisions, to diversify research portfolios for scientific and mission-related reasons, and to broaden researcher participation.
- NIH should provide feedback on the diversity of recently funded grants (aggregate data on topic, first-time PI status, institution-type, gender, race, ethnicity) to IC leadership, staff, and IC advisory councils, due to the recent finding that study topic contributes to a sizable component (about 20%) of the African-American/Black R01 racial funding disparity.

Recommendation #3: NIH should collect data to identify whether any NIH policies and practices are acting as barriers to creating a diverse scientific workforce at extramural institutions and identify ways to mitigate those barriers.

- Since training mechanisms offer good leverage for NIH to catalyze institutional change, NIH should study diversity outcomes of funding individuals compared to funding institutions for training programs, using retrospective data. Directing funding to individuals rather than to institutions may accelerate the transition process for postdocs from training to independent careers.
- NIH should expand funding of institutional training grants (T32s) at awarded institutions to building partnerships between research-intensive universities and less research-intensive institutions with more diverse populations.

- NIH should evaluate outcomes of trainees who received NIH support (i.e. mentoring, funding, support), to identify why some trainees never applied for an R01 grant or left science.
- NIH should consider expanding existing processes for addressing diversity in T32 grants NIH-wide, by reframing the agency-wide funding opportunity announcement with an enhanced focus on diversity efforts.

Recommendation #4: Conduct ongoing evaluation of BUILD and NRMN through enhanced DPC collaboration with the ACD WGD; Ensure BUILD awardee institutional leadership support.

- CEC has established the infrastructure and models for evaluation of BUILD and NRMN. Results of this real-time evaluation should be incorporated into adaptive-design models for dissemination and scaling of effective intervention across BUILD sites and beyond.
- Establish a new subcommittee within the ACD WGD to meet periodically with DPC leadership to evaluate whether hallmarks of success are being reached at the individual, faculty, and institutional levels. The subcommittee should include postdocs and early career-stage researchers and should provide recommendations to the ACD WGD, and in turn to the ACD, through the lens of transformational change.
- For BUILD and NRMN grant awards, encourage participation by leadership of awardee institutions: for example, encourage inclusion of provosts and other awardee institutional leadership who can champion systemic change and invest in facilities for future sustainability.

Recommendation #5: Expand resources of the NIH SWD office, to support the NIH's growing and expanded mandate related to scientific workforce diversity.

Recommendation #6: NIH should promote institutional partnering to disseminate best practices from successful recruitment and retention models.

- Examples include the NIH-funded Initiative for Maximizing Student Development and MARC Undergraduate Student Training in Academic Research programs, as well as highly successful institutional efforts such as the University of Maryland, Baltimore County's Meyerhoff program.

II. Mentoring, Career Development, Recruitment, and Retention

Since its 2014 launch, the DPC has provided an extraordinary opportunity to examine influences upon, and effects of, diverse research learning environments. Continuously collected and analyzed by the CEC, rich data sets are informing NIH's ongoing efforts to design and tweak diversity programming, beyond the 10 BUILD sites and NRMN vehicle. The task at hand is to catalog and package these data toward implementing systematic change at institutions beyond the DPC. SWD has identified successful models of postdoctoral programs for enhancing diversity such as the NIH Institutional Research and Academic Career Development Awards (IRACDA) program, which has been successful in transitioning postdocs into research careers, and others at individual institutions. SWD is also developing plans to fund public-private partnerships to complement NIH's DPC program, toward sustaining national diversity through multi-sector perspectives, involvement, and resources.

Recommendation #7: NIH should partner with academic institutions and professional societies to develop accountability policies and metrics that enhance diversity in the transition from trainee to independent careers.

- A recent published analysis demonstrated a 9-fold increase over the past 25 years in Ph.D. recipients who are from underrepresented groups; yet, hiring these individuals into faculty positions has stalled.
- NIH should develop institutional accountability metrics that are incorporated into the peer-review process for NIH institutional awards. Such metrics will provide definitive measures of equity in trainees access to faculty careers.

- Revisit characteristics and curricula of various training vehicles (NIH Medical Scientist Training Program, post-bac programs, master's programs, and others), with an eye to length of training and potential unintended consequences of pay models on trainees from underrepresented groups.

- Develop interventions that address barriers faced by individuals from underrepresented groups during training transitions such as providing foundational knowledge in a discipline, adequate mentoring, and sufficient financial resources (enabling master's-level coursework to contribute to the doctorate; programs that identify and create cohorts of freshman undergraduate classes and provide them with financial resources and mentorship across training transitions).

Recommendation #8: NIH should recognize the value provided by teaching at various levels, toward recruiting individuals from underrepresented groups who had not considered science careers.

- Expand the workforce diversity of research faculty. This will enhance the availability of role models.
- Expand the NIGMS IRACDA program to other NIH ICs.
- Consider using an interagency approach (NIH, NSF, and the Department of Education) to enhance diversity in the scientific workforce by promoting science identity and math competency in individuals from underrepresented groups through K-12 programs.

Recommendation #9: NIH should pilot a nationwide public/private partnership model (currently conceived as Hubs of Innovation in Scientific Workforce Diversity).

- NIH is planning a next-generation program, Hubs of Innovation, to connect the BUILD-trained cadre of new researchers (18,000 expected by 2019) with the STEM job market. NIH would contribute the people and the evidence-based strategies to attract and retain the best STEM talent. Industry, including the pharmaceutical, biotech, and information-technology sectors, would provide entrepreneurial perspectives, approaches, and novel resources.
- Hubs should be structured to include expertise from business, social/behavioral science, and industry, to make career pathways more transparent at the training-to-career independence transition.

Recommendation #10: SWD should develop and share its integrated recruitment and retention methods as an open-source toolkit that addresses how to diversify the candidate pool (via searching various sources that house diverse talent), conducting unbiased talent searches and proactive outreach, and fostering inclusion and belonging.

- Including specific case studies in the toolkit will facilitate institutional adoption of SWD's recruitment and retention strategies.

- In partnership with the extramural research community, SWD should develop and promote measures of campus climate, inclusion, and belonging. One strategy will be learning from studies of career-development/leadership cohorts; SWD is implementing this approach within the NIH IRP tenure-track scientist community.

III. Research and Interventions

Most evidence to support the value of workforce diversity has been obtained from studies outside biomedicine, pointing to the need for further study, analyses, and application within scientific settings. Further study of the science of scientific workforce diversity will accelerate efforts and maximize the return of investment in this domain. This research agenda will yield a strong conceptual and methodological foundation of the desirable or undesirable outcomes of diversity in scientific settings and identify dimensions that diversify the workforce. Doing so requires the collaborative effort of scientists who are well-versed in the theories and existing evidence of workforce diversity and the working knowledge of biomedical scientists to fill knowledge gaps with workable interventions. Knowledge gained should also contribute to resolving disparities in funding and other measures of career success for individuals from underrepresented groups.

Recommendation #11: A trans-NIH partnership should launch a funding announcement requesting proposals on research projects focused on the science of scientific workforce diversity.

- For several years, NIGMS has funded research on understanding interventions that promote diversity in the scientific workforce as well as hosting an annual meeting. Broadening this effort will benefit from a coordinated, trans-agency approach with appropriate, dedicated review expertise.

- NIH should explore ways of scaling the Center for Evaluation and Coordination (developed for the Diversity Consortium Program), as a model for evaluating all NIH diversity programs.

Recommendation #12: NIH should consider reviewing and tracking funding outcomes of grant types including and beyond R01s (such as U01s) to develop and implement interventions that may improve opportunities for funding success for African-American/Black researchers who tend to favor translational, clinical, and community-based research.

- NIH should also consider evaluating the relative contributions (ideation, writing) of co-investigators on grant applications, as well as whether any disparities are apparent.

- NIH should revisit policies that may disadvantage individuals from underrepresented groups at small institutions (such as the number of PIs in a discipline per grant application).

Recommendation #13: NIH should analyze the impact that methodologies and institutional prestige have on review and funding outcomes for various grant types.

- Based on the outcomes of the ongoing CSR anonymized review study, develop interventions as needed to mitigate bias against topic, investigator, and institution.
- Encourage NIH-wide funding of health disparities research to broaden participation and ensure appropriate expertise in peer review.

Appendix A: Thirteen Recommendations from the Report of the Advisory Committee to the Director Working Group on Diversity in the Biomedical Research Workforce

June 14, 2012

Prepared By:
Working Group on Diversity in the Biomedical Research Workforce (WGDBRW),
Advisory Committee to the Director (ACD)

Recommendation #1: The NIH must ensure that appropriate resources are allocated for the systematic tracking, reporting, and evaluation of the immediate and long-term outcomes of all trainees, including those supported on all research project grants.[11]

The NIH should assign a unique identifier to every individual at the time of his/her first NIH-funded training experience to permit tracking of undergraduates engaged in summer research through graduate and postdoctoral training through later career development. Monitoring should include those individuals supported on research project grants and other mechanisms.

Given the lack of data regarding sub-populations of Hispanic researchers, the lack of data regarding people with disabilities, and the suspected substantial differences between socially and educationally advantaged groups and those who are disadvantaged and marginalized, the NIH should immediately begin to enhance its data collection capabilities for these populations.

All programs should undergo systematic review and evaluation every 5 years. Those programs and activities found to be particularly effective in increasing the participation of minorities in the biomedical sciences should be used as models for other programs that are not as effective, and the effective ones should be considered for expansion.

Recommendation #2: The NIH should take a direct leadership role in developing the interest and curiosity of greater numbers of K-12 and undergraduate URM students in biomedical and behavioral sciences through the design and dissemination of NIH-specific activities; providing an increased number of research experiences for high school students and their teachers; and by advocating for and promoting cooperative efforts across Federal agencies and with private and philanthropic organizations.

Recommendation #3: NIH should increase number of scholarships for undergraduates (building on the NIH intramural Undergraduate Scholarship Program) that include "payback" through participating in a meaningful research experience, and additional fellowships for the anticipated increased numbers of URM graduate students in biomedical research. This needs to be supplemented by enhanced mentoring as highlighted in Recommendation #5.

[11] A number of NIH mechanisms fall under the research project grant grouping including R01s

Recommendation #4: The NIH should assess the reason(s) for the disparity in the frequency of awards to African American applicants for postdoctoral positions on T32 training grants and F32 fellowships, and take appropriate remedial actions once the reason(s) for this disparity have been determined.

Recommendation #5: NIH, through NIMHD serving the coordinating function, should partner with established minority scientific and professional groups and other trusted organizations to implement a system of mentorship "networks" for underrepresented minority students that will provide career guidance throughout their career development. The mentorship networks would be expected to make available a cadre of investigators who would, among other mentoring activities, provide workshops in grant writing, grant presentations, and optimal participation in editorial and NIH review processes.

Recommendation #6: Establish a working group of the ACD, of racially and ethnically diverse scientists, to provide regular input to the Director of NIH, and the Institutes and Centers, regarding the state-of-the-art in effective programs that overcome or reduce disparities in research awards.

Recommendation #7*:* Investigators whose applications are unscored should be provided with a more detailed explanation of the factor(s) that led to this determination, thus enabling an applicant to better understand the areas of concern leading to the decision about his or her proposal. Ideally, these comments from the peer reviewers should help the applicant decide whether he or she should "resubmit or rethink" an unscored application.

Recommendation #8*:* Under the leadership of NIMHD, and in coordination with other STEM initiatives underway in HHS and across other Federal government agencies, NIH should undertake a bold, well-funded, multi-year, incentive-based, competitive grant process to support infrastructure development in those comparatively under-resourced institutions with a documented track record of producing and supporting URM scientists as well as stimulating creative partnerships among these institutions and, where appropriate, including more resource-rich institutions.

Recommendation #9: The NIH should expeditiously establish a new Working Group of the ACD comprised of experts in behavioral and social sciences and studies of diversity with a special focus on determining and combating real or perceived biases in the NIH peer review system. In particular, this new Working Group should:

- Oversee the collection and analyses of quantitative and qualitative data relevant to the research project grant review and grant-making decision process.
- If this additional analysis provides evidence of bias, provide guidance and insight on potential actions that the NIH could take to combat bias.
- Provide oversight to an analysis of the discourse content from peer review sessions so as to contribute to the understanding of potential bias.
- Provide expert oversight to a text-based analysis of the commentary on individual grant reviews, including R01s and a subset of applications for those awards (career awards, fellowships, smaller research project grants, and others) most likely to precede an investigator submitting a R01 application.

- Oversee other efforts that investigate potential effects of unconscious bias in peer review.

Recommendation #10: NIH should first pilot different forms of validated implicit bias/diversity awareness training for NIH scientific review officers and program officers to determine the most efficacious approaches. Once the best training approaches have been identified with NIH staff, pilot these programs with members of study sections to ascertain if their value is sustained. If they are, provide to all study section members.

Recommendation #11: NIH should design an experiment to determine the effects of anonymizing applications with respect to applicant identity as well as that of an applicant's institution. The WGDBRW understands that the nature of implicit bias cuts across processes, structures, organizations, and societal groups. The prospect of bias in the NIH peer review process is a serious matter that calls for deliberative action in a timely fashion.

Recommendation #12: Appoint a Chief Diversity Officer (CDO) and establish an Office of Diversity with a suitable budget. The CDO should be an established biomedical scientist with considerable expertise in diversity in academic and academic medical settings. The CDO should report directly to the NIH Director and be responsible for ensuring the coordination of diversity-focused efforts across the NIH, including:

- developing diversity training programs for investigators
- providing resources to facilitate the recruitment of URM scientists, women, persons with disabilities, and veteran candidates
- supporting scientific research in diversity as related to STEM professions, health care, the interrelationship of a diverse health care workforce to a diverse scientific community, health care policy, health care delivery, and other related areas
- undertaking a systematic and thorough review of all IRP programs and determining appropriate intervention points
- recruiting and retaining diverse tenure-track scientists
- training post-baccalaureate, postdoctoral, and other levels of scientists at the NIH

Recommendation #13: Using the trans-NIH Earl Stadtman Investigator search process as a model, and learning from its experience, the NIH should institute a more comprehensive search process for tenure-track investigators to ensure the identification of a diverse pool of candidates.

Appendix B: Members of the ACD Subcommittee on Workplace Climate and Harassment

Louise Fitzgerald, Ph.D.
Emeritus Professor of Gender and Women's Studies
Professor Emerita of Psychology
University of Illinois Urbana-Champaign

John Pryor, Ph.D.
Distinguished Professor of Psychology
Illinois State University

Lilia Cortina, Ph.D.
Professor of Psychology, Women's Studies, and Management
University of Michigan

Jon Krosnick, Ph.D.
Frederic O. Glover Professor in Humanities and Social Sciences
Professor of Communication, Political Science, and Psychology
Stanford University

Appendix C: Hallmarks of Success and Logic Models: Enhancing the Diversity of the NIH-Funded Workforce

	Individual-Level (Student) Hallmarks
IND-B1	Psychosocial Variables (Including: Academic and Scientific Self-Efficacy, Science/Researcher Identity, Participation in Academic/Professional Student Organizations, Satisfaction with Faculty Mentorship, Social Integration/Perceived "fit" with University Setting, Intent to Pursue Career in Biomedical Research)
IND-B2	Pursuit of Biomedical Science Undergraduate Degree or discipline relevant to BUILD*
IND-B3	Retention and Persistence in Biomedical Science Discipline relevant to BUILD*
IND-B4	Participation in Undergraduate/Summer Biomedical Research Training in Labs or Similar Research Environment
IND-B5	Poster or Presentation at Scientific Conferences
IND-B6	Submitted Applications and Receipt of Awards, including Research Fellowships and Scholarships
IND-B7	Evidence of Biomedical Research Career Preparedness (grades, GRE; std. exams)
IND-B8	Authorship/Co-Authorship of Peer-Reviewed Publication(s)
IND-B9	Completion of Undergraduate Degree in Biomedical Science Discipline relevant to BUILD*
IND-B10	Application & Acceptance to Attend Graduate Program in Biomedical Science Discipline relevant to BUILD*
IND-B11	Entrance to Graduate Program in Biomedical Science Discipline relevant to BUILD*
	Institutional-Level Hallmarks
INST-B14	Increase, enhance, and/or develop Inter-Institutional collaborations to achieve BUILD outcomes related to research, mentorship, and faculty development (e.g., linkages with Community Colleges or other partner institutions, collaborations and postdocs at Research-Intensive partner institutions, engagement with NRMN)
INST-B1	Improved Undergraduate Retention Rates of Students in Programs Relevant to BUILD* (biomedical/ behavioral sciences)
INST-B2	Increased Participation in Mentoring Activities (Students and Faculty) in Programs Relevant to BUILD*
INST-B12	Increase in Number of Student Research Training Opportunities for students and faculty in Programs Relevant to BUILD*
INST-B13	Increase in Number of Underrepresented Students Enrolled in BUILD Biomedical Research- Related Programs
INST-B3	Increase in Number of Underrepresented Students Retained in BUILD Biomedical Research- Related Programs
INST-B17	Institutional commitment to BUILD sustainability evidenced by site maintenance of key elements of program interventions after grant period**
INST-B18	Increased institutional commitment to sustaining activities of BUILD (i.e. research infrastructure, FTE, scholarships, space), changing the academic culture, culture of faculty promotion, tenure, research development (release time), stronger emphasis on student mentoring and advising to increase institutional outcomes, curriculum improvements**

INST-B19	Increase enrollment and participation of underrepresented Students in biomedical research fields
INST-B20	Increase in participation of faculty in mentorship activities - defined as: Increase in number of faculty seeking and participating in mentor training
	Faculty/Mentor-Level Hallmarks
FAC-B15	Increase in the number of trainees mentored in Programs Relevant to BUILD*
FAC-B4	Increase in Participation in Professional Development Activities for faculty in Programs Relevant to BUILD*
FAC-B12	Increase in Faculty Participation in Mentorship Activities in Programs Relevant to BUILD (may include structured activities to train the next generation of biomedical scientists) **
FAC-B8	Increased Research Productivity in Publications, Grant Submissions and Awards as PI, multi-PI and/or collaborator for faculty in Programs Relevant to BUILD
FAC-B16	Increased quality of mentoring (Student and mentor perceptions)
FAC-B1	Change/Increase in self-efficacy as instructor, mentor and/or researcher
	Demographic/Background Variables (Student, Faculty, Institution)
Student	School/Institution
Student	Geographic Location
Student	Gender
Student	Ethnicity
Student	Disability Status
Student	Socioeconomic Status
Student	High School GPA
Student	Standardized Test Scores
Faculty/Mentor	Institution
Faculty/Mentor	Gender
Faculty/Mentor	Race/Ethnicity
Faculty/Mentor	Disability Status
Faculty/Mentor	Socioeconomic Status
Faculty/Mentor	Field of Study

Faculty/Mentor	Years Since Degree
Faculty/Mentor	Prior NIH Support
Faculty/Mentor	Prior Research Experience
Faculty/Mentor	Prior Mentoring Experience
Institution	Institution Type
Institution	MSI Status
Institution	Geographic Location
Institution	Public/Private Sponsorship
Institution	Faculty/Staff Diversity
Institution	Student/Client Diversity
Institution	Collaborations with Institutions
Institution	Research Intensiveness
Institution	Mission

*Refers to biomedical, social, behavioral and health sciences including biomedical engineering
**Pertains to BUILD only

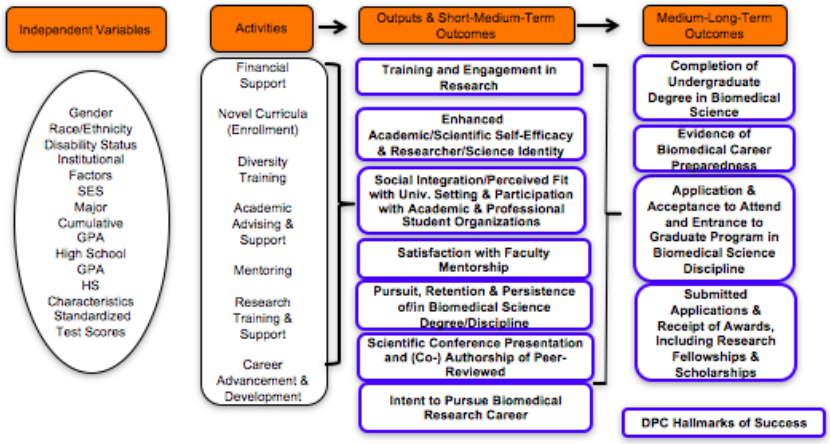
National Research Mentoring Network (NRMN) Simplified Logic Model with 5-Year Cumulative Projections, Key Outcomes, Most Important Outcomes and Evaluation/Research Questions Being Addressed (version 12/5/2016)

Mission: To promote and provide mentoring to diversify the biomedical workforce

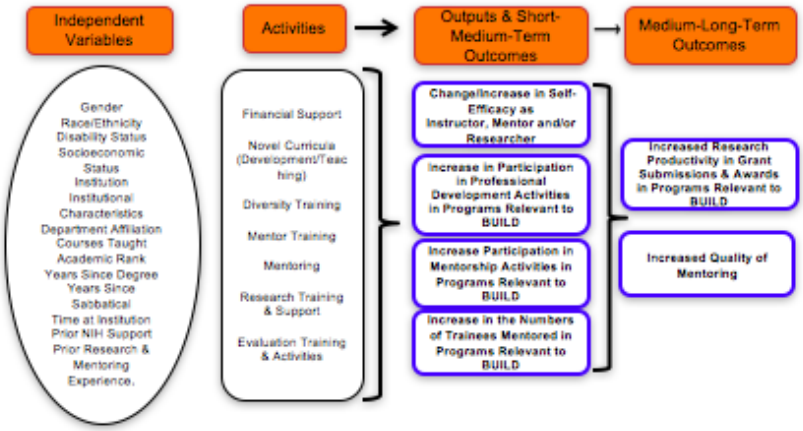
Overarching Goal: To significantly contribute to national efforts of increasing the size, quality, diversity, and research productivity of the biomedical workforce trained to improve human health

Program Components, Goals, and Projected Outputs		Key Outcomes and Impacts	Research and Evaluation Questions NRMN Will Address
Key Program Outputs	**Projected 5-Year Participant Totals**	**Key Outcomes *Most Important Outcome (MIO)**	**Requires coordinated NRMN and CEC data
MATCHING/ LINKING			
# participants registered on NRMNet.net	10,000	A national network for diverse mentors and mentees who connect virtually and face-to-face* • Greater career persistence in biomedical sciences among under-represented groups. • Greater self-efficacy in ability to succeed in biomedical careers.	• Do mentees who register for NRMNet and access additional mentors through the NRMN Network self-report increased self-efficacy in their ability to succeed in a biomedical career and go on to persist in biomedical science?** • Do mentees who engage in the NRMN Virtual Guided Mentorship Program or My NRMN activities (e.g. individual networks, groups functions) self-report increased access to mentors and an expanded mentoring network? ** *Note that analysis of mentee networks will require social network analysis which neither NRMN or the CEC are funded to conduct.*
# mentees and mentors engaged in relationships initiated or supported in any way across all NRMN programs	7,500		
# mentors and mentees actively networking in MyNRMN	2,500		
# mentors and mentees matched through a Virtual Guided Mentorship Program	1,000		
TRAINING			
# early career faculty trained in grant writing	700	Evidence-based intensive grantsmanship coaching for early career faculty* Evidence-based training for mentors and mentees across career stages and disciplines* • Increased skills, knowledge and self-efficacy (confidence) in grant writing • Increased skills, knowledge and self-efficacy (confidence) in creating and	• Do early career faculty who engage in intensive grantsmanship coaching self-report increased skills, knowledge, and self-efficacy in grant writing and subsequently submit and receive more grants (compared to the rates in the Ginther report)? (**after 18 months) • Do mentors who engage in training through NRMN (and in some cases certified) self-report increased knowledge, skills and self-efficacy in their ability to maximize their mentoring relationships in a culturally responsive manner? Do these increases correlate with dosage, mode and topics of training?
# mentors trained	5,000		
# individuals certified as NRMN or NRMN Master mentors	200		
# mentees trained	1,000	maintaining effectiveness of mentoring relationships. • Greater advocacy for mentorship • Increased commitment to cultural awareness in promoting diversity in biomedical research.	• Do mentees who engage in training through NRMN self-report increased knowledge, skills and self-efficacy in their ability to maximize their mentoring relationships? • Do mentees rate their relationships with NRMN trained mentors as more effective than mentees working with mentors not NRMN trained mentors?**
REFERRING			
# organizations and institutions actively partnering with NRMN	100	Resources for mentors and mentees across career stages and disciplines* • Increased pool of high quality, audience-valued, targeted resources available to diverse individuals across career stages pursuing biomedical careers*	• Do mentees who register on NRMNet and access additional resources through the NRMN Network of organizations and partnering institutions self-report increased self-efficacy in their ability to succeed in a biomedical career and persist in biomedical science?** • Do mentors and institutional officials who engage in training through NRMN self-report increased efficacy in navigating and referring scholars to mentoring resources on NRMNet?**
# unique resources made widely available on the NRMNet	45		
# of access hits across resources on NRMNet	5,000 page views per week		
PROMOTING			
# faculty trained as grant writing coaches	200	A national organization with a core infrastructure advancing the science of mentoring for research career persistence. * • Influence on institutional climate and structural barriers to creating an environment supporting diverse populations in the biomedical career pipeline • Recognition of the value of mentoring for diverse workforce at all career stages at colleges/universities. • Commitment by institutions nationwide to promote diversity in biomedical sciences	• Do grantsmanship coaches report increased knowledge, skills and self-efficacy in teaching others to be more effective grant writers? Do these coaches expand the impact of NRMN through implementation of their skills within their own institutions/ organizations and beyond? • Do mentor/mentee training facilitators report increased knowledge, skills and self-efficacy in teaching others to be more effective mentors/mentees? Do these facilitators expand the impact of NRMN through implementation of their skills within their own institutions/ organizations and beyond? Does effectiveness of their training and extent of their impact correlate with level/ type of facilitator training, critical mass of facilitators in their institution/ organization and perceived institutional/ organizational barriers? • Do institutional change agents (e.g. AAMP Pioneers, Mentoring Academy participants, master facilitators) engage in activities, which increase the attention to/ support for mentoring program at their institution/ organization? *Note: Analysis of barriers and supports for institutional/organization change and national impact is not currently funded and will require additional resources for data collection and analyses.*
# facilitators trained to implement mentor and mentee training	750		
# leaders, institutional change agents and Master Facilitators	100		

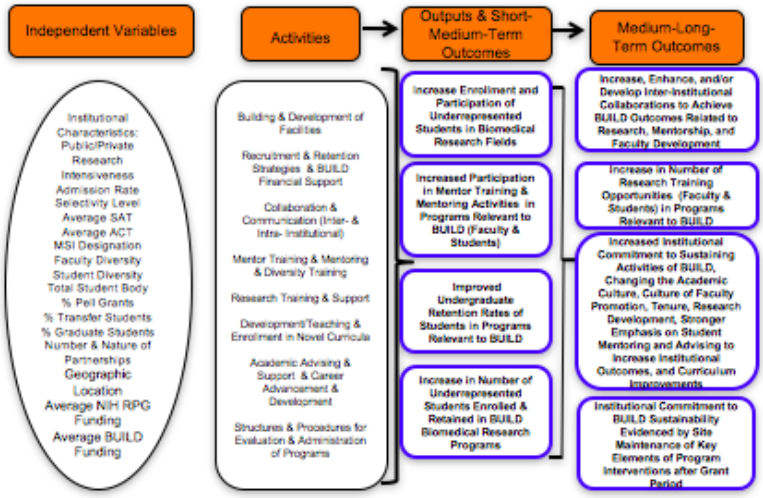
BUILD Student Logic Model



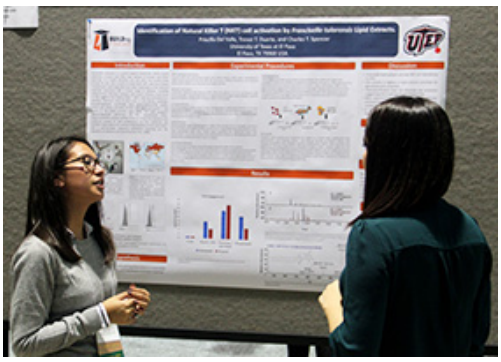
BUILD Faculty Logic Model



BUILD Institutional Logic Model



Appendix D: BUILD Success Stories



Spotlight: Born in El Paso, Texas, Priscilla Del Valle moved to Saltillo, Mexico, where she spent most of her childhood. Shortly after graduating from high school, she returned to El Paso to start undergraduate courses at El Paso Community College (EPCC), to pursue an M.D. Del Valle explains that in Mexico, unlike in the United States, careers in medical research are not really emphasized in the student community or in society, so she did not have firsthand experience with research. Del Valle discovered her passion for research when she was assigned a project on malaria as part of an EPCC course. She was fascinated by the parasite that causes malaria. "It impressed me how something so little could infect a person so harshly," she says. This experience spurred Del Valle to apply to the Research Initiative for Scientific Engagement (RISE) program at EPCC, where she conducted research and published her findings through the Texas AgriLife Research and Extension Center in El Paso, an extension of Texas A&M University. Del Valle transferred to UTEP at the start of her sophomore year, after she was awarded a BUILDing SCHOLARS research traineeship. Del Valle says she likes "the way that they [BUILDing SCHOLARS] take care of us and the workshops and opportunities that we have."

Spotlight: Chyann Richard (Junior, Psychology Major, California State University, Long Beach). Before BUILD and CSULB, Richard's college pathway hadn't been easy, with many of her peers saying "Graduate school is a lot of time." She describes herself as highly motivated and optimistic. Many of her struggles do not deter her from "wanting to do it." Her path began junior year of high school where a major event sparked her interest in neuroscience. Her mother was diagnosed with generalized anxiety disorder which led her to take an Advance Placement psychology course which "brought [my mom's condition] into perspective." From there, Richards enrolled at Cerritos College, a community college based in Inglewood, California where she took courses, played basketball, and held employment to develop her identity and future aspirations. While attending, she was informed about the BUILD program at CSULB and opened up her perception of psychology and realigned her motives to become a researcher. Through BUILD, Richard works in CSULB Assistant Professor Michelle Barrack's lab where she contributes a unique viewpoint as the sole psychology major to the lab's multi-disciplinary focus on health and nutrition. Richard is enthusiastic about the mentoring received from

Barrack and advises students “not [to] get discouraged” when pursuing a career path different from their parents or friends. The BUILD program has prepared her for a successful graduate career and their support along with her family motivates her to succeed as does overcoming some stereotypes about what a scientist should look like. Richard says “If you really want to do it, make sure you get it done.”

Spotlight: Being in the BUILD program has helped Kendale Watson gain confidence, and that helps him learn more. His goal is to get an M.D., M.P.H., and he’d like to be an Ob-GYN physician. Watson grew up in rural Louisiana, in a single-parent household, and is the first in his family to go to college. It’s been a big change for him coming to Xavier, and he says “everybody has so much faith in me to come back and make a change in our city,” so he has a lot of pressure on him to succeed; he hopes he can be an example to the other kids in the neighborhood and really wants to do well as a result. Watson would like to go back to the area near his home and open clinics or be an admin in the hospital there. Watson thinks small towns (like where he grew up) need more doctors and family-care practitioners so that women and families don’t need to go to the city for care. The mentorship he’s gotten through BUILD, and the career development activities (including how to present research, developing an “elevator speech,” understanding jargon/ and avoiding use of jargon in presentations) have been beneficial, and he has learned how to read and understand scientific research papers. BUILD feels like a “mini-grad school, or a pre-grad school, and it’s a good environment because the other students are also driven and interested in research. Kendale gained confidence from participating in the program, and he says the stipend and tuition assistance help.

Appendix E: NRMN Success Stories

Mentors and mentees have already noticed positive results from their interactions with NRMN. Below are examples highlighting experiences from two participants:

Spotlight: Sergio Ita was recently awarded a Ph.D. from Harvard Medical School, and he is now working as a Postdoctoral Fellow at Boston College. Ita was a non-traditional student, as he came into his program married with young twin daughters, and he is the first-generation of his family born in the United States. He recognizes the importance of mentorship in the sciences, as it helps create a feeling of community and support: "It took me 7 years to complete my Ph.D., and during that time I hadn't gone to any SACNAS[12] or ABRCMS[13] meetings, so my participation in activities like this saw almost a complete drop-off when I came here [Boston College]. NRMN brought that back. I hadn't exactly forgotten about the importance of having a community of support, but when there was no visible support I just assumed that's how it was in the new environment. It has been re-invigorating to be a part of a community again. I love that part of it."

Select image below to watch Sergio Ita's success story testimonial

Spotlight: Maria Elena-Zavala is a professor at California State University, Northridge. She is an Associate Director of NRMN's Mentorship and Networking Core and Grantsman Mentor. She says, "You want people to be mentors, not tormentors." As associate director at the National Research Mentoring Network (NRMN), "we need strong advocates in leadership positions to actually help change the face of science."

Elena-Zavala grew up in traditional Mexican-American home in Laverne, California. She attended Pomona College to complete her undergraduate degree and went on to pursue a Ph.D. Her experiences shaped her goals for the future – rather than becoming a physician, she wanted to affect victims of their socio-economic status. She decided to continue her career as a professor in an institution where she could work with minorities and invest in the future that way. According to Elena-Zavala, "no scientist becomes a scientist overnight and it's important for mentoring programs to be flexible and recognize how students respond to various challenges as they progress."

[12] Society for the Advancement of Chicanos/Hispanics and Native Americans in Science.
[13] Annual Biomedical Research Conference for Minority Students.

Appendix F: OITE GSOAR Program Details

This program is designed for recently matriculated, first or second year graduate students enrolled in a biomedical PhD program, especially those interested in integrating quantitative approaches into research design and analysis. Students completing a master's degree who are transitioning into a biomedical PhD program are also eligible to apply. Students from diverse backgrounds and students who have faced disadvantage that impacted their educational or research opportunities earlier in their educational careers are especially encouraged to apply.

GSOAR students will spend the summer working at the NIH side-by-side with some of the world's leading scientists, in an environment devoted exclusively to biomedical research. The GSOAR Program will begin with a three-day orientation and leadership training program followed by a two-day symposium on the uses of data science in the biomedical sciences.

During their internships at NIH, scholars will be matched with research mentors in the NIH Intramural Research Program (IRP) where they will be immersed in a culture of translational science and will explore important elements of the basic, translational and clinical research enterprise. In addition to performing full-time research, scholars will:

- Participate in a customized curriculum that will use journal clubs, case studies, and group activities to develop communication, critical thinking, career readiness, and leadership skills needed to thrive in interdisciplinary graduate programs and research environments in the biomedical sciences.
- Participate in a leadership development program focused on self-awareness, resiliency, conflict management, effective mentoring relationships, and understanding emotional intelligence.
- Attend a two-day symposium on data science to provide a foundation for the development of quantitative skills needed to successfully compete for future opportunities in biomedical research careers.
- Engage the broader NIH community in discussing cutting-edge research through participation at NIH Summer Poster Day.
- Establish an individualized development plan to take advantage of the many workshops and seminars offered for all NIH summer interns. These include our summer lecture series, communication skills workshops, and the NIH Graduate Partnerships Program (GPP) Annual Scientific and Professional Development Retreat.
- Have the option to attend the OITE Translational Science Training Program.

During their internships at NIH, scholars will receive a monthly stipend and Transhare benefits for travel within the Metro DC area (Transhare is a transportation subsidy provided to individuals who agree to use any form of public transportation and not their car to get to work).

A program evaluation is planned for GSOAR. The following are the evaluation components:

1. Demographic survey

2. Post-completion program evaluation asking participants to rank their overall summer experience, the value of the curriculum, the effectiveness of the teaching, and whether they would recommend the program to their peers
3. Three- and six-month post-completion follow up with participants to learn whether:
    a. participants are considering pursuing an individual agreement partnership to return to the NIH to do their dissertation research
    b. material participants learned during the program has benefited them now that they are back at their home university

Appendix G: OITE HiSTEP Program Details

The HiSTEP Program includes:

- Scientific skills, career, and team-building seminars: These will focus on the scientific, professional, and personal skills required for success in STEM-M careers.
- Exploration of STEM-M careers: Students get to experience the scientific enterprise and the role played by scientists, health care workers, and science policy experts. Students will complete case studies and examine current hot topics in human health.
- Leadership training: Students are helped to develop self-awareness, assertiveness, and interpersonal and resiliency skills. Success in college and in STEM-M careers depends on these skills.
- College advising: Topics will include the application process, finding scholarships and mentors, and successful transitions to college.
- Career advising: Students will discuss finding careers, finding internships, writing resumes and cover letters, interviewing, and professionalism.

During their internships at NIH, scholars will receive a monthly stipend and NIH Transhare benefits for travel within the Metro DC area (NIH Transhare is a transportation subsidy provided to individuals who agree to use any form of public transportation and not their car to get to work).

Appendix H: Descriptive Statistics of Race/Ethnicity for Awardees, FY 2000 – 2015, Postdoctoral Traineeships (T32)

Figure 24: Racial Demographics of Postdoctoral T32 Awardees

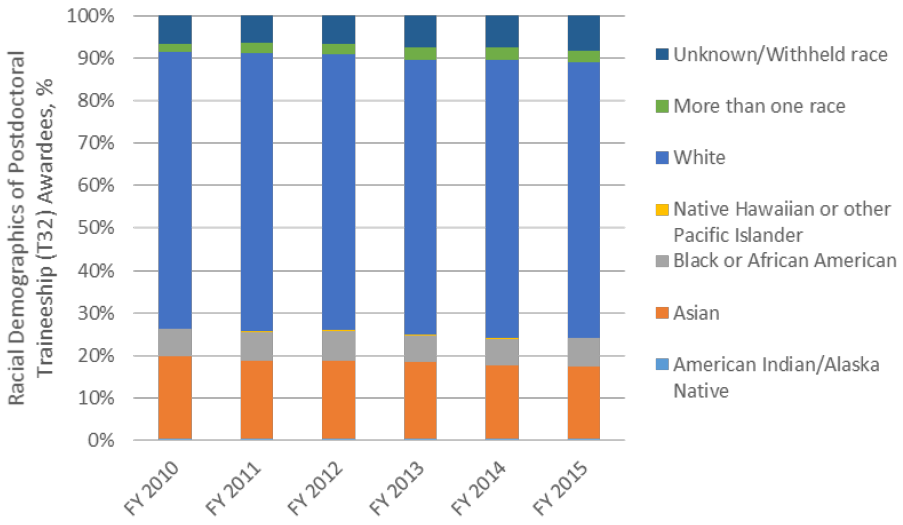
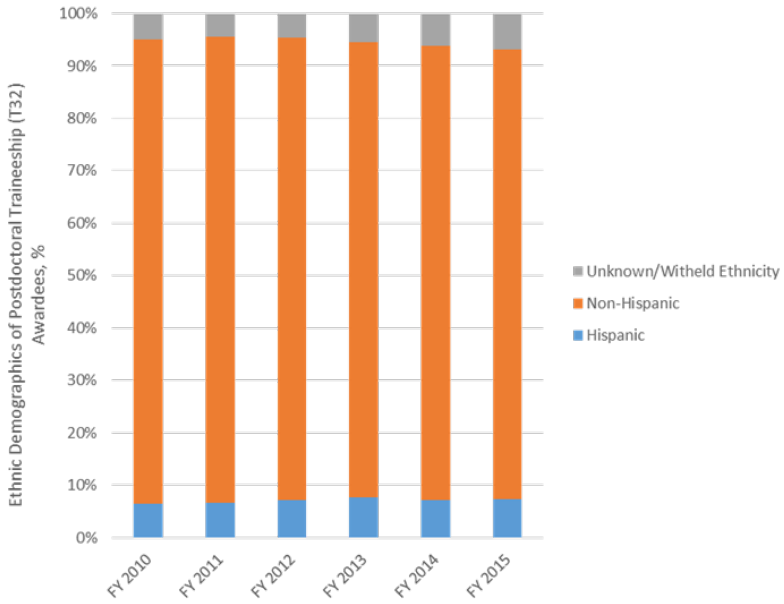


Figure 25: Racial Demographics for Hispanic and Non-Hispanic Postdoctoral T32 Awardees



Appendix I: Descriptive Statistics of Race/Ethnicity for Awardees, FY 2000 – 2015, Postdoctoral Fellowships (F32)

Figure 26: Racial Demographics of Postdoctoral F32 Awardees

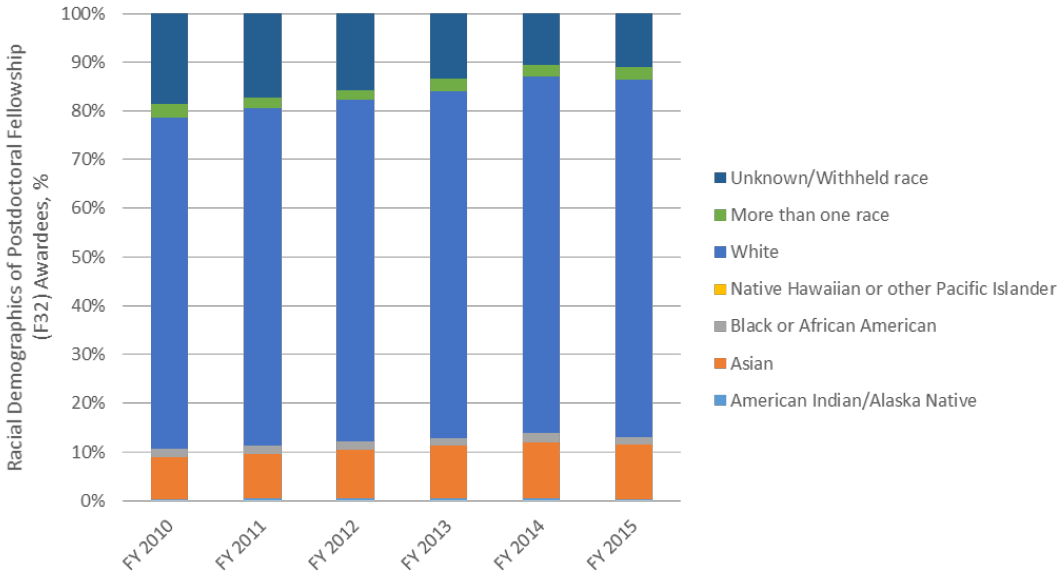
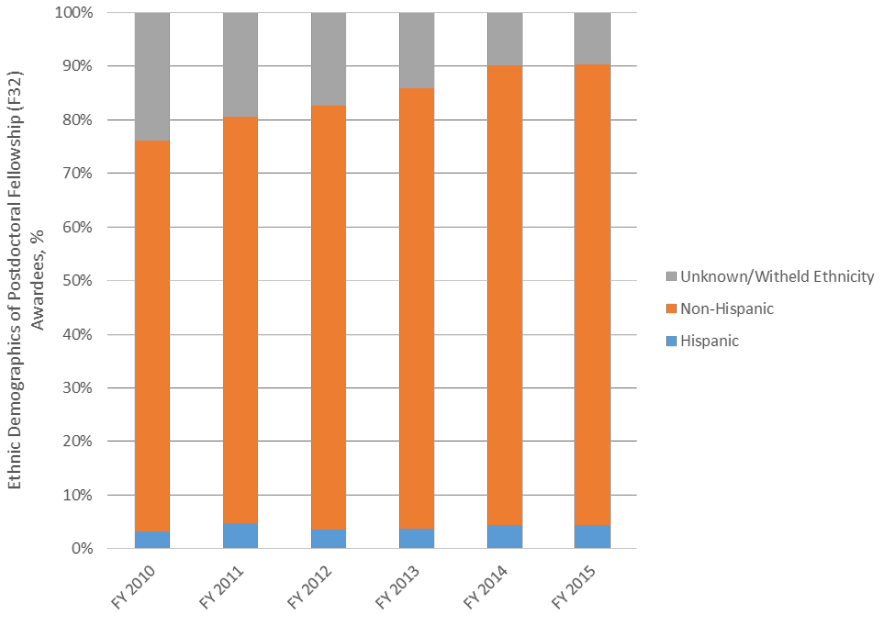
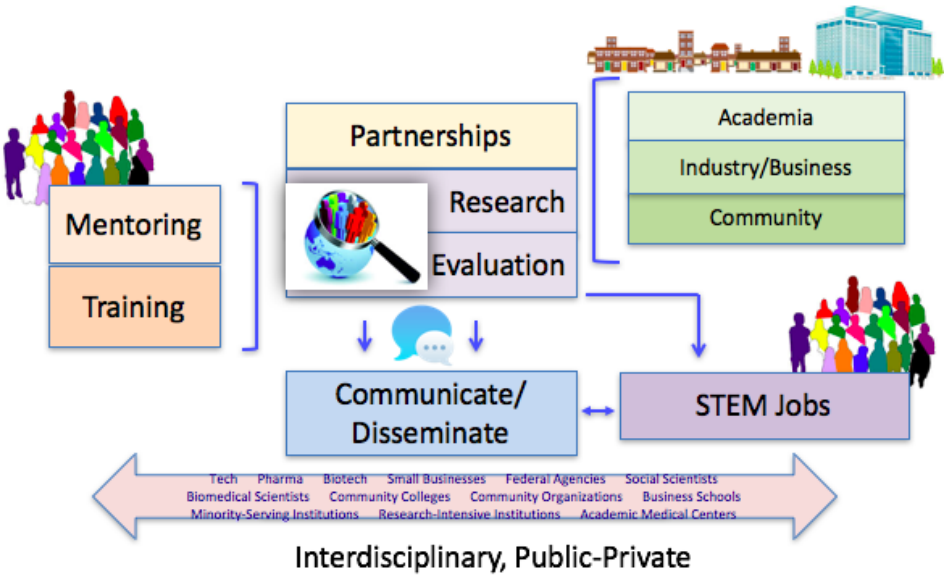
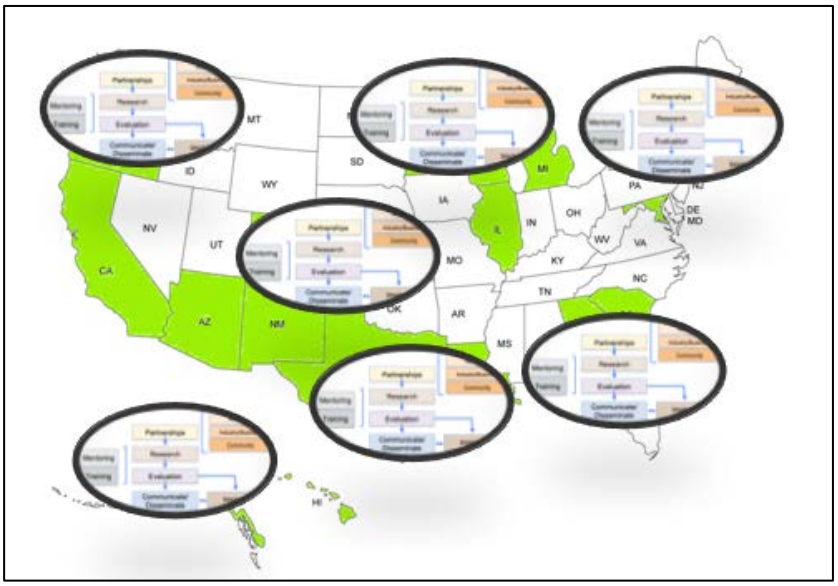


Figure 27: Racial Demographics for Hispanic and Non-Hispanic Postdoctoral F32 Awardees



Appendix J: Conceptual Model for Hubs of Innovation Public-Private Partnership





The proposed Hubs of Innovation is a comprehensive, research-centric systems approach to STEM talent recruitment and retention. In this model, interdisciplinary teams of experts will evaluate programs and track progress. Linked via a national network, perhaps building on existing NIH investments (such as BUILD), the Hubs will engage public and private partners in shared decision-making toward developing sharable integrated tools and resources to enhance and sustain scientific workforce diversity across the United States.