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# NIH REQUEST FOR INFORMATION: DIVERSITY IN THE BIOMEDICAL RESEARCH WORKFORCE

ANALYSIS OF PUBLIC COMMENTS

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APRIL 16, 2012

This report includes an analysis of the comments received through the NIH Request for Information (RFI): Input on Diversity in the Biomedical Research Workforce (NOT-OD-12-031)

## Executive Summary

Recognizing that achieving diversity in the biomedical research workforce is critical to the full realization of our national research goals and is in the best interest of our country, the National Institutes of Health (NIH) Advisory Committee to the Director (ACD) formed a Working Group on Diversity in the Biomedical Research Workforce.<sup>1</sup> The Working Group was charged with the task of examining issues related to diversity in the biomedical research workforce in the United States. As part of the process, the Working Group gathered input from the extramural community through a Request for Information (RFI): “Input into the Deliberations of the Advisory Committee to the NIH Director Working Group on Diversity in the Biomedical Research Workforce” (NOT-OD-12-031).<sup>2</sup> Ripple Effect Communications, Inc. was contracted to provide third party analysis of the comments received through the RFI; this report provides analysis of the 140 responses to the RFI and summarizes respondent suggestions. The Working Group will make recommendations to the ACD to help ensure a diverse and sustainable biomedical and behavioral research workforce.

The diversity Working Group identified two primary categories with a total of six issues and ten sub-issues as important to consider for enhancing diversity in the biomedical research workforce. Respondents were asked to consider the identified issues as they responded to the following three questions:

1. For any of the areas identified above and any other specific areas you believe are worthy of consideration by the Working Group, please identify the critical issues(s) and impact(s) on institutions, scientists, or both.
2. Please identify and explain which of the issues you identified are, in your opinion, the most important for the Working Group to address and why.
3. Please comment on any specific ways you feel these issues would or should affect NIH policies or processes.

## DATA AND METHODS

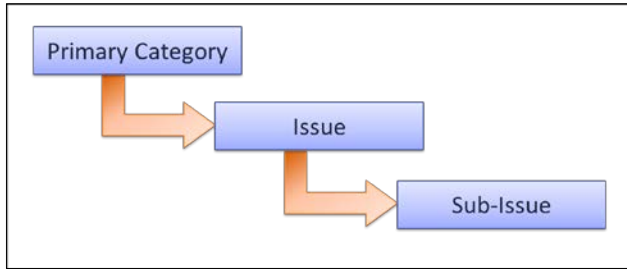
NIH received submissions from 140 respondents, most of whom provided feedback from a personal perspective (self, 68%; organization, 32%). The 140 respondent submissions were parsed into 547 comments and each comment was coded according to the issues identified by the Working Group, and others that emerged from the data.

A coding scheme was developed based on the two primary categories, six issues, and ten sub-issues identified by NIH. That structure provided the conceptual foundation, which team members further developed using an iterative, grounded theory approach. The final coding scheme consisted of the two

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<sup>1</sup> <http://acd.od.nih.gov/dbr.htm>

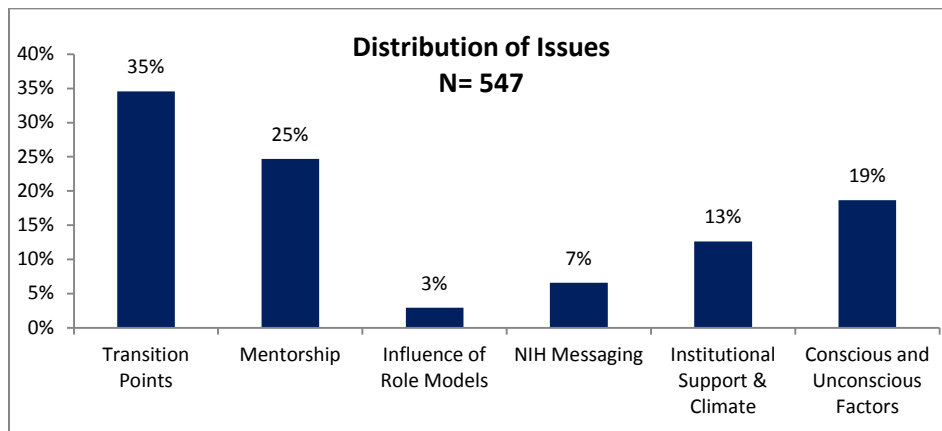
<sup>2</sup> <http://grants.nih.gov/grants/guide/notice-files/NOT-OD-12-031.html>



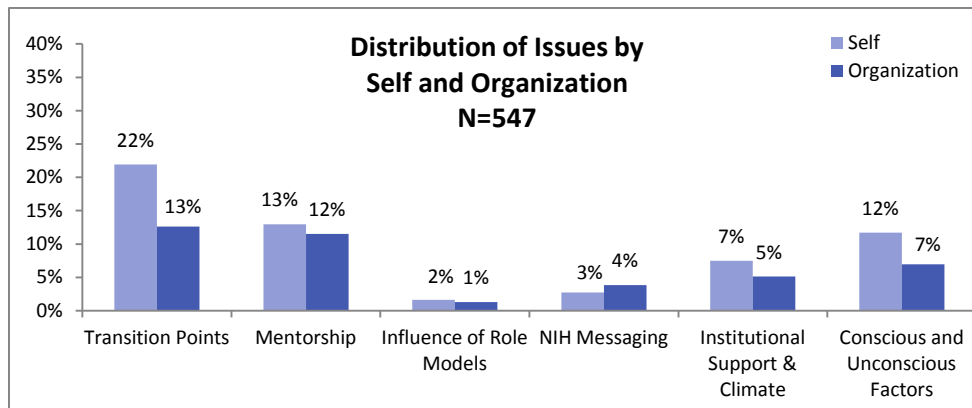
primary categories, six issues, and ten sub-issues identified in the RFI, plus 14 sub-issues derived from the data. Responses to one issue, *Influence of Role Models*, did not warrant the development of sub-issues; those comments were coded at the issue level. In total, 25 “codes” were applied to the data (one issue, 24 sub-issues).

## FREQUENCIES, PRIORITY AND RECOMMENDATIONS

Of the two primary categories identified by NIH, respondents most frequently commented about the Biomedical Research Workforce Pipeline. At the issues level, the top three most frequently coded issues were *Transition Points* (35%), *Mentorship* (25%) and *Conscious and Unconscious Factors* (19%).



When analyzed by self-reported affiliation, there were slight differences in how the codes were distributed. Those who self-identified as commenting from a personal perspective (self: n=96; 69%), commented more frequently about transition points, institutional support and climate, and conscious and unconscious factors in the review process, compared to those who self-identified as commenting from an organizational perspective (organization: n=44; 31%).



Priority was assigned to comments that explicitly stated it was a priority concern. The order of frequency distribution across priority issues matched the order of the larger dataset; however, at the sub-issue level, affiliation made a difference. Both groups identified transition points as the highest priority, but individuals voiced greater priority for the review process, while organizations voiced greater priority for mentorship.

Collectively, respondents recommended that NIH increase efforts at priming the pump before graduate school, work with organizations and institutions toward supportive collaborations at all institutional levels (to provide resources, such as professional development and mentorship opportunities), and evaluate NIH programs and funding sources to maximize NIH diversity efforts.

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# Background

## NIH REQUEST FOR INFORMATION

Recognizing that achieving diversity in the biomedical research workforce is critical to the full realization of our national research goals and is in the best interest of our country, the National Institutes of Health (NIH) Advisory Committee to the Director (ACD) formed a Working Group on Diversity in the Biomedical Research Workforce.<sup>3</sup> The Working Group was charged with the task of examining issues related to diversity in the biomedical research workforce in the United States. Its recommendations will include ways to improve the retention of underrepresented minorities, persons with disabilities, and persons from disadvantaged backgrounds through critical transition periods in the career pipeline.

To help inform the development of recommendations, the Working Group announced a Request for Information (RFI) to gather input from various sources, including extramural and intramural researchers, academic institutions, industry, and the public. For the RFI, the Working Group asked for feedback on the following issues and sub-issues that fall under the two primary categories of the biomedical research workforce pipeline and factors in the review process:

- Biomedical Research Workforce Pipeline
  - The appropriate transition points where NIH's training, career development and research grant programs could most effectively cultivate diversity in the biomedical research workforce
    - Entry into graduate degree programs
    - Transition from graduate degree to post-doctoral fellowships
    - Appointment from a post-doctoral position to the first independent scientific position
    - Award of the first independent research grant from NIH or equivalent in industry
    - Award of tenure in an academic position, at the NIH, or the equivalent in an industrial setting
  - The role of mentorship in the training and success of biomedical researchers throughout their careers
    - Development of relationships between professional societies, institutions, and individuals to develop mentoring programs
    - Creation and expansion of institutional mentoring programs
    - Mentoring of applicants and preparation of applications prior to submission
  - The influence of role models whose qualities and characteristics can positively affect the training and success of underrepresented biomedical researchers through their careers
  - The role of NIH messaging in encouraging underrepresented researchers to apply for NIH fellowships and grants

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<sup>3</sup> <http://acd.od.nih.gov/dbr.htm>

- The role of institutional infrastructure support and climate as a factor in the success of underrepresented researchers
- Factors in the Review Process
  - The potential role of institutional affiliation, academic pedigree, and various conscious and unconscious factors on review outcomes
    - Exploration of the possible influences of racial, ethnic, gender, affinity, or other biases
    - Research on the NIH Peer Review system to determine appropriate methods or interventions to identify and if necessary redress bias, including efforts to anonymize applications or test the effects of unconscious bias training on outcomes

Respondents were asked to consider the identified issues as they responded to the following three questions:

1. For any of the areas identified above and any other specific areas you believe are worthy of consideration by the Working Group, please identify the critical issues(s) and impact(s) on institutions, scientists, or both.
2. Please identify and explain which of the issues you identified are, in your opinion, the most important for the Working Group to address and why.
3. Please comment on any specific ways you feel these issues would or should affect NIH policies or processes.

The online submission process was open from January 10 through February 24, 2012. This report is an analysis and summary of the public comments and will serve as a tool for the Working Group to use as part of its process for making concrete recommendations to the NIH Director on ways to improve diversity of the biomedical workforce.

## THE ROLE OF RIPPLE EFFECT COMMUNICATIONS, INC.

Ripple Effect Communications, Inc. was engaged by the NIH Office of the Director to perform an analysis of the data received through the RFI. As an independent contractor, Ripple Effect staff is not invested in the ACD committee deliberations and therefore has no bias toward the outcomes of the assessment; however, Ripple Effect is uniquely positioned to bring a continuum of working knowledge and expertise about NIH to the analysis process. Our staff's diverse levels of knowledge about NIH allow an open interpretation of respondents' thoughts and ideas, which ensures full expression but also provides context for understanding potentially complicated messages.

Ripple Effect was established in 2006 to provide "Intelligent Project Management"<sup>TM</sup> to the federal government and is often called upon to provide support in one or more of the following areas: Communications; Program & Policy; Technology; Conference & Events Management; Organization & Process Improvement; Research & Analysis; and Project Management. We assess, plan, manage, and execute projects that aid the government (with the current focus on increasing transparency) in transforming into a "people-centric, results-driven and forward-thinking" organization.



## Methods

We engaged both quantitative and qualitative research methods as part of the analysis process. While focusing on and maintaining the integrity and structure of the issues identified by the Working Group, we remained open to the data. We used grounded theory data analysis methods to capture the ideas that were either pervasive enough to warrant their own code or went beyond the issues identified by the Working Group.

### ABOUT THE DATA

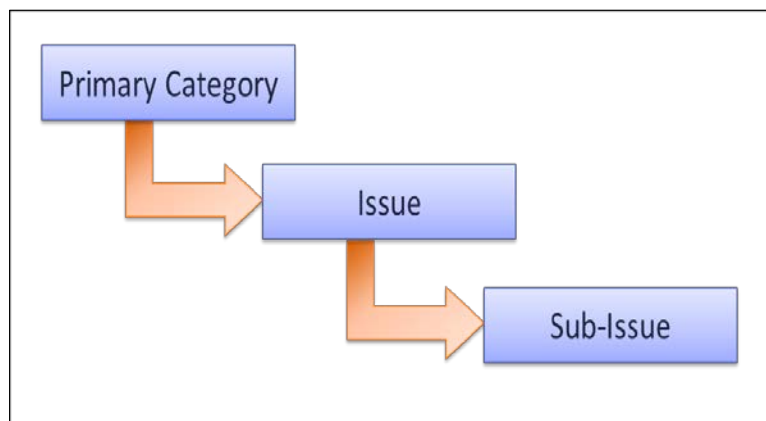
A total of 140 respondents provided feedback to the RFI; 134 through the online submission process (open January 10 through February 24, 2012) and 6 via email (late submissions that were included in the analysis). Most respondents, including 7 respondents with an NIH email or NIH identified organization, provided feedback from a self-reported individual perspective (self: n=96; 69%); others identified an organizational affiliation and were verified as responding on behalf of an organization (organization: n=44; 31%).

### ANALYSIS PROCESS

All submissions were uploaded and organized into a central SharePoint database. The contents of a single respondent's submission (individual or organization) were parsed into multiple comments. The result was a data set of 547 comments, coded according to the Working Group issues and others that emerged from the data, and then analyzed using both SharePoint and Excel.

### Code Development

Code development began using the two primary categories, six issues, and ten sub-issues identified by NIH as the conceptual foundation of the coding scheme. Team members further developed the coding scheme using an iterative, grounded theory approach, which involved studying the data, suggesting themes for inclusion, reviewing each other's code application, and resolving disagreements.



Conceptually, the codes that emerged from the data were all at the sub-issue level. In addition to the ten sub-issues identified by NIH, 14 others, referred to as “data-driven” codes, were developed and applied to the data. The final coding scheme included two primary categories, six Issues, and 24 sub-issues. Responses to one issue, *Influence of Role Models*, did not warrant the development of sub-issues;

those comments were coded at the issue level. In total, 25 “codes” were applied to the data (one issue and 24 sub-issues). The full coding scheme (including code descriptions) can be found in [Appendix A](#); below is a table illustrating the conceptual levels and code names used throughout this report.

Primary Category	Issue	Sub-Issue	
Biomedical Research Workforce Pipeline	Transition Points	Prior to Graduate School*	
		Entry to Graduate School	
		Postdoctoral Training	
		First Independent Position	
		First Funding Award	
		Award of Tenure	
		Leadership Appointments*	
		Retention/Career Sustainability*	
	Mentorship	Strengthen Relationships	
		Create/Expand Programs	
		Application Preparation	
		Quality Mentorship Unavailable*	
		Incentivize Mentoring*	
		Alternative Mentoring Models*	
	Influence of Role Models	None	
	NIH Messaging	Improve/Enhance Communications*	
		Improve Biomedical Career Image*	
		Promote Value of Diversity*	
	Institutional Support and Climate	Leadership Commitment and Education*	
		Identify and Address Barriers*	
		Minority Scientists Overburdened*	
		Accessing Institutional Support*	
	Factors in the Review Process	Conscious and Unconscious Factors	Bias Against Applicants
			Review System Bias/Redress
Diversify Study Sections*			

\*Data-driven sub-issues

## Priority

To assess the priority of issues identified by each respondent, we created a sub-group of comments that met at least one of the following criteria:

- 1) The comment was included in response to Question 2, “Please identify and explain which of the issues you identified are, in your opinion, the *most important* for the Working Group to address and why.”
- 2) The commenter explicitly expressed priority by using priority language, such as “critical,” “important,” or “essential,” etc.

If no priority was indicated or if the commenter explicitly expressed that the item was NOT a priority, the comment was not included as part of the priority analysis.

Analysis was a straightforward count of the number of people who identified each issue and sub-issue as a priority. From the individual perspective, priority is presented as an order based on the frequency with which each person identified a code, not as a mathematical rank. Analysis of this sub-group is presented in Section Two of the Findings.

## NIH Responsibility

To assess the role that respondents believed NIH should play in response to the issues identified in the RFI, we created a sub-group of all comments where individuals explicitly suggested an NIH responsibility or indicated that the issue fell under the purview of the NIH. Specifically, we included comments when at least one of the following criteria was met:

- 1) The comment was located in response to Question 3, “Please comment on any specific ways you believe these or other issues would or should affect NIH policies or processes.”
- 2) The commenter specifically stated that NIH should be responsible.
- 3) The comment addressed an existing NIH program.

If the respondent explicitly expressed that the item should NOT be the responsibility or purview of NIH or the comment was general and did not explicitly state NIH responsibility, it was not included in the NIH responsibility analysis.

Analysis occurred in two steps. First, we compared the frequency distribution of all sub-issues identified as an NIH responsibility with the overall data set. Second, we reviewed all data for overarching themes that informed explicit recommendations for NIH. Analysis of this sub-group is presented in Section Three of the Findings.

## Findings

Findings are divided into three sections that reflect different conceptual levels of analysis and respond to the questions posed in the RFI. The first section includes analysis in response to Question 1: “For any of the areas identified above and any other specific areas you believe are worthy of consideration by the Working Group, please identify the critical issues(s) and impact(s) on institutions, scientists, or both.” This section provides a quantitative overview of the primary categories and issues, along with a quantitative distribution and a qualitative analysis of the 25 sub-issues.

The second section addresses Question 2: “Please identify and explain which of the issues you identified are, in your opinion, the most important for the Working Group to address and why.” We coded and quantified the data for respondents that explicitly identified priority issues.

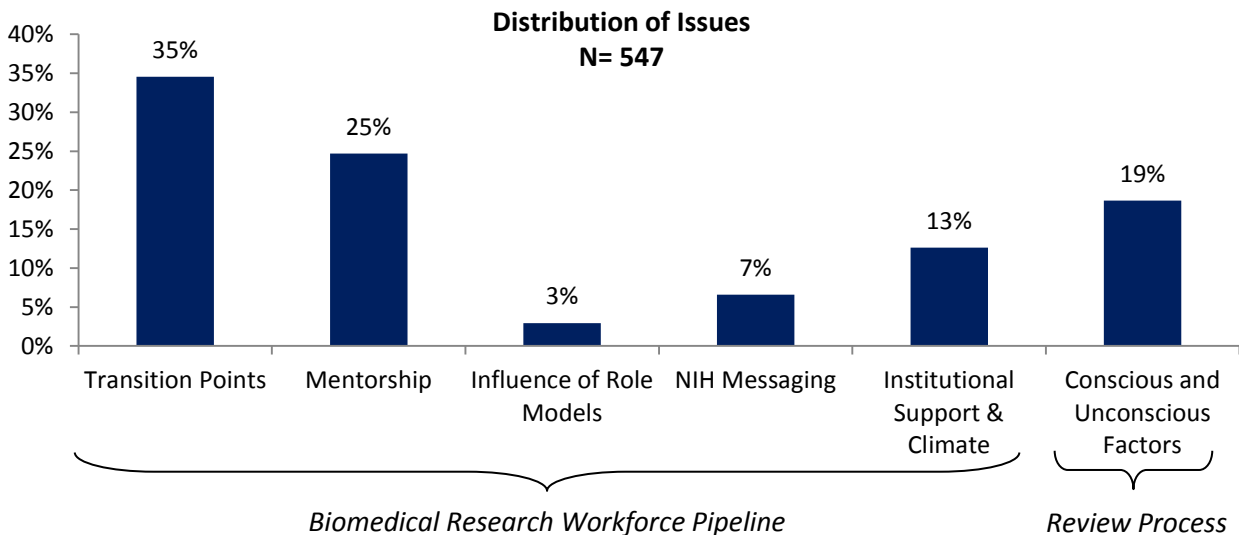
The third section includes a descriptive summary of the ideas commenters presented as relevant to Question 3: “Please comment on any specific ways you believe these or other issues would or should affect NIH policies or processes.” We coded and quantified the comments that referred to specific recommendations for NIH.

### SECTION ONE: QUANTITATIVE AND QUALITATIVE ANALYSIS OF CRITICAL ISSUES

A total of 140 submissions were received and parsed into 547 comments; each comment received one code and was analyzed for frequency and content.

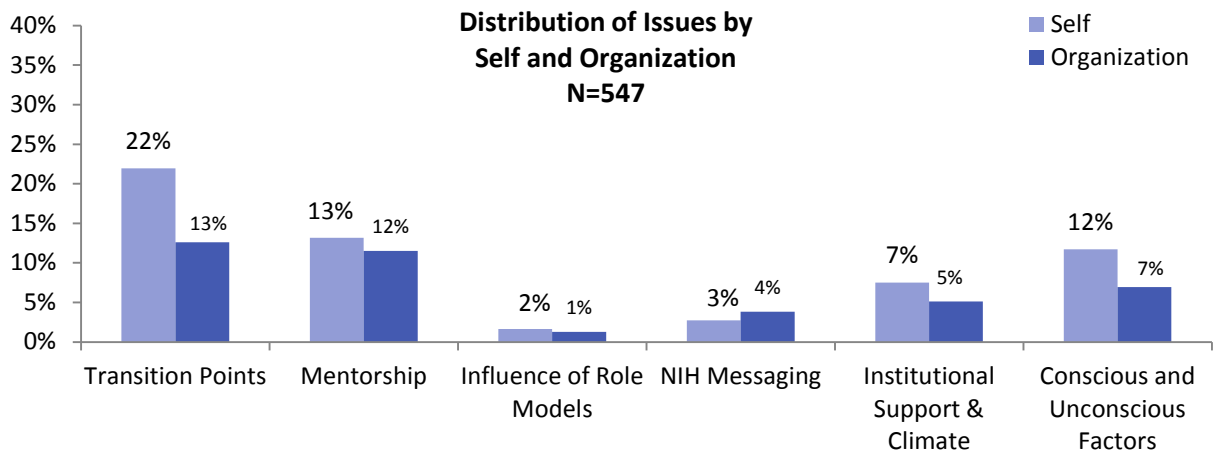
#### A Quantitative Overview of Primary Categories and Issues

Of the two primary categories identified by NIH, respondents most frequently commented about the *Biomedical Research Workforce Pipeline* (81%). Across the board, *Transition Points* was the issue most frequently commented on (35%), followed by *Mentorship* (25%) and *Conscious and Unconscious Factors* (19%).



## Issues by Respondent Affiliation

Respondents were identified with one of two types of affiliation: as an independent individual (self) or on behalf of an organization (organization). Those who responded from a personal perspective commented more frequently than organizations about *Transition Points*, *Institutional Support and Climate*, and *Conscious and Unconscious Factors* in the review process. Those responding on behalf of an organization commented most frequently on *Transition Points* and *Mentorship*, and also provided more suggestions about *NIH Messaging* compared to those responding on their own behalf.

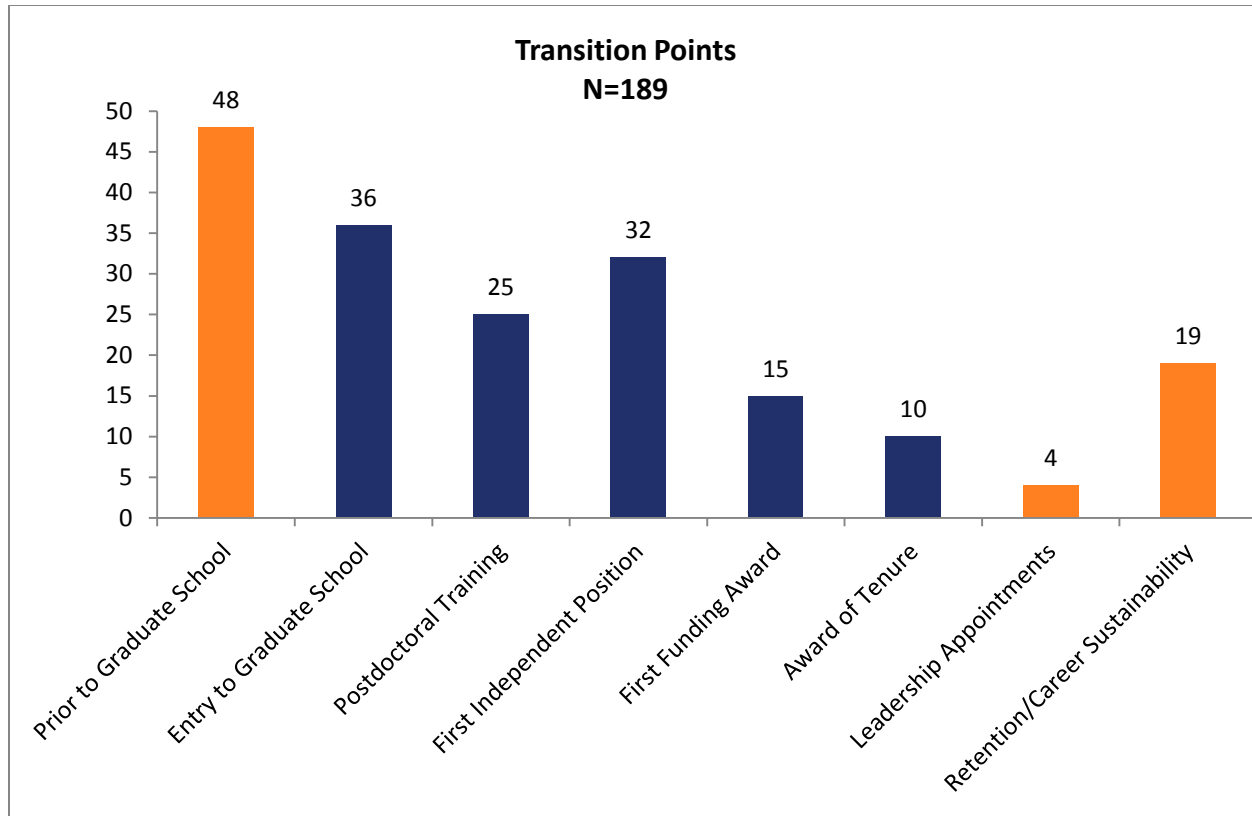


## A Quantitative and Qualitative Analysis of Sub-Issues

The six issues and 24 sub-issues, as identified by NIH and derived from the data, are illustrated and discussed here in detail. A graph that summarizes the frequency distribution across all sub-issue is provided in [Appendix B](#). Where relevant, the NIH-identified sub-issues are shown in blue, while data-driven sub-issues are shown in orange.

### Issue One: Transition Points

The issue most salient to respondents was pipeline *Transition Points*. In addition to the five transition points outlined in the RFI, respondents noted three other important points related to priming the pump and maintaining the pipeline: *Prior to Graduate School* (K-12 and undergraduate); *Leadership Appointments*; and *Retention/Career Sustainability*. The majority of comments were concerned with the earlier points in the pipeline, up to and including the point of *First Independent Position*.



### ***Prior to Graduate School***

This sub-issue was most frequently coded within the *Transition Points* issue, accounting for approximately 25% of all comments on this issue. *Prior to Graduate School* captured comments about the importance of priming the pump before entry to graduate school. We divided this code into three categories: K-12, undergraduate, and both. Of the 48 comments that suggested early intervention, 14 believed that K-12 interventions were essential, 13 believed undergraduate interventions were sufficient, and 21 expressed that both stages required attention.

Respondents who highlighted K-12 voiced a critical need to not only strengthen K-12 Science, Technology, Engineering, and Mathematics (STEM) curricula, but also to enrich the early education experience with funded outreach programs and hands-on, mentored research experiences. Such programs were believed to energize younger students' passion for science and related careers. Respondents identified barriers for students in K-12, including fear, poor career guidance, and insufficient support systems. More attention and stronger instruction toward developing communication and critical thinking skills were noted as paramount for success.

A similar pattern was observed for those respondents that identified a need only for undergraduate interventions. Enhancing curricula was considered important; however, enrichment, mentoring, and external research opportunities, such as summer research internships, were perceived as critical components to encourage more interest in the sciences at this stage. Increased awareness of the needs

of first-generation college applicants and student members of minority and underserved groups was a common concern.

It was frequently suggested that enhancing relationships between minority-serving schools and larger research-intensive institutions would open doors for educators who have the potential to serve as early mentors. It was believed that efforts to “broaden the net” would help recruit students in educationally underserved or remote areas where college matriculation levels are low and college retention rates are even lower.

### ***Entry to Graduate School***

A disparate range of ideas were expressed about how to improve *Entry to Graduate School*, the second most frequently cited transition point. Overall, respondents agreed that there were many barriers to recruiting minorities into biomedical graduate programs. From a cultural perspective, racism was cited as a concern; several commenters worried that recent research findings, such as findings in Ginther et al.,<sup>4</sup> were deterring students at the earliest stages of the pipeline.

Individual barriers involved the perceived requirements and rewards of a career in science. Respondents described minority students as being family-oriented (which a career in science would interrupt) and financially burdened (which could both prevent and deter a career in science) in comparison to their non-minority peers. Also, some respondents suggested that many students believed careers in science were too difficult. An effort toward better educating underrepresented minorities at the undergraduate level regarding degree and career options, especially dual-degree programs, would help recruitment at this stage.

At the institutional level, respondents suggested that undergraduates who would bring diversity to programs needed greater mentoring and guidance to promote their matriculation into a graduate program. Providing underrepresented students with more active assistance, such as finding a graduate school, assisting with the application process, and helping to prepare for entrance exams, was considered another means to increasing the number of diverse students entering graduate programs. Successful admission to graduate school was also linked to extra-curricular research experiences, such as summer research programs and research fellowships. Respondents believed that if minorities and other groups underrepresented in science are to be competitive applicants for graduate school, they would need assistance locating, applying to, and successfully entering such enrichment experiences.

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<sup>4</sup> Ginther DK, Schaffer WT, Schnell J, Masimore B, Liu F, Haak LL, Kington R. Race, ethnicity, and NIH research awards. *Science*. 2011 Aug 19;333(6045):1015-9. PubMed PMID: 21852498.

### ***Postdoctoral Training***

Comments regarding the transition to *Postdoctoral Training* varied, with different barriers and remedies identified. Some suggested an increase in the number of training grants awarded, others recommended that NIH should alter institutional requirements for new applications to allow less research-intensive institutions and minority-serving institutions access to these funds (potentially through collaborations). There was also a call for a significant shift away from institutional training grants to more individual-oriented funding structures, such as fellowship awards.

Again, career attraction was identified as a problem. Respondents suggested that postdoctoral researchers who would bring diversity to programs are in need of professional skills development, career guidance, and information outreach that would educate them on the postdoctoral application process and encourage retention in the field of research. Specifically, comments included suggestions for education on “soft skills,” such as grant administration, lab set up, developing a teaching philosophy, mock interviews, and negotiating hiring contracts. Minority students were again characterized as being family-oriented, with strong geographical ties that made finding postdoctoral training positions challenging.

### ***First Independent Position***

In a job market where increased competition for fewer faculty appointments defines the environment, it was suggested that individuals who would bring diversity to an organization were either moving from one postdoctoral position to another and another, or busy seeking more secure or higher paying jobs in other related fields. To keep the pipeline flowing at the point of *First Independent Position*, respondents suggested that increases in early career and start-up funding would be needed to improve hiring for minority scientists. This was viewed as especially important in a competitive hiring environment that favors applicants who can bring their own funding to a new institution.

*It might tip the balance in favor of interviewing someone who does not look like the rest of their faculty, and encourage a search committee to be a little more adventurous. NIH has supportive mechanisms for those under-represented in life science or STEM areas for undergraduate, graduates and postdocs. If one does not help in the next critical step, getting a job, it makes the preparative steps less than effective in changing the life sciences or STEM workforce. (#93)*

Loan forgiveness, higher salaries, and increased institutional support and resources (e.g., career guidance) were mentioned as possible methods or incentives to keep struggling trainees in the biomedical research workforce.

### ***First Funding Award***

A lack of available funding was perceived as part of the problem with achieving the *First Funding Award* stage (and the next stage) of the pipeline. One respondent described how intricate the situation was and placed a lack of funding as the central problem that transcends a particular point along the pipeline.



*For the majority of scientists of color that I know, we have become a group of migrant workers floating from institution to institution being "mentored" in temporary teaching/research programs where the host institution really has no intention of making a tenure track position available. After a while it becomes a catch-22, in my case my last NIH review said "We don't want to fund you because we would rather that you were in a tenure track position" and the institution said "we won't put you on the tenure track without funding." (#86)*

It was noted that diversity hiring initiatives have not been met with adequate mentoring and professional development; as such, hiring increases have not resulted in increased funding success for minority faculty. Giving these new researchers access to resources, such as further training (e.g., writing and grantsmanship skills) was cited as one way institutions could compensate for inadequate mentoring.

NIH programs, such as the Early Career Reviewer Program,<sup>5</sup> were touted as a quality resource. While respondents encouraged more programs that would provide first-hand experience with the grants process, they also called for investigating the grant preparation process (time spent, number of internal reviewers, type of mentorship) as a way to determine if institutional support may account for some of the bias affecting minority funding at this career stage.

### ***Award of Tenure***

Respondents generally agreed that traditional tenure policies are not in sync with the professional and personal lives of minority and underrepresented researchers. Consistently described as family-focused and service-oriented, minority and underrepresented researchers were perceived as having many commitments outside of their research and academic careers, which interfered with their ability to meet traditional definitions of success that would lead to *Award of Tenure*. Respondents believed that if the challenges of earning tenure are not addressed, improvements in diversity early in the pipeline will continue to be met with an insufficient pool of mentors. This paucity of mentors would remain an impediment to the success of future researchers entering the field.

### ***Attainment of Leadership Appointments***

A few respondents expressed concern that a lack of diversity at the level of *Leadership Appointments* was having an adverse trickle-down effect. Respondents agreed that a low numbers of minorities in leadership positions influenced the distribution of institutional resources and opportunities.

*The challenge at the senior scientist level is tremendously important as AA, women, etc. are not represented at the level of department chairs, society presidents, etc., so not only mentoring but distribution of resources and opportunities are often controlled by people from a narrow gender/ethnic background set. (#11)*

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<sup>5</sup> <http://public.csr.nih.gov/reviewerresources/becomeareviewer/pages/overview-of-ecr-program.aspx>

One respondent suggested that executive coaching and leadership training should be increased to support efforts to diversify the upper ranks.

### ***Retention/Career Sustainability***

Attrition and long-term career sustainability emerged as an independent sub-issue. Respondents voiced concern for the sustainability of all current mid-career scientists, who often becomes disenfranchised in an increasingly competitive funding environment. Noting that competition may be tougher due to barriers facing investigators who would bring diversity to the field, respondents believed that improvements for all would result in positive change across the board.

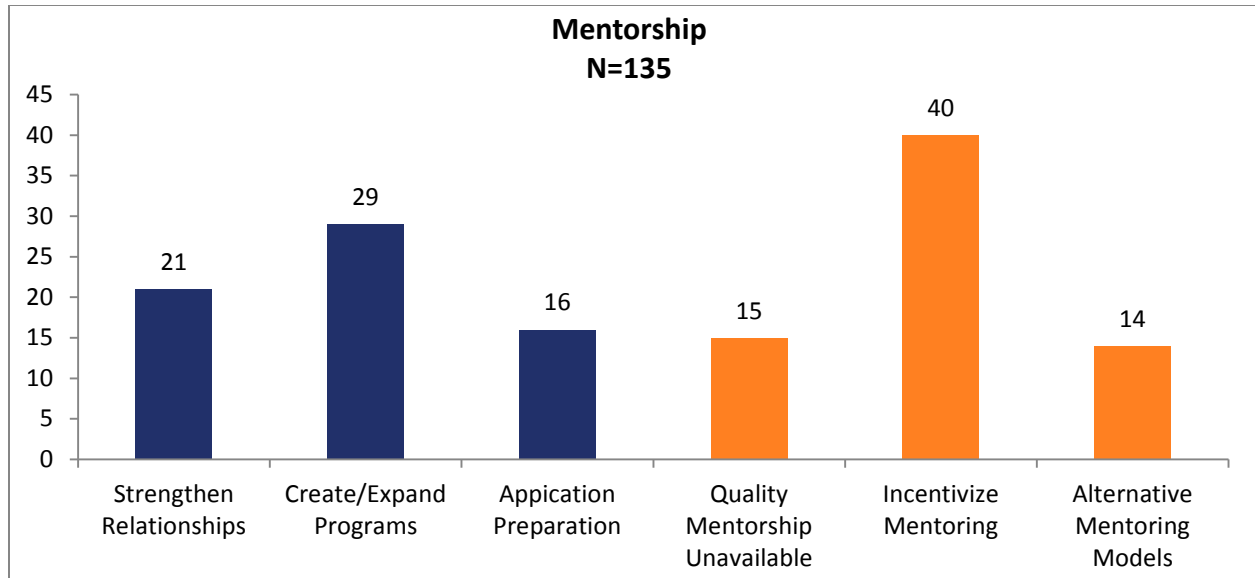
*Something has to be done to help people who are in the latter stage of their career but have lost funding. Young investigators are given a break. But if you do not have funding you are looked down upon because you lost your grant. It's a prejudice. (#40)*

Respondents were concerned that young minority or disadvantaged students were dissuaded by the funding environment and were opting for other career trajectories with better compensation and stability. A change in funding structures (e.g., more R01s and fewer institutional training grants) was suggested, as was more long-term funding stability. A few individuals commented that improvements to the funding environment as a whole would translate to improvements for all and would begin to attract and retain quality scientists of all backgrounds.

### **Issue Two: Mentorship**

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*Mentorship* was the second most frequently commented upon issue. Consensus emerged that effective and consistent mentorship was a key component for navigating the path toward success as a biomedical scientist, especially for members of underrepresented groups. In addition to the three sub-issues identified in the RFI, three other specific sub-issues were derived from the data: *Quality Mentorship Unavailable*, *Incentivize Mentoring*, and *Alternative Mentoring Models*.



### ***Strengthen Relationships***

In support of increasing the quality and amount of available mentors, respondents suggested that strengthening relationships between organizations would help in the development of more effective mentoring programs. Many of these comments requested that NIH improve its relationships with professional societies and other minority-serving organizations, specifically identifying many programs that might be valuable templates for future efforts. Respondents suggested that organizations were an excellent medium for pairing minority researchers with minority mentors.

*Quality mentoring is essential to the advancement of a researcher's career. Researchers may not, however, be aware of specific needs or concerns of underrepresented minority or women scientists. NIH can help by identifying these concerns and challenges, providing guidance and resources tailored to these needs, and supporting society and institutional programs/efforts to address such concerns, potentially through grants or grant supplements to support programs which mentor underrepresented minority or women scientists at various stages of their career. (#90)*

There was also a call for increased collaborative mentoring between smaller and minority-serving institutions and major research institutions. One respondent elaborated on how such partnerships, if produced thoughtfully, could be symbiotic.

*Clearly students benefit from their active participation in research and MSI faculty benefit from a higher level of professional activity, networking and access to state of the art facilities. This can ultimately help them secure independent funding. Equally important, scientists at major institutions benefit from the research skills of MSI faculty who are already highly trained in their fields. (#91)*

Such institutional collaborations could simultaneously bolster mentoring efforts for minority faculty and students at smaller and minority-serving institutions, while providing diversity of thought and training to larger institutions.

### ***Create and Expand Programs***

Dovetailing as a means to address how NIH might incentivize mentoring, respondents commented on the general need for the creation or expansion of mentoring programs at all academic levels, from K-12 to tenure track. Existing programs were described as having a positive, but minimal influence; restructuring and expanding was suggested as a means to increase a program's maximum potential for mentoring new scientists who can bring diversity to their field.

Respondents suggested that plans for creating or expanding mentoring programs should take into account three very important needs:

- Training of mentors, especially with respect to the needs of underrepresented and minority mentees
- Setting up long-term mentoring relationships
- Ensuring continuous evaluation of individual mentor/mentee relationships

Most comments favored increased NIH involvement, such as an expansion of diversity supplements, extensions on time limited award mechanisms such as the K24, or new funding mechanisms. NIH influence was also requested as a means for providing critical structure and monitoring that could lead to improvements in existing mentoring programs at research institutions.

*Skilled mentors augment networking opportunities, steer mentees to opportunities for visible engagement with scientific colleagues, and advocate for a mentee's career advancement. The ACD working group should therefore consider a larger role for NIH in promoting, guiding and monitoring mentoring activities in NIH-supported research and programs with training components. This should include efforts to foster institutional mentorship training programs that embody institutional commitment to quality mentoring and emphasize the importance of workforce diversity. (#102)*

Overall, respondents agreed that the biomedical field needed more mentoring programs and that there was a critical need to restructure and refocus the programs that exist today.

### ***Application Preparation***

Although it was one of the less frequently identified sub-issues, mentoring through the *Application Preparation* process was believed to be a crucial provision by those respondents who mentioned it. At all application junctures, including initial applications, resubmissions, and renewal, it was believed that mentoring would improve the likelihood of persistence toward funding success. One respondent echoed the call for pre-submission mentoring programs that match new investigators with mentors who have proven grant writing experience.

*Early critiques to potential applicants can mean the difference between receiving a career-altering grant and a discouraging denial that does not result in resubmission. Professional contacts and experienced advisors are a critical source of feedback at this juncture. Individuals underrepresented in the biomedical research workforce often lack the appropriate mentorship networks which provide a valuable leg-up in the application process. (#101)*

Interpreting summary statements and crafting application resubmissions was perceived as particularly important. Respondents believed that once underrepresented and minority researchers had transitioned to independent funding mechanisms, there would be less need for opportunities designed to enhance diversity.

### **Quality Mentorship Not Available**

Respondents emphasized the lack of quality mentoring available to minorities and other underrepresented groups. Some pointed to the low number of minority mentors, while others complained about how inadequate available mentors were. A few offered personal stories about how a lack of quality mentorship continued to affect them.

*There is a lack of properly mentoring minority PhDs by their advisors. Many postdocs and junior faculty do not “learn the ropes” from their immediate supervisor, and they are not pointed in the right direction. My dissertation advisor was useless in helping locate a good lab and as a junior faculty member, no one took the time to introduce me to the inner workings of NIH, nor did anyone suggest I be a reviewer. Therein lies the difference in my career path and ability to obtain funding. (#18)*

Consensus among respondents was that minorities, already at a disadvantage, were more negatively affected by the lack of quality mentoring than were members of the majority group.

Some respondents emphasized the importance of increasing the number of quality mentors from minority and underrepresented groups; others felt that this was less important than improving the quality of all mentors and ensuring sensitivity to the needs of minority and underrepresented mentees. Most respondents agreed that any attempts to improve mentoring would likely have a broad, positive effect on the workforce, which would not be limited to improving diversity.

### **Incentivize Mentoring**

Mentorship is an important activity. The most frequently offered solutions for improving the number and quality of mentors available was to *Incentivize Mentoring* and to increase accountability. Respondents suggested that efforts should be made to ensure institutions and training programs are adequately investing in the success of their trainees. One respondent explained that in the absence of institutional oversight, mentoring had become “an individually-driven ad hoc activity that relies on the readiness and interest of the trainee,” rather than a reliably supportive environment. The suggestion

was made that NIH should provide a mentoring rubric at major funding milestones, including initial applications as well as competitive and non-competitive renewals.

*NIH should be asking and mandating the federally-funded investigators to train and mentor young impressionable budding scientists from all racial/ethnic/geopolitical/disadvantaged/vulnerable populations/groups as a requirement for their R01 projects and it should be made a review criteria. (#13)*

Equally as important, however, respondents encouraged NIH to reward quality mentoring and provide mentors, especially those who are minorities themselves, with adequate support to carry out mentoring activities.

### ***Alternative Mentorship Models***

Several respondents noted the value of *Alternative Mentoring Models*, which they believed could either replace or augment more traditional one-on-one mentoring relationships. Mentoring groups were commonly recommended, such as peer group mentoring or multi-institutional faculty mentoring teams. In either case, respondents believed that team-based mentoring would provide depth and breadth for the mentee experience, while alleviating mentoring burdens for minority mentors who are in high demand. Another high-impact model suggested was the continuation and expansion of mentoring seminars. Respondents supported seminars for their potential to provide excellent mentoring without extensive long-term commitments or burdens on invited mentors.

### **Issue Three: Influence of Role Models**

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The lowest number of comments came in reference to the issue of *Influence of Role Models*. Just 16 comments (3% of the overall number of comments coded) referred to the paucity of diversity in those who hold positions of senior leadership. Those who commented on this issue stressed the need to build a critical mass of role models who could inspire young members of disadvantaged groups at all stages of their educational and career development. As a pipeline issue, one respondent suggested a shift in funding priorities away from earlier stages.

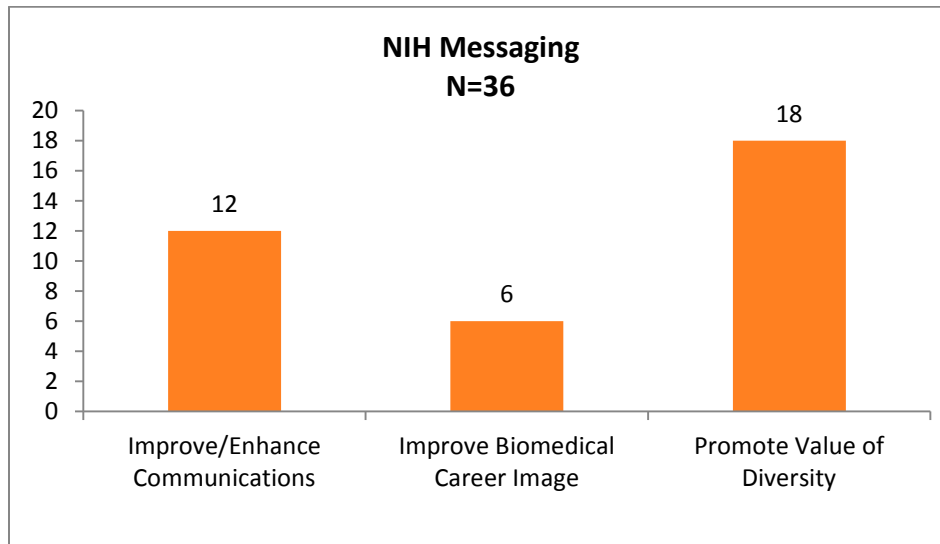
*Supporting minorities at the postdoctoral levels and beyond is likely to have a greater impact than the current strategy for pre-doctoral training because it would maximize the chance that senior minority faculty would be generated to serve as role models for younger scientists. (#53)*

Role models from underrepresented groups were valued by respondents for their potential to demonstrate to aspiring young people from various walks of life that a career as a scientist was not only possible but rewarding.

### **Issue Four: NIH Messaging**

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In order to encourage underrepresented researchers to apply for NIH fellowships and grants, respondents believed a continuum of efforts was required. Comments generally related to the broader idea that NIH should use its voice to demonstrate commitment to diversity. Through NIH policies and communications, the message should be clear that contributions from minority investigators are valued and an integral part of the overall whole. *NIH Messaging* includes three data-driven sub-issues: *Improve/Enhance Communications*, *Improve Biomedical Career Image*, and *Promote Value of Diversity*.



### ***Improve/Enhance Communications***

Respondents had several ideas about how NIH could improve or enhance existing communications efforts. Not only did respondents ask NIH to improve the lines of communication through more targeted messaging to reach intended groups, they also suggested NIH start asking for direct input from members of diverse groups. Several respondents from racial and ethnic minority groups mentioned they were disappointed that they had not been asked for their thoughts or opinions about their experiences with NIH programs or their ideas for improving the system.

*One thing disappointingly absent from the NIH's deliberations and comments on this matter is the thought that perhaps interviews with successful and unsuccessful applicants from underrepresented groups would lead to new insights. Not just findings from the most successful and established people who happen to be African-American, but those who have struggled to get funded...or may never have been able to acquire funding. Ask them what they have been doing. How many applications submitted? How many revisions? What breadth of proposals have they made? Etc. And to then see how those behaviors compare to the more successful applicants. (#8)*

In reference to improving communications related to the review process, one respondent pointed to the importance of considering the sociocultural context of the recipient when providing feedback to grant applicants.

*It may be possible to cushion the emotional and psychological blow of receiving a summary statement by providing less experienced investigators with guidance on how to receive, interpret, and react to scores and summary statements. This could be provided in the form of (1) an email message from SROs that is sent to all minority, new and early stage applicants ahead of the posting of their summary statements, (2) creation of a video similar to the “NIH Tips for Applicants” on the NIH website that features more experienced and/or minority researchers who have been successful in securing NIH funding, and/or (3) presentations and discussion at national meetings attended by minority, new, and early stage researchers. (#96)*

Improving the content of what is communicated, the style with which it is communicated, and the method of dissemination were all identified as crucial elements of NIH diversity efforts.

### ***Improve Biomedical Career Image***

A handful of respondents suggested that NIH should extoll the advantages of a biomedical research career to show those who are considering this life path that the benefits outweigh the obstacles.

*Execute a national public awareness campaign that highlights the appeal of becoming a biomedical scientist and the importance of diversity in the research workforce. Several institutions suggested NIH could increase publicity regarding their workforce diversity programs, including profiles of successful and diverse graduates. The positive attention may help to combat the cynicism regarding a career in biomedical research that leads many high-ability undergraduate students to choose other options. (#110)*

While improving the image of biomedical careers was important, there was also some caution voiced by the few respondents whose comments were assigned this code: Efforts to promote biomedical careers should not undermine realistic expectations of the challenges presented by a successful research career.

### ***Promote Value of Diversity***

Half of the respondent comments on this issue suggested that NIH actively promote the value of a diversified biomedical workforce. Respondents suggested that progress toward creating a diversified workforce required that NIH use its considerable voice to demonstrate that diversity is highly valued and has tangible benefits. It was suggested that NIH promote the value of diversity by engaging in general awareness campaigns.

*If individuals perceive that their own ethnic backgrounds are underrepresented, they may interpret this as a sign of exclusion, and this could deter them from pursuing a research career. NIH should strive to represent a diverse research training environment and workforce that includes ethnic and racial minorities, women, and people with disabilities in all of its public outreach materials as well as on NIH committees and panels. (#204)*

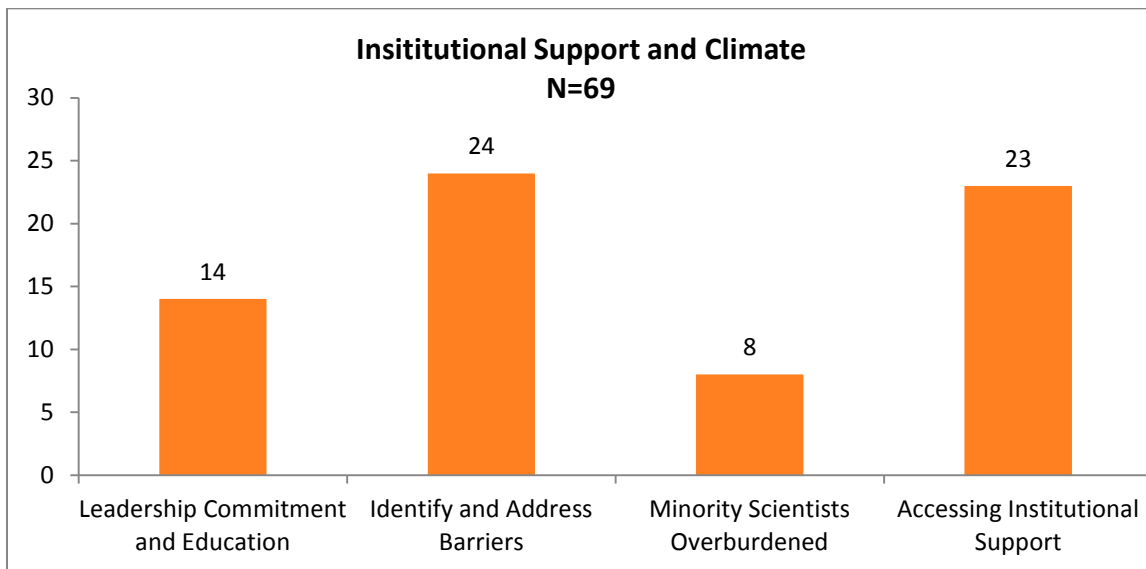


One specific idea suggested that NIH develop a campaign to encourage major research institutions and undergraduate minority-serving institutions to forge partnerships that would ideally result in an increased number of minority supplements awarded to R01 investigators. Also, in order to build trust with members of groups that had been mistreated in the past (e.g., Tuskegee and Guatemala experiments), another respondent suggested NIH demonstrate that it is an ethical and compassionate organization that is redressing bias.

### Issue Five: Institutional Support and Climate

The majority of comments on *Institutional Support and Climate* referred specifically to university environments. Comments included remarks related to departmental structure and support, resource allocation, and institutional culture and climate. Recurring themes related to the importance of inclusion, creating a safe environment for researchers who would bring diversity to their institution, and providing adequate access to resources and support. Respondents called for greater commitment to diversity from university leadership with a commitment to institutional reform.

Four data-driven sub-issues in the *Institutional Support and Climate* issue include *Identify and Address Barriers*, *Accessing Institutional Support*, *Leadership Commitment and Education*, and *Minority Scientists Overburdened*.



#### *Leadership Commitment and Education*

Respondents called on NIH to use its considerable influence and encourage increased *Leadership Commitment and Education* at the institutional level. Responding on behalf of an organization, this individual highlighted the importance of leadership and suggested collaboration as a means to achieve institutional leadership commitment.

*Engage more deeply with university presidents, provosts, and research leaders in supporting efforts to create a more diverse biomedical workforce. Presidential leadership and institutional commitment is an essential precondition for NIH programs*

*to be effective. Institutional leaders play a pivotal role in prioritizing diversity, and establishing an environment that is conducive for mentoring and the success of under-represented students and junior faculty on their campuses. Associations like USU and APLU can be key resources in working with NIH to foster greater awareness and implementation of best practices. (#110)*

Respondents suggested NIH could either lead by example or provide incentives and resources, such as diversity training and cultural competence education. The end result was hoped to be improved communication among groups, the fostering of collaboration over competition, and the creation of less hostile, more understanding environments that would then reflect that diversity is valued and understood. Respondents described campus and workplace environments where prejudice, slurs, and other conscious and unconscious biases persisted in the teaching materials, methods, and dominant culture. Education and training were perceived as an integral part of the solution toward removing experiences that would be insulting to diverse populations.

### ***Identify and Address Barriers***

Identifying, evaluating, and addressing environmental barriers to success was the most frequently coded sub-issue, accounting for 35% of comments on this issue. Respondents voiced concern about harsh working environments, which they described in terms of institutionalized prejudice, exclusion and isolation of minorities, and nepotism. Such displays of insensitivity, hostility, and ignorance toward minorities were perceived as barriers not experienced or, in some cases even recognized, by the dominant culture. One respondent noted that “daily insults, emotional stress, and distractions that non-minority students never have to face” had the potential to limit personal career aspirations and negatively impacted the success of diverse researchers.

Acknowledging the challenges of effecting change at the institutional level, this respondent emphasized that such efforts were greatly needed to promote diversity in the biomedical workforce.

*It will be very tempting for the Working Group to spend most of its effort on the “pipeline” and “mentoring” aspects of this important U.S. scientific workforce issue. These focus areas are important, and they are easier to address in many social and political respects; but they tend to focus the solutions on perceived deficiencies in minority scientists instead of on the barriers they face as a consequence of racism in America. If the Working Group will balance their attention to strategies for identifying and reducing barriers due to racism, unfair conscious discrimination, and unfair bias, which minority scientists face at their home institutions and in the NIH review process, they will do America a great service. (#64)*

Isolation and exclusion were dominant themes in comments on this sub-issue. Respondents referred to the research environment as “chilly” and unwelcoming to minority trainees and researchers. In the absence of a critical mass of underrepresented individuals, a sense of vulnerability to discrimination was described. Some respondents shared experiences in which their concerns were left unaddressed or disregarded, even after being brought to the attention of institutional leadership. As a result,

respondents believed that it was not enough to simply increase quantifiable markers of diversity; real change could only occur when inclusion of minorities became a top priority.

### ***Minority Scientists Overburdened***

A common concern of both self-identified underrepresented researchers and other respondents was the demand for underrepresented researchers' time toward institutional efforts at improving diversity, i.e., *Minority Scientists Overburdened*. Institutional obligations, such as mentoring, participating on committees, and presenting at non-scientific meetings, take time away from research and thus can adversely influence career advancement. Respondents suggested protected time for institutional activities, especially those where minority representation was highly valued, or rewards so their participation would not impede their professional career.

### ***Accessing Institutional Support***

Identified almost as frequently as identifying and addressing barriers was *Accessing Institutional Support*, i.e., resources to support research, such as grant writing workshops, administrative support, and protected time. Some respondents highlighted the value of institutional "bridge funding" or "seed funding" – funding that would alleviate some of the financial stress or pressure felt as a result of the current funding environment. One respondent highlighted the importance of departmental support, particularly financial assistance.

*Support from the faculty member's department chair and research chair is critical. This support may take the form of providing episodic bridge funding to cover research time until grant monies pay for all of the protected time for research, sharing examples of successful grant applications, and supporting time to attend professional development conferences. (#58)*

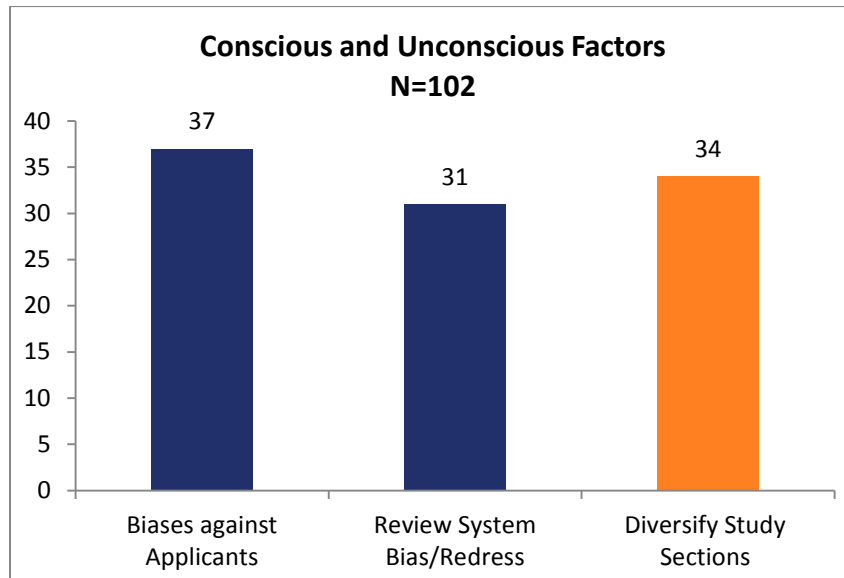
Respondents noted that while institutions may provide ample support to underrepresented researchers, they still may fail to produce results because of poor institutional structure and organization. Respondents described overlapping or duplicative programs that targeted and recruited the same group of underrepresented individuals. It was suggested that NIH could help to identify and eliminate this overlap.

As a more specific institutional issue, respondents described an "uneven playing field" between minority-serving institutions and other small, less well-funded institutes compared to larger, well-funded research-intensive institutions. While dealing with reduced infrastructure and higher teaching workloads, faculty struggle to get access to resources. As a means to achieve better equity among institutions, respondents suggested that NIH recognize, encourage, and reward cross-institutional resource sharing and collaboration.

## **Issue Six: Conscious and Unconscious Factors**

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In order to adequately capture the nuances identified by *Conscious and Unconscious Factors*: “The potential role of institutional affiliation, academic pedigree, and various conscious and unconscious factors on review outcomes,” we reorganized the language of the original RFI. Due to the frequency with which institutional affiliation and academic pedigree appeared concurrently with concerns about race and gender, we removed those biases from the broader definition of the issue and included them at the sub-issue level with all of the other potential biases identified in the RFI. In total, there were three sub-issues identified as part of the issue, *Conscious and Unconscious Factors: Bias Against Applicants, Review System Bias/Redress*, and *Diversify Study Sections*.



**Biases Against Applicants**

Respondents relayed concerns that conscious and unconscious *Bias Against Applicants* were influencing the success rates of diverse grant applicants. The table below provides tallies (the number in parenthesis) for the specific biases that were mentioned as concerns. Biases listed on the left were identified as part of the RFI; biases listed in the right hand column were additional biases identified by respondents.

Biases identified in RFI	Biases identified by respondents
<ul style="list-style-type: none"> <li>• Race (15)</li> <li>• Ethnicity (6)</li> <li>• Gender (8)</li> <li>• Affinity (0)</li> <li>• Institutional affiliation (9)</li> <li>• Academic pedigree* (14)</li> </ul>	<ul style="list-style-type: none"> <li>• Age (2)</li> <li>• Research focus/discipline (6)</li> <li>• Communication style (2)</li> <li>• Professional/social network (8)</li> </ul>

\*Academic pedigree included education, professional credentialing, and productivity.

Race, academic pedigree, and institutional affiliation were the most frequently identified biases of concern. One respondent referred to academic pedigree and institutional affiliation as creating “invisible endorsements” that result in a “halo effect.”

### ***Review System Bias/Redress***

*Review System Bias* captured comments that identified ways in which the review system itself may be resulting in funding disparities. For example, respondents requested further exploration of the following aspects of the review process:

- Availability of information that identifies applicant characteristics (e.g., the biosketch)
- Evaluation criteria
- Determinations of which applications will be discussed or not discussed
- Recent policy change decreasing the allowed number of resubmissions

Respondents were divided on the suggestion to improve applicant anonymity. Biosketches and similar applicant descriptions provide many contextual clues about applicant demographics (e.g., race and gender); some respondents felt this type of information must be unavailable to reviewers, while others believed academic and institutional information were essential for determining the applicant's fitness to conduct the proposed research. A two-stage or two-tier system was suggested as a compromise, where scientific merit would be assessed first, *without* knowledge of applicant history or characteristics.

To redress bias, three main ideas emerged from respondents: greater transparency and accountability in the review process, training, and post-review support. To provide greater transparency and accountability, respondents called for increased monitoring of the review process to expose disparities in applicant scoring and funding success; as part of the process, respondents asked for the data to be distributed to study section members and the public. Another suggestion was to provide scoring advantages, based on diversity-related criteria, to address scoring disparities.

Training efforts were a frequently suggested means for redressing bias in the review process. The most common suggestion was reviewer training related to the influence of conscious and unconscious bias. There was also a call for training efforts that would include guidance to SROs and reviewers on how to address bias when it becomes apparent during a review. Other types of suggested training included: diversity training that would sensitize reviewers to different communication styles, and training that would facilitate legitimate evaluation of scientific approaches or methods unfamiliar to reviewers.

Post-review support for minority and underrepresented applicants was another means reviewers suggested for redressing bias. Respondents noted that researchers from underrepresented groups are more likely to internalize negative comments from reviewers as personal shortcomings, which could deter resubmissions.

*While the structure of summary statements must remain uniform across investigators, perhaps targeted supplemental messages can be sent to minority, new, and early stage investigators to (1) prepare them for the experience of receiving a summary statement and (2) to help investigators to digest their summary statements in a way that increases the likelihood that they will revise and resubmit their applications. (#96)*

While respondents offered different ideas about which aspects of the review process produced the most disparity in funding success, there was consensus that the process itself was not designed to promote diversity.

### ***Diversify Study Sections***

The need to *Diversify Study Sections* was an idea that warranted individual coding and independent analysis. Several respondents expressed dissatisfaction with the reviewer selection process, noting that the current criteria for becoming a peer reviewer overemphasize funding success, publication productivity, academic rank, and the influence of a researcher's social and professional network. Combined, the outcome of these factors was low diversity among peer reviewers and a reinforcement of barriers for researchers to reach these traditional markers of professional achievement. Citing the documented success related to becoming an NIH reviewer, respondents suggested that increased diversity among peer reviewers could increase the overall success rates of scientists belonging to underrepresented groups.

Another concern resulting from low study section diversity included voice imbalance between senior and junior reviewers. This imbalance of power was explained as senior scientists exerting authority and power over the review discussion, giving little regard to the views of minority and junior reviewers. Referred to as "low diversity of thought," respondents believed this could create a collective bias.

*A more diverse group may prioritize disease prevention over drug development or collaboration over competition. They might value steady progress towards addressing neglected health problems and community impact over perceived "great leaps" on the "hot topics" of the moment. The benefits of cultivating diversity include, presumably, diversification of what science is done, who benefits, and what impact it brings to the American public. (#77)*

Collectively, respondents believed that low diversity among peer reviewers was resulting in low funding rates for diverse researchers and minority health-related research.

## **SECTION TWO: PRIORITY ISSUES**

Respondents generally recognized the challenges inherent with diversifying the biomedical workforce. While it was rare for respondents to rank the order of the issues and sub-issues they identified as priorities, a few respondents articulated a reluctance to suggest priority, noting that all issues were important, with some easier to correct. Most commonly, respondents provided a short paragraph or two identifying the issues they felt were most important.

The frequencies presented in this section are different than the numbers represented throughout the rest of this report. To give the Working Group an idea of how many people identified which issues and sub-issues were a priority, we have presented this data from the individual perspective (as opposed to code application frequencies, which represent the total number of comments that received a particular

code). Of the 140 respondents who provided feedback to this RFI, 105 (75%) identified at least one priority sub-issue.

### Priority of Issues

The distribution of issues based on priority criteria matches the distribution of issues found in the overall comment analysis in Section One. *Transition Points*, *Mentorship*, and *Conscious and Unconscious Factors* were identified as the three most important issues, followed by *Institutional Support and Climate*, *NIH Messaging*, and the *Influence of Role Models*.

Order of Priority by Issue	Number of Respondents (n=105)
Transition Points	60
Mentorship	47
Conscious and Unconscious Factors	32
Institutional Support and Climate	25
NIH Messaging	12
Influence of Role Models	8

When comparing the order of priority issues by respondent affiliation (e.g., self or organization), the issues followed the same order, but at the sub-issue level, affiliation made a difference.

### Priority of Sub-Issues

A breakdown of the top ten sub-issues for self and organization is provided below; a complete list of prioritized sub-issues by affiliation is provided in [Appendix C](#). Priority order was established based on the total number of respondents that expressed priority for each sub-issue.

#### Priority of Sub-Issues: Self

Those who reported from their own individual perspective expressed greatest priority for two transition points: *Prior to Graduate School* and transition to *First Independent Position*. *Biases Against Applicants* was prioritized third in the order of sub-issues; *Create/Expand Programs*, *Incentivize Mentoring*, and *Quality Mentorship Unavailable* were also top priorities for individuals. This group next assigned priority to the pipeline points of *Entry to Graduate School* and *Retention/Career Sustainability*.

#### Self (n=76)

Issue	Order of Priority by Sub-issue	Number of Respondents	Priority
Transition Points	Prior to Graduate School	20	1
	First Independent Position	14	2
Conscious and Unconscious Factors	Biases against Applicants	13	3

**Self (n=76)**

Issue	Order of Priority by Sub-issue	Number of Respondents	Priority
Mentorship	Create/Expand Programs	11	4
	Incentivize Mentoring	9	5
	Quality Mentorship Unavailable	9	6
Transition Points	Entry to Graduate School	8	7
	Retention/Career Sustainability	8	8
Institutional Support and Climate	Accessing Institutional Support	8	9
Conscious and Unconscious Factors	Diversify Study Sections	8	10

Individuals prioritized three sub-issues that were not identified in the top-ten priority order for organizations: *First Independent Position*, *Entry to Graduate School*, and *Retention/Career Sustainability*.

**Priority of Sub-Issues: Organization**

Individuals who provided feedback from their organizational perspective also placed greatest priority on the *Prior to Graduate School* sub-issue within *Transition Points*. However, the next four sub-issues came from the *Mentorship* issue; specifically, organizations prioritized in descending order the following sub-issues: *Strengthen Relationships*, *Create/Expand Programs*, *Incentivize Mentoring*, and *Quality Mentorship Unavailable*. Organizations prioritized *Influence of Role Models* and *Promote Value of Diversity* next; neither of these sub-issues was a top-ten priority for individual respondents. Finally, respondents providing an organizational perspective prioritized two *Conscious and Unconscious Factors* sub-issues: *Bias against Applicants* and *Diversify Study Sections*.

**Organization (N=29)**

Issue	Order of Priority by Sub-issue	Number of Respondents	Priority
Transition Points	Prior to Graduate School	7	1
Mentorship	Strengthen Relationships	6	2
	Create/Expand Programs	6	3
	Incentivize Mentoring	6	4
	Quality Mentorship Unavailable	5	5
Influence of Role Models	Influence of Role Models	5	6
NIH Messaging	Promote Value of Diversity	5	7
Institutional Support and Climate	Accessing Institutional Support	5	8
Conscious and Unconscious Factors	Biases against Applicants	5	9
	Diversify Study Sections	5	10

Organizations prioritized three sub-issues that were not identified in the top-ten priority order for individuals: *Strengthen Relationships (Mentorship)*, *Influence of Role Models*, and *Promote Value of Diversity*.



## SECTION THREE: RESPONDENT RECOMMENDATIONS

Our analysis for this section involved two approaches. The first approach was to compare code frequency distributions across the entire dataset with the subset of data created to represent specific ideas for NIH. The second approach involved qualitative analysis of the subset of data to identify common themes that permeated across respondent suggestions.

### Code Frequency Comparison

Comparing the distribution of issues between the total data set and the subset of NIH Responsibility revealed subtle differences. *Transition Points* was identified most frequently across both data sets and the *Influence of Role Models* was least identified, but the order of frequency distribution of the middle four issues differed. The *Conscious and Unconscious Factors in the Review Process* was the second most frequently-identified issue for NIH to address, followed by *Mentorship*, *NIH Messaging*, and then *Institutional Support and Climate*. The table below illustrates the overall order of frequencies for both groups.

NIH Responsibility Sub-Set	Total Data Set
Transition Points	Transition Points
Conscious and Unconscious Factors	Mentorship
Mentorship	Conscious and Unconscious Factors
NIH Messaging	Institutional Support and Climate
Institutional Support and Climate	NIH Messaging
Influence of Role Models	Influence of Role Models

### Qualitative Themes

A number of specific suggestions were presented throughout Section One; in this section, we analyze the subset of NIH Responsibility data to present a more holistic view of respondent recommendations.

#### Accurate Understanding

To adequately address diversity-related challenges, respondents suggested that NIH must better understand the current situation and the issues preventing diversification of the biomedical workforce.

#### Conduct More Research

Findings from the previously-cited Ginther et al. (2011) article were criticized, with respondents describing the approach and data as limited in scope and inadequate for capturing an accurate picture of the current situation. Comments included suggestions for more granular analyses. For example, there was concern that data claiming to represent women may not be indicative of the challenges faced by women of ethnic minorities. Similarly, data claiming to provide insight into the Latino community was

criticized, with a call for further disaggregated data to allow a better understanding of the differences between smaller groups within that community.

Research was also called for as a way to better understand where the “bottlenecks in the pipeline” actually are and to better understand the sources that create barriers to success. Armed with a more accurate understanding of the situation, respondents believed NIH would be better able to make meaningful improvements to diversity efforts.

### ***Evaluation and Continued Monitoring***

Respondents urged NIH to embark on a series of self-evaluations, suggesting that NIH conduct investigations to determine where the NIH systems, programs, or funding criteria may be preventing diversity candidates from entering the field. For example, the biosketch was perceived as a structural impediment to success even before the grant application was received by the Center for Scientific Review. While it was common for respondents to call for more program support or more funding, the deeper message was to provide more support and funding only to those programs and funding mechanisms that are working.

Respondents also suggested carefully monitoring NIH efforts toward creating diversity in the biomedical workforce. Noting that programs should have measurable indices for success, respondents asked that NIH ensure consistent and meaningful monitoring to ensure program goals are met.

*The success of these NIH programs should be reevaluated and redefined to ensure that the measurement of achievement includes quantifiable outcomes such as how many URM research applicants actually receive grant funding at the next level and the period of time taken to do so. (#203)*

Some respondents suggested NIH require institutes and centers, grantee institutions, and independent awardees to track, report, and improve success rates for underrepresented investigators; others suggested the NIH Office of the Director should be responsible for monitoring. A small group felt the National Institute on Minority Health and Health Disparities should be expanded, giving it oversight and monitoring authority with respect to diversity initiatives.

A specific idea related to monitoring and ensuring quality training outcomes was for NIH to develop and require a set of core competencies that all postdoctoral researchers would be expected to achieve. Respondents believed that requiring skills that go beyond the traditional expectations, especially “soft skills,” e.g., grantsmanship, would level the playing field by strengthening the postdoctoral experience and adequately preparing them to compete at higher career levels.

Respondents were concerned that if NIH continued to fund programs without an accurate understanding of the problems and possible solutions, and without raising the bar and setting new standards for excellence, then students and trainees would be pushed along the pipeline into situations where they would be unable to meet new challenges. Without adequate training, mentoring, and professional development, respondents expected that the pipeline will remain leaky.

## **Improve, Expand, and Add New Diversity Funding Opportunities**

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The struggle to acquire funding was perceived as greater for individuals that would bring diversity to the field, resulting in attrition at all career stages. At the front end of the pipeline, students and trainees were described as reticent to begin scientific careers, particularly in light of evidence that suggested minorities fight an uphill battle. Further along the pipeline, severe competition and little support were blamed for junior and mid-career investigators' choices to seek alternative careers. To combat attrition, respondents suggested better support for individual grantees and institutions through improvements and expansion of current efforts and the creation of new diversity initiatives.

### ***Support Individuals***

At the individual level, respondents suggested that NIH improve current funding awards and expand or create new ones. Unhappy with the current balance between individual and institutional awards, some respondents suggested that NIH shift some of the institutional funding in favor of individual awards, such as individual fellowships, K-awards, and R01s. Respondents also voiced favor for the diversity supplements and called for their expansion; however, several noted the application process should be streamlined so the program could be more effective.

*From my experience and that of other investigators, obtaining these supplements can take 9 months-one year, such that the term of support is usually greatly reduced by the time it is awarded. Moreover, one cannot get a supplement if you happen to already have that minority student in your lab being supported by your NIH grant. The impracticality of not being able to support a minority student off of your research grants while you wait one year for the supplement makes this type of mechanism of limited utility. (#33)*

Other changes included a call for increased funding for protected time to cover clinical and teaching responsibilities. This was especially important when respondents expressed concern about finding ways to compensate faculty for time spent mentoring minority and underrepresented trainees. Respondents also suggested that protected time was more important for faculty at institutions with the greatest likelihood of impacting diversity, such as minority-serving institutions where teaching loads are high. Also for that group, there was a call for an expansion of smaller, short-term forms of funding, such as funds to hire summer research assistants or interns.

Further, suggestions for encouraging more applications from individual minority and underrepresented scientists included: 1) providing incentives, such as score advantages to minority applicants, 2) extending privileges, such as involvement with the Early Stage Investigator program, and 3) requiring ICs to adopt minimum quotas or proportions for funding investigators that would bring diversity to the ranks of NIH-funded scientists.

### ***Support Institutions***

Overall, respondents indicated that institutions needed more funding and support to successfully execute diversity initiatives. To address the early pipeline issues, respondents called for increased funding for hands-on research experiences for K-12 and undergraduate students interested in pursuing science careers. At the upper levels, student recruitment, enrichment activities and programs, professional development, and mentoring were most frequently mentioned as efforts in need of financial support. The following respondent suggested that NIH help fund a “diversity center.”

*Institutions with strong NIH support and training records could become centers for diversity where the focus is broad education about overt bias and passive racial micro aggression that involve students, faculty, and even staff of the grantee institutions. I think this will increase the number of minority students in scientifically rich training environments and will facilitate structural changes to those environments that remove the kind of racial bias and microaggression that makes it difficult for minority students to focus on their scientific learning and to remain interested in joining the scientific workforce (#30).*

At institutions with training programs, some respondents described a struggle to make their Diversity Recruitment and Retention Plans practicable and successful. Expanding funding and providing flexibility with the allocation of training funds was a recurring request that, if satisfied, would enable programs to provide full tuition support to trainees and cover salaries for program support staff. Respondents agreed that the absence of funds in these areas makes it difficult for training programs to reach diversity goals and support quality trainees.

Many respondents called for increased funds for mentoring and professional development programs, either from NIH or from the institution. Some respondents suggested funds for enhancing or creating new postdoctoral research support centers; others highlighted the need to create better professional development resources that would specifically address the needs of those who can increase diversity in the workforce, regardless of their career stage.

## **Encourage Collaboration and Continuity**

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Increased collaboration and coordination were consistently identified as important for improving the biomedical pipeline. Respondents called for collaboration on a variety of levels and emphasized that involving all stakeholders in a discussion about the needs of trainees and scientists will improve recruitment and retention of a diverse workforce.

### ***Collaboration within NIH and between Federal Agencies***

Beyond NIH, respondents suggested greater efficiency by streamlining federal efforts. Citing a recent Government Accountability Office report, one respondent noted the federal government has over two hundred programs designed to increase knowledge of careers in STEM fields with “overlapping target populations and objectives.” Respondents did not identify specific programs or efforts which they believed could be consolidated, but recommended a full evaluation of all federal biomedical workforce diversity programs to align program goals and decrease overlap.

Similarly, respondents urged NIH to examine its own efforts and consider ways to reduce duplication and maximize the potential of its constrained budget. Within NIH, respondents were eager to see a unified diversity mission for all Institutes and Centers, and they were also interested in seeing successful programs, such as collaborative training and career development programs, as models for “trans-IC initiatives.” Within NIH, collaboration was seen as a key element toward building committed, coordinated, long-range efforts that would address all stages of the pipeline, thus reducing segregation of efforts that target specific stages. Respondents advocated for a coordinated effort within NIH in order to create continuity of support and potentially address some of the leaks that occur in later stages of the pipeline.

### ***Collaboration with Institutions and Organizations***

Several respondents called on NIH to partner with professional societies that are making inroads toward enhancing and supporting minority and underrepresented scientists in the biomedical workforce. Some organizations are responding to research development needs, such as research question and design development and feedback on works in progress. Still others are providing greatly needed mentoring programs to their membership. NIH support of and involvement with these efforts could broaden the programs’ impact on the workforce. Specific suggestions for NIH included collaboration with appropriate partner organizations to 1) develop training webinars addressing diversity in the workforce, and 2) develop a centralized database of resources for minority researchers and students. Such resources could then be available to the extramural community.

### ***Collaboration between Institutions***

Respondents believed NIH could use its considerable influence to promote and improve collaboration within and between institutions. With respect to diversity, respondents suggested that NIH encourage and reward synergies between top tier institutions and smaller ones. Repeatedly, respondents suggested that NIH support mentoring and resource sharing (e.g., one-on-one relationships or

programmatic cooperatives) between minority-serving institutions, such as Historically Black Colleges and Universities, and research-intensive universities. The outcome of these collaborations was expected to include benefits for both students and faculty at both institutions. Smaller institutions would have increased exposure to top-tier research and access to infrastructure; top-tier institutes would gain knowledge and a better understanding of non-dominant perspectives and potentially new research ideas.

Collaborations were believed to be a crucial element of a successful plan for addressing the needs of a diverse workforce. Some respondents noted the success of NIH Clinical Translational Science Awards (CTSAs) and pointed to this mechanism as an obvious method for rewarding collaboration that has potential for increasing diversity in the workforce.

### **Diversify Requests for Proposals**

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This theme often accompanied concern about the review process and emerged as a method for addressing funding inequities. A large number of respondents called for increased focus on health disparities and minority health. By virtue of their affinity and commitment to research relevant their communities, increasing support for health disparities research was perceived as a means for increasing the number of funded investigators from racial or ethnic minority groups.

In developing new requests for proposals, respondents suggested that NIH work with representatives of diverse populations to ensure new programs accounted for the limitations of traditional methods in minority health and health disparities research. For example, unique challenges presented by smaller sample sizes and recruitment of participants could be discussed and addressed through meaningful dialogue. When it came time for review, respondents urged that non-traditional research methods had to be given greater consideration; ideally, review panels should include representation from disciplines such as social and behavioral sciences. One respondent suggested that any proposal designed to study a specific population should have at least one investigator from that target population on the review panel.

A handful of respondents suggested funding that would not only create ethnic diversity in the workforce, but also diversity by profession. It was suggested that physician-investigators need funding opportunities that accommodate their clinical responsibilities and that support cross-disciplinary efforts to encourage bedside-to-bench innovation. Respondents also highlighted the importance of specifically supporting minority physicians in their efforts to engage in research.

### **Redefine NIH Paradigms**

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The final recommendation is conceptually less tangible than previous recommendations; however, top of mind for several respondents was the need for NIH to reframe how it defines both success and diversity. Current definitions were believed to be limiting; broadening what NIH considers as “success” and “diverse” was suggested as a means for achieving greater diversity in the biomedical workforce.

### ***Reconsider NIH Definition of Success***

In light of a growing population and shrinking budgets, respondents questioned how NIH ultimately measured success. R01 status is difficult to achieve, and arguably more difficult to retain. Respondents suggested that NIH should allocate some funding to diversity efforts that valued contributions beyond traditional scientific discovery via an R01.

*In previous times, the URM pipeline was the pathway to success for the URM trainee. Today, the pipeline for all scientists has evolved into several pathways, any of which a URM trainee may choose to follow successfully. However, there are more pitfalls for URMs, and perhaps focus should shift to defining programs better suited to meet these changes. (#137)*

In addition to NIH efforts to diversify the pool of funded investigators, NIH was encouraged to reconsider independent funding as the only career milestone worth targeting. Using a marker of success that is difficult to achieve for all scientists, and more difficult for minority and underrepresented groups of scientists, respondents asked that NIH invest in mentoring and institutional supports that would help pave new pathways toward equally valued career alternatives and definitions of success.

### ***Reconsider NIH Diversity Definition and Criteria***

Although not frequently mentioned, some respondents challenged the NIH to reevaluate its definition of diversity, raising a complex and politically sensitive issue. Those who identified this issue as important viewed the current definition as too narrow.

*Diversity doesn't fit into a check box. Our program has people from many walks of life, but we get marks only for people who can be fit into a category. Where do I put the Japanese-Brazilian dermatologist? The gay steel-town football star who joins our program to become molecular biologist? I have one student whose father is a goat herder in Africa and the student is the first generation to live in a building with a basement. Our program mixes Mormons with Muslims, and both are better for the experience. But there are no boxes or forms to illustrate how our program gains strength from our diversity. (#14)*

Respondents suggested that definitions of diversity should be broadened to allow for characteristics such as socioeconomic status, field of study, religion, and geographic location. The few respondents who suggested NIH should tackle this issue believed that evaluating how NIH defines and determines diversity would eventually promote the type of diversity of thought that would benefit the scientific community and, subsequently, the nation's health.

# Appendix

## A. FULL CODING SCHEME: DESCRIPTION OF ISSUES AND SUB-ISSUES

### Primary Category: Biomedical Research Workforce Pipeline

#### Issue 1: Transition Points

The appropriate transition points where NIH's training, career development, and research grant programs could most effectively cultivate diversity in the biomedical research workforce

NIH Sub-Issue	Description
<i>Entry to Graduate School</i>	Entry into graduate degree programs (Biomedical research is not an attractive career regardless of diversity markers; other factors that prevent minority scientists from entering grad programs; and solutions to get those in graduate school to stay, e.g., with better access to high quality training, i.e., level the playing field)
<i>Postdoctoral Training</i>	Transition from graduate degree to postdoctoral fellowships
<i>First Independent Position</i>	Appointment from a postdoctoral position to the first independent scientific position
<i>First Funding Award</i>	Award of the first independent research grant from NIH or equivalent in industry
<i>Award of Tenure</i>	Award of tenure in an academic position, at the NIH, or the equivalent in an industrial setting (support for mid-career scientist)

Data-Driven Sub-Issue	Description
<i>Prior to Graduate School</i>	Priming the pump; cultivating diversity begins before Graduate School (K-12; Undergraduate; Both)
<i>Leadership Appointments</i>	Attainment of executive and/or leadership level position (Department chair, NIH study section chair)
<i>Retention/Career Sustainability</i>	General comment about the loss of trainees/faculty already in the pipeline due to various barriers (lack of job opportunities, difficulty obtaining funding, difficulty obtaining membership on NIH research teams, competition, etc.); the volatility of being a mid-career scientist.

#### Issue 2: Mentorship

The role of mentorship in the training and success of biomedical researchers throughout their careers

NIH Sub-Issue	Description
<i>Strengthen Relationships</i>	Development of relationships between professional societies, institutions, and individuals to develop mentoring programs



NIH Sub-Issue	Description
<i>Create/Expand Programs</i>	Creation and expansion of institutional mentoring programs (including NIH)
<i>Application Preparation</i>	Mentoring of applicants and preparation of applications prior to submission

Data-Driven Sub-Issue	Description
<i>Quality Mentorship Unavailable</i>	URMs have difficulty finding mentors (not enough); mentors are not effective (don't provide quality mentoring).
<i>Incentivize Mentoring</i>	Build accountability (evaluation tied to funding) and reward (funding, protected time, recognition) into mentoring activities to motivate potential mentors to devote time and effort to mentoring.
<i>Alternative Mentoring Models</i>	Acknowledge/encourage alternative mentoring models (peer mentoring, mentor groups, etc.), in addition to the traditional one-on-one model.

### Issue 3: Influence of Role Models

The influence of role models whose qualities and characteristics can positively affect the training and success of underrepresented biomedical researchers through their careers

NIH Sub-Issue	Description
<i>None</i>	

Data-Driven Sub-Issue	Description
<i>None</i>	

### Issue 4: NIH Messaging

The role of NIH messaging in encouraging underrepresented researchers to apply for NIH fellowships and grants

NIH Sub-Issue	Description
<i>None</i>	

Data-Driven Sub-Issue	Description
<i>Improve/Enhance Communications</i>	Build on what NIH is currently doing. Improve the content of what you communicate (e.g., gather input from minority scientists), but also how it is communicated (e.g. sensitivity to language) and how to improve the channels of communication so the messages reach the intended audience (e.g., use targeted communications strategies).
<i>Improve Biomedical Career Image</i>	Promote a positive view of biomedical research careers.
<i>Promote Value of Diversity</i>	Progress toward creating a diversified biomedical research workforce requires that diversity is valued; the research and educational communities need to buy in and support the efforts. Leadership is essential to meeting this goal.

## Issue 5: Institutional Support and Climate

The role of institutional infrastructure support and climate as a factor in the success of underrepresented researchers

NIH Sub-Issue	Description
<i>None</i>	

Data-Driven Sub-Issue	Description
<i>Leadership Commitment and Education</i>	Leadership commitment to diversity efforts is required; should lead to education and training that address a variety of discriminatory issues, e.g., racism/sexism.
<i>Identify and Address Barriers</i>	Institutionalized prejudice, stereotypes, and nepotism create hostile environments (e.g., learning tools illustrate racial bias or stereotypes, existing faculty and staff vocalize prejudice); an active display of insensitivity toward underrepresented groups [URGs].
<i>Minority Scientists Overburdened</i>	Minority scientists are overburdened with institutional service duties that are not rewarded and do not count toward research success (e.g., ensuring there is one minority on every committee requires a disproportionate commitment from that group compared to their peers).
<i>Accessing Institutional Support</i>	Inequity exists in relationship to the availability of, and equal access to, research support and resources at one's home institution (i.e., the existence of and knowledge about resources, such as grant writing workshops, administrative support, bridge/seed funding, etc.).

## Primary Category: Factors in the Review Process

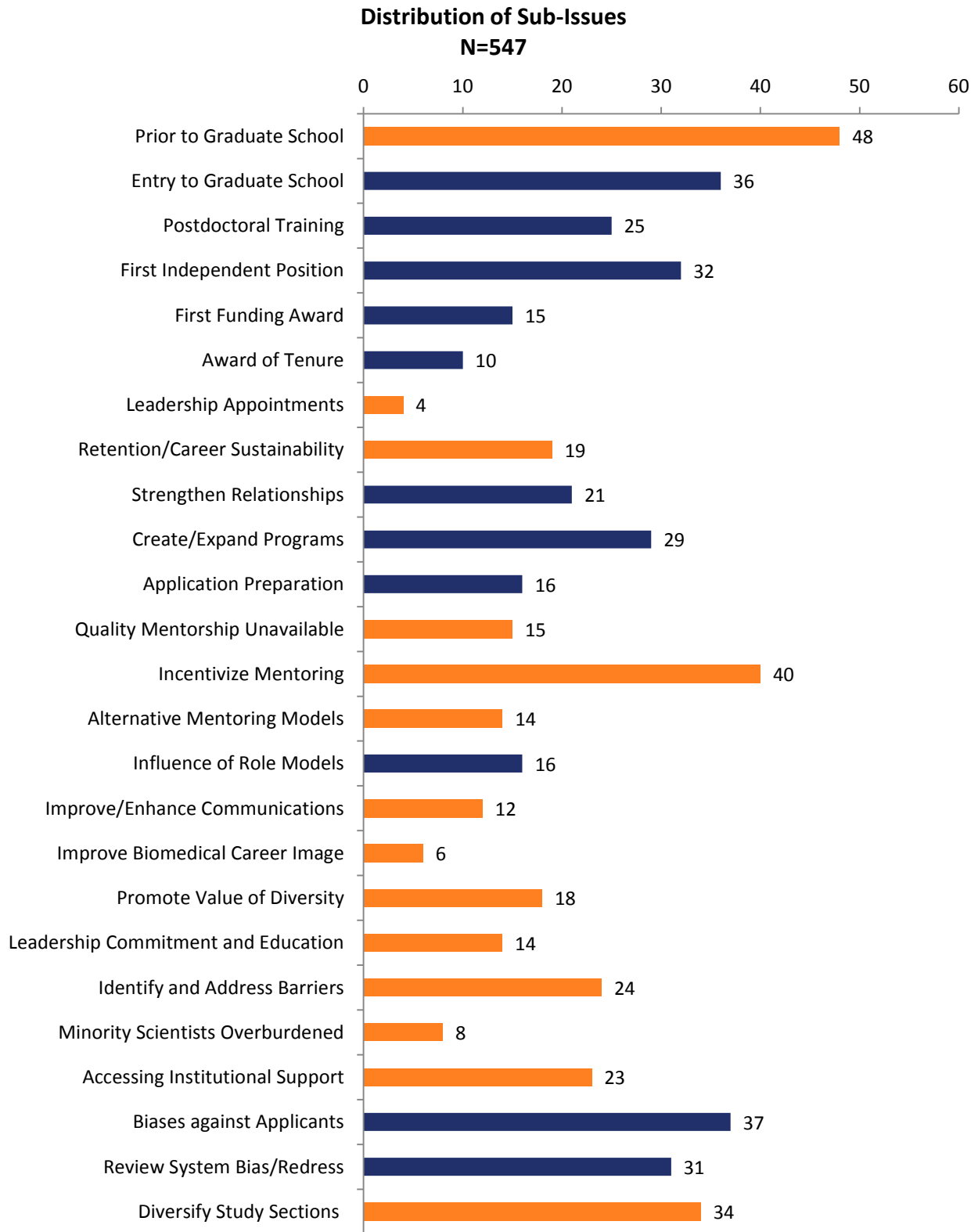
### Issue 6: Conscious and Unconscious Factors

The potential role of institutional affiliation, academic pedigree, and various conscious and unconscious factors on review outcomes

NIH Sub-Issue	Description
<i>Biases Against Applicants</i>	Exploration of the possible influences of racial, ethnic, gender, affinity, institutional affiliation, academic pedigree, or other biases on review outcomes. Additional biases: research focus, age, experience, network status.
<i>Review System Bias/Redress</i>	Research on the NIH Peer Review system to determine appropriate methods or interventions to identify and if necessary redress bias, including efforts to anonymize applications or test the effects of unconscious bias training on outcomes.

Data-Driven Sub-Issue	Description
<i>Diversify Study Sections</i>	Diversify the composition of study sections to reduce conscious or unconscious bias of members; not always necessarily a bias against, but favoritism toward.

**B. SUMMARY OF FREQUENCY DISTRIBUTION ACROSS ALL SUB-ISSUES**



**C. ORDER OF PRIORITY: ALL SUB-ISSUES BY AFFILIATION****Order of Priority: Self (N=76)**

Issue	Sub-Issue	Number of Respondents
Transition Points	Prior to Graduate School	20
Transition Points	First Independent Position	14
Conscious and Unconscious Factors	Biases against Applicants	13
Mentorship	Create/Expand Programs	11
Mentorship	Incentivize Mentoring	9
Mentorship	Quality Mentorship Unavailable	9
Transition Points	Entry to Graduate School	8
Transition Points	Retention/Career Sustainability	8
Institutional Support and Climate	Accessing Institutional Support	8
Conscious and Unconscious Factors	Diversify Study Sections	8
Institutional Support and Climate	Identify and Address Barriers	7
Conscious and Unconscious Factors	Review System Bias/Redress	7
Transition Points	Postdoctoral Training	6
Transition Points	First Funding Award	6
Transition Points	Award of Tenure	5
Mentorship	Strengthen Relationships	3
Influence of Role Models	Influence of Role Models	3
Institutional Support and Climate	Leadership Commitment and Education	3
NIH Messaging	Promote Value of Diversity	3
Transition Points	Leadership Appointments	2
Mentorship	Application Preparation	2
NIH Messaging	Improve/Enhance Communications	2
Institutional Support and Climate	Minority Scientists Overburdened	2
Mentorship	Alternative Mentoring Models	1
NIH Messaging	Improve Biomedical Career Image	0

**Order of Priority: Organization (N=29)**

Issue	Sub-Issue	Number of Respondents
Transition Points	Prior to Graduate School	7
Mentorship	Strengthen Relationships	6
Mentorship	Create/Expand Programs	6
Mentorship	Incentivize Mentoring	6
Mentorship	Quality Mentorship Unavailable	5
Influence of Role Models	Influence of Role Models	5
NIH Messaging	Promote Value of Diversity	5
Institutional Support and Climate	Accessing Institutional Support	5
Conscious and Unconscious Factors	Biases against Applicants	5
Conscious and Unconscious Factors	Diversify Study Sections	5
Transition Points	Award of Tenure	4
Transition Points	Retention/Career Sustainability	4
Transition Points	First Independent Position	3
Conscious and Unconscious Factors	Review System Bias/Redress	3
Transition Points	Entry to Graduate School	2
Transition Points	Postdoctoral Training	2
Mentorship	Application Preparation	2
Mentorship	Alternative Mentoring Models	2
NIH Messaging	Improve/Enhance Communications	2
Institutional Support and Climate	Identify and Address Barriers	2
Transition Points	First Funding Award	1
NIH Messaging	Improve Biomedical Career Image	1
Institutional Support and Climate	Leadership Commitment and Education	1
Institutional Support and Climate	Minority Scientists Overburdened	1
Transition Points	Leadership Appointments	0