

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Thursday, August 03, 2017

Dear Colleague,

The Next Generation Researchers Initiative Committee of the National Academies of Sciences, Engineering, and Medicine invites your input on effective, systemic strategies to ensure the successful launch and sustainment of research careers in the biomedical and behavioral sciences.

This initiative was requested by the U.S. Congress in the 2016 Appropriations Act (Public Law 114-113) that directed the National Institutes of Health (NIH) to contract with the National Academies to produce “(A) an evaluation of the legislative, administrative, educational, and cultural barriers faced by the next generation of researchers; (B) an evaluation of the impact of Federal budget constraints on the next generation of researchers; and (C) recommendations for the implementation of policies to incentivize, improve entry into, and sustain careers in research for the next generation of researchers, including proposed policies for agencies and academic institutions.”

The Committee is examining evidence-based programs and policies that create more opportunities, incentives, and pathways for successful transitions to independent research careers, as well as factors that influence the stability and sustainability of the early stages of independent research careers.

Request for Information

As a committee of the National Academies, our purpose is to examine the policy and programmatic steps that the nation can undertake to ensure the successful launch and sustainment of careers among the next generation of researchers in the biomedical and behavioral sciences, including the full range of health sciences supported by NIH. We can recommend policy proposals for Congress, federal agencies, academic institutions, state and local government, scientific societies, foundations, and others. We are interested in understanding evaluated or evidence-based practices to improve and incentivize transitions into research independence, particularly actions of university and other non-NIH stakeholders in the enterprise.

As the Committee explores the evidence base and potential reforms for the final report, we are seeking input from the full range of stakeholders on the barriers that the next generation of researchers will face as they aspire to and maintain independent research careers in the biomedical and behavioral sciences. We are especially interested in the community’s perspective on recommendations offered in previous reports or literature that have not been implemented, and we have highlighted some examples in the subsequent pages. A summary of the larger scope of recommendations from previous reports over the past 20 years examining barriers to the next generation of researchers, “Responses to Prior Report Recommendations,” is publicly available to view on the project website, www.nas.edu/NextGen.

In the sections that follow this letter, the Committee sketches four broad groups of issues on which we are seeking input. For each group, we provide a brief description of the committee’s

preliminary understanding of the issues, based on the information we have gathered to date, as well as examples of recommendations that have been suggested by others. This information is not complete but serves as a starting point for comments from the community. We also welcome public input on additional issues or topics that may not be reflected below.

Please send your responses to us by October 1, 2017, via this link:
<http://www.nas.edu/NextGenInput>.

Submitting Input

We look forward to any and all input as we prepare to develop a final report that offers recommendations and promising practices to maintain a high quality, responsive, and vital research enterprise by supporting the next generation of promising biomedical and behavioral researchers.

The information you share will help us gather sufficiently broad input to ensure that we consider all important perspectives and information pertinent to this topic in our deliberations. In addition to requesting your input, we ask you to forward this request for content to those colleagues and thought leaders, as well as affiliated partners in biomedical and behavioral research, who you think might make a unique contribution to this study. Please note that any information you or your colleagues share with the Committee will be made public, but anonymous, through our project website, consistent with the Federal Advisory Committee Act.

To allow ample time for the committee to consider your contribution before the drafting and publication of the report, please contribute your input by **October 1, 2017**. If we have follow-up questions regarding your letter, we may contact you by phone or e-mail (if you choose to provide this information). For further information on the study, you may email the study director, Lida Beninson at lbeninson@nas.edu.

Your efforts and input will be greatly appreciated.

On Behalf of the Committee,

Ron Daniels

Core Issues for Consideration

I. Level, Sources, and Stability of Research Funding

The U.S. system of biomedical research involves a complex and intricate set of partnerships among the federal government, research universities, scientific societies, foundations and charities, and corporations. However, the portion attributable to the federal government—by far the largest contributor—has declined steadily over time,¹ and NIH funding has fallen more than 15 percent in real dollars from FY 2003 to FY 2017.² Most recently, the Administration’s 2018 budget proposal includes an additional cut to NIH of more than 20 percent, including roughly a two-thirds reduction in the indirect costs that go to sponsoring institutions.³

Although considerable concern has been expressed surrounding the impact of funding reductions on the vigor of the U.S. biomedical research enterprise, we are particularly interested in the impact these reductions would have on the next generation of researchers. For example, some analysts have observed that, because of multi-year commitments, fluctuations in federal funding have had a dramatic effect on the capacity of the NIH to award new grants.⁴ We have also heard concerns about the effect that the current funding environment may have on the character of the science that is being supported – that it may pose challenges for creative risk-taking, team-based research, and fundamental science.

Examples of recommendations that we have heard from stakeholders, or that have been proposed in the literature, and on which the Committee would be interested in the views of the community, include:

- Congress should move to advanced or multi-year appropriations or provide more flexible carry-over authority for the NIH budget.⁵
- Congress should increase the amount of NIH funding that goes to the NIH Common Fund.⁶
- The NIH should expand the number of awards provided through the Director’s New Innovator Award Program (DP2).⁷

¹ Moses, H. III et al. (2015). The Anatomy of Medical Research: U.S. and International Comparisons, *JAMA* 313(2), 174-189.

² The Fiscal Year 2017 figure is a preliminary estimate.

³ Federation of American Sciences for Experimental Biology (FASEB), NIH Appropriations in Current and Constant Dollars, available at http://faseb.org/Portals/2/PDFs/opa/2017/2017Factsheet_Restore%20NIH%20Funding.pdf; Jocelyn Kaiser, NIH plan to reduce overhead payments draws fire, *Science*, Jun. 2, 2017.

⁴ Berg, J. Modeling success rates from appropriations histories, *Science: Sciencehound*. August 25, 2016, available at: <http://blogs.sciencemag.org/sciencehound/2016/08/25/modeling-success-rates/>.

⁵ Kennedy, J.V. & Atkinson, R.D. (2015) Healthy Funding: Ensuring a Predictable and Growing Budget for the National Institutes of Health.

⁶ A Vision and Pathway for NIH: Recommendations for the New Administration, November 2016.

⁷ Hyman, T. et al. On Research Funding and the Power of Youth. *ASCB newsletter*, Oct. 3, 2016.

- Colleges and universities should revise their criteria for promotion to reduce the emphasis on individual research grant and publication credentials.⁸

II. The Scope of Grant Award and Review

Another focus of our work is the capacity of the U.S. biomedical research enterprise to renew itself. Observers have pointed to a range of evidence to support a concern that the enterprise may be eroding support for the next generation of investigators. For example, the average age to first R01 has increased from 38 years in 1986 to 42 years in 2016.⁹ Early career investigators are the principal investigators (PIs) or co-PIs on fewer and smaller grants than other investigators, and so may be more vulnerable to the loss of a grant award on renewal.¹⁰ Further evidence suggests that the aging workforce appears to be drawing grants away from younger investigators, and models demonstrate that the aging of the NIH funded biomedical workforce is likely to continue.¹¹

The NIH has intervened over the years to address these trends and the long-term stability of the workforce, including through the introduction of the NIH Pathway to Independence Award (K99/R00), the Director's New Innovator Award Program (DP2), the Directors Early Independence Awards (DP5), and new and ESI programs.¹² Recently, the NIH introduced a new Next Generation Researchers Initiative program to reinforce its efforts to bring balance to the workforce.

Separately, the peer review process has come under scrutiny for its possible role in these larger trends. Some studies have suggested that the peer review process may disadvantage underrepresented populations or unconventional ideas.¹³ NIH is currently funding studies to further investigate the presence of bias in the peer review process and identify strategies to respond.

Examples of recommendations in these areas that we have heard from stakeholders, or that have been proposed in the literature, and on which the Committee would be interested in the views of the community, are:

- NIH should modulate the duration of its research project grants to move to either longer¹⁴ or shorter¹⁵ awards, perhaps across the board, or for early career investigators in particular.
- NIH should alter the K99/R00 program to focus it more specifically on creating opportunities for independent and innovative research.¹⁶
- NIH should act to limit the number of grant applications per investigator and the turnaround time between submission and decision.¹⁷

⁸ Casadevall, A. & Fang, F.C. (2012). Reforming Science: Methodological and Cultural Reforms. *Infection and Immunity*, 80(3), 891-896.

⁹ Data provided courtesy of NIH

¹⁰ Data provided courtesy of NIH

¹¹ Blau, D.M. & Weinberg, B.A. (2017). Why the US science and engineering workforce is aging rapidly. *PNAS*, 114(15), 3879–3884.

¹² More information is available in “Responses to Recommendations in Previous Reports on Biomedical and Behavioral Researchers” at www.nas.edu/NextGen.

¹³ National Institutes of Health. 2012. Working Group on Diversity in the Biomedical Research Workforce.

¹⁴ FASEB. 2015 Sustaining Discovery in Biological and Medical Sciences, A Framework for Discussion.

¹⁵ National Academies Press. (2005) Bridges to Independence: Fostering the Independence of New Investigators in Biomedical Research.

¹⁶ Hyman, A.A. (2014). Encouraging innovation. *Molecular Biology of the Cell*, 25(4), 427–428.

¹⁷ Kimble, J. et al. (2015). Strategies from UW-Madison for rescuing biomedical research in the US. *eLIFE* 4, e09305.

Further, we are interested in the views of the community as to the nature of the programs you would recommend the NIH implement through the NGRI program.¹⁸

III. Training, Mentoring and Transparency

The trajectory of the next generation of researchers will be defined in no small measure by the trainee experience. The concerns expressed in the community about this aspect of the biomedical enterprise are numerous, including preparation of trainees for non-academic career pathways, and the possible tension between training experiences and labor roles.¹⁹ Regarding postdoctoral positions in particular, previous studies and reports have examined the impacts of salary levels and benefits; prolonged and uncertain postdoctoral periods; inconsistent training opportunities; the absence of formalized career paths for advancement; as well as new evidence suggesting that outside of tenure track academic jobs, employers do not financially value postdoctoral training.²⁰

There are a number of theories in the literature as to the leading causes of these problems. Some say that postdoctoral researchers are not provided adequate data to empower them to make fully informed decisions about their training and career.²⁰ Others locate the problem in a failure to create pipelines that guide students towards a diversity of biomedical careers.²¹ And still others point to deeper, structural problems in the system – for instance, the advocacy group Rescuing Biomedical Research are among those who claim that at the heart of the trainee problem is a misalignment between the number of trainees and the number of available permanent research positions in all sectors.²²

Examples of recommendations that we have heard from stakeholders, or that have been proposed in the literature, and on which the Committee would be interested in the views of the community, are:

- Universities should take action to make available to trainees comprehensive data in areas such as time to degree completion or end of fellowship, salary and benefits, and career outcomes.²⁰
- Universities and NIH should actively implement policies to shift from a reliance on postdoctoral fellows and graduate students to staff scientists in research laboratories, including through an expansion of grant programs for staff scientist support.²³
- NIH should shift to a regime where a far greater number of postdoctoral fellows are supported by training grants or fellowships rather than research grants.²⁴

IV. Underrepresented Populations

¹⁸ NIH Next Generation Researchers Initiative, available at <https://grants.nih.gov/ngri.htm>.

¹⁹ National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. 2014. The Postdoctoral Experience Revisited.

²⁰ Kahn, S. & Ginther, D.K. (2017). The impact of postdoctoral training on early careers in biomedicine. *Nature Biotechnology*, 35(1), 90-94.

²¹ Pickett, C. et al. (2015). Toward a sustainable biomedical research enterprise: Finding consensus and implementing recommendations. *PNAS*, 112(35), 10832–10836.

²² Alberts, B. et al. (2014). Rescuing US biomedical research from its systemic flaws. *PNAS*, 111(16), 5773–5777.

²³ Gibbs, K.D. Jr., et al. (2013). What Do I Want to Be with My PhD? The Roles of Personal Values and Structural Dynamics in Shaping the Career Interests of Recent Biomedical Science PhD Graduates. *CBE- Life Sciences Education* 12(4), 711-723.

²⁴ National Institutes of Health, 2012 Biomedical Workforce Working Group Report and National Institutes of Health, 2014 Physician-Scientist Workforce Working Group Report.

One area of investigation relates to the challenges certain populations face in entering and developing successful careers in the biomedical research enterprise. The capacity of the system to support the best science will be subverted if systemic barriers thwart the recruitment of the best and brightest scientists irrespective of their race, gender, socioeconomic, or ethnic background. Although the federal government has pursued a range of interventions over the years, and is now actively pursuing additional initiatives in the wake of a 2012 NIH working group report from the Advisory Committee to the Director, studies indicate that we are continuing to fall short of the full objective of achieving diversity in the workforce.²⁵

Another vulnerable group in the current biomedical research system is the physician-scientist population. Faced with mounting clinical demands, long training periods, their own unique funding challenges, and an aging workforce, the physician-scientist workforce has declined from 5 percent of all physicians in 1987 to only 1.5 percent in 2014.²⁶ To address these challenges, Congress and NIH have introduced targeted interventions in recent years, including an expansion of the loan repayment program, pilot programs to improve or shorten physician research training, and an NIAID K99-R00 specifically for physician scientists.

Examples of recommendations in these areas that we have heard from stakeholders, or that have been proposed in the literature, and on which the Committee would be interested in the views of the community, are:

- NIH should gather demographic data and outcomes for all trainees supported through RPGs.²⁶
- Universities should take action to target the postdoctoral population for improved diversity, in light of evidence that the structure of postdoctoral fellowships is deterring underrepresented populations from pursuing faculty careers.²³
- Academic medical centers should take action to reform, centralize and better integrate medical and research postgraduate training for MD-PhDs.²⁷

²⁵ National Institutes of Health. 2012. Working Group on Diversity in the Biomedical Research Workforce.

²⁶ Davila, J.R. (2016). The Physician-Scientist: Past Trends and Future Directions. *Michigan Journal of Medicine*, 66-73.

²⁷ Milewicz, D.M. (2015). Rescuing the physician-scientist workforce: the time for action is now. *Journal of Clinical Investigation*, 125(10), 3742-3747.