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Since the end of World War II, the United States' preeminence in biomedical research has been widely recognized. There are a number of features of the US system that are responsible for its success, but surely one of the most important was the early embrace of high levels of federal research investment, coupled with the allocation of funds on a competitive, peer-reviewed basis. This trait is credited with helping the nation create a vibrant and innovative ecosystem for the advancement of knowledge and the human condition, and the US system has been emulated throughout the world.

Yet for all the biomedical research enterprise's many strengths, there are growing concerns that it is starting to slowly unravel—that its incentives are coming out of balance, with unsettling consequences for the researchers in the system, and in particular for the incoming generations of scientists.

The problems are many, and interwoven: The cost of conducting research has steadily risen, and the size of federal research awards has not kept pace. At the same time, the biomedical research workforce is aging, and a shrinking percentage of federal research grants are awarded to young scientists, who often spend many years in postdoctoral positions characterized by low pay and no guarantee of mentorship or career development. Although the graduate student and postdoctoral population in biomedical research has grown, there has been no growth in the number of academic faculty research positions, for which many of them have trained. These concerns are magnified by the lack of comprehensive counseling and mentorship for research careers in nonacademic settings.

Securing the Future of the US Biomedical Research Workforce

After decades of hand-wringing but little action, a workable plan to improve biomedical research career pathways is coming into focus.

Meanwhile, the system has been subject to intense criticism for its lack of success in diversity recruitment.

These issues are well-rehearsed. Over the past two decades, numerous commissions, task forces, and individual scientists have issued warnings of these vulnerabilities in the biomedical research workforce. As far back as 1994, a committee convened by the National Research Council traced the outlines of several of these problems in a report titled *Meeting the Nation's Needs for Biomedical and Behavioral Scientists*. In 2005, a National Academies panel issued the report *Bridges to Independence: Fostering the Independence of New Investigators in Biomedical Research*, which described how these emerging trends were creating special problems for early-career investigators—and even at that point it identified a “history of concern for these issues.” In 2014, four prominent biomedical scientists again sounded the alarm in a highly influential journal article, titled “Rescuing US biomedical research from its systemic flaws,” that called out a “severe imbalance” in a system that was “on an unsustainable path”

Each step of the way, the reports sounded calls for action and specified recommendations for reform. And yet, a great many of the recommendations went unaddressed. And the challenges endured, and in some cases, worsened.

Time to act

These same challenges have now drawn congressional attention. In the Consolidated Appropriations Act of 2016, Congress called on the National Academies of Sciences, Engineering, and Medicine to conduct a comprehensive study of the policies affecting the next generation of researchers in the biomedical sciences. The legislation, sponsored by Senators Susan Collins (R-ME) and Tammy Baldwin (D-WI), specified the creation of an expert committee to produce “recommendations for the implementation of policies to incentivize, improve entry into, and sustain careers in research for the next generation of researchers.” Two of the authors of this article served as the chair (Daniels) and study director (Lida Beninson) of the committee convened to address these problems.

Early in the committee’s deliberations, we wrestled with the question of why the problems had persisted in the face of earlier investigations and recommendations. We observed a time-honored propensity of many of the stakeholders in the system to discount their own role in the persistence of these problems and to instead ascribe to the federal government—particularly the National Institutes of Health (NIH)—the singular responsibility for reform. We found that declining resources at a time of austerity had left less opportunity for investment in policy reform or experimentation. We found that the highly distributed nature of the stakeholders in the sector had made it all the more challenging to address the entrenched

problems, which often implicated actors in every part of the system. And we found that there was simply no structure or tradition of the sort of sustained, collective problem-solving across the sector that was needed to meet these problems. Indeed, we noted that stakeholder engagement on these issues has been episodic over the years, with working groups and expert committees often disbanding after issuing their recommendations.

Our careful review of prior recommendations found that whereas NIH and other federal actors had been at least somewhat responsive to earlier calls for reform, other entities had been less so. For instance, multiple reports over the decades had urged stakeholders to collect and make available data on the outcomes of graduate students and postdoctoral researchers. Among other steps, NIH started tracking postdoctoral researchers participating in its funded grants, automated the tabulation of data on trainees on training grants, piloted with the National Science Foundation a new survey on early-career doctorates, and created an office to collect and analyze biomedical research workforce data. But with a few exceptions, the committee found that there had been little to no meaningful action on these recommendations on the part of universities and other research institutions.

After a year of intense deliberations, the committee in 2018 issued its report, *The Next Generation of Biomedical and Behavioral Sciences Researchers: Breaking Through*. It offered a range of recommendations in response to specific challenges in the system. We called on Congress to increase NIH’s budget to enable it to boost support for early-career researchers by expanding existing awards or creating new competitive awards for trainees and early-stage researchers to establish and advance their own independent investigations. In support of prior recommendations, we urged NIH to require principal investigators and research institutions to provide comprehensive and disaggregated data on postdoctoral researchers. The committee recommended that NIH conduct pilot studies to assess the feasibility of implementing a cap on the number of years of support that postdoctoral researchers can receive from NIH research project grants. We also recommended that NIH use its institutes and centers as vehicles to pilot new mechanisms designed to support the independence of early-career researchers

But we went further, calling for an overarching change in the approach to the biomedical enterprise. For too long, research universities, research centers, philanthropic foundations, private industry, and the federal government had worked at arm’s length on questions of training, incentives, and funding rules that touch them all, and true reform would require sustained and collective action by actors across the sector. Our committee decided that to address such broad, ongoing challenges, as well

as future challenges across the biomedical research enterprise, the nation needed a forum for sustained coordination, problem-solving, and assessment of progress. We thus proposed the creation of a public-private Biomedical Research Enterprise Council (BREC).

Design of the BREC should be guided by several broad, but not overly prescriptive, principles. First, the council should include representatives from federal agencies, research institutions, industry, disciplinary societies, nonprofit organizations, and foundations and philanthropies. Second, it should be an independent, nonprofit entity, so that it could be a fair interlocutor across the sectors. Third, the federal government might help to create and incubate the council in its early days: Congress might authorize the council, and NIH could provide early financial support for a modest support staff and initial convention. Finally, the BREC should eventually transition to a self-supporting model of funding with contributions from participating members.

The BREC will be a forum to conceptualize and develop ideas and policies to support the biomedical research workforce, share metrics and information, convene workshops to develop multisector strategies, and evaluate implementation on policy reforms. Additionally, it could work to anticipate future trends and needs in the biomedical enterprise and produce reports summarizing their activities and assessments. Ultimately, the council would work to build collective solutions to accelerate the pace of change needed to bring security to the biomedical research workforce.

Proof of concept

Public-private multistakeholder bodies akin to the concept of a BREC already operate successfully in other sectors. One example is InfraGard, a partnership among the Federal Bureau of Investigation, state law enforcement, academia, industry, information technology security professionals, and a range of others, in which they collaborate and share information to protect the nation's critical infrastructure.

The Smart Grid Interoperability Panel, launched by the National Institute of Standards and Technology, is another example. Designed to coordinate standards development for smart grids, the panel connects public and private stakeholders to interact and accelerate standards harmonization, advancing the interoperability of smart electric grid devices and systems.

Recently, however, a new model has emerged that only strengthens the promise of the multistakeholder approach to reform but could even serve as a vehicle for a BREC-like body moving forward. About two years ago, the National Academy of Medicine began to establish what it called "action collaboratives" to meet the clear need for a coordinated and collective response

to pressing national challenges. These collaboratives would be flexible and action-oriented, built on the recognition that the relationship among multiple stakeholders is central for systems-level change.

In its first effort, the academy in 2017 launched an action collaborative on clinician well-being and resilience, with over 60 member organizations that were committed to developing and advancing multidisciplinary solutions to reduce clinician anxiety, burnout, depression, stress, and suicide. The academy followed this up with the launch in 2018 of an action collaborative to counter the US opioid epidemic. It includes over 35 organizations from across government, local communities, health systems, provider groups, payers, industry, nonprofits, and academia to share knowledge and align efforts to drive multisector solutions.

The action collaboratives show that it is possible to assemble the necessary public and private stakeholders around a common problem and sustain those collaborative efforts over an extended period in service of the national good. They are demonstrating that a systems-level approach involving a range of public and private actors can help to make progress on some of the nation's most intractable problems. For the BREC to work, representatives of government, the biomedical and pharmaceutical industry, nonprofit organizations, philanthropists, professional associations, scientific societies, and academia would need to come together to openly acknowledge and jointly confront unmet challenges such as optimizing postdoctoral training and mentoring, collecting comprehensive and disaggregated data, and aligning multisector priorities. The National Academy of Medicine's action collaboratives demonstrate that this is possible and sustainable if there is conviction of the need for action on a nationwide problem.

With proper incentives, sufficient resources, and coordinated efforts, the United States can ensure its ability to cultivate a cadre of scientists who will work to improve the health, well-being, and prosperity of people around the globe. It is time to adopt long-term structures and conditions to both initiate and sustain change so that the need for episodic task forces and reports that detail stasis and inactivity are replaced with ongoing and enduring change across the research enterprise. It is time to break through on these decades of persistent problems—not only for the next generation of researchers, but the generations to follow.

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