U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HEARING CHARTER

Building Back the U.S. Research Enterprise: COVID Impacts and Recovery

Thursday, February 25, 2021
10:00 am – 12:00 pm ET
Cisco WebEx

PURPOSE

The purpose of this hearing is to assess the near- and long-term impacts of the COVID-19 health crisis on the U.S. science and innovation enterprise. The Committee will examine the steps taken to mitigate the spread of the virus and the consequences for research production, the pipeline of STEM talent, and U.S. economic competitiveness. The hearing is also an opportunity for Members to explore what is needed to recover from these setbacks and ensure the U.S. maintains its leadership role in science and innovation. This hearing is also an opportunity for the Committee to hear testimony on the *Research Investment to Spark the Economy (RISE) Act* and *the Supporting Early-Career Researchers Act.*

WITNESSES

- **Dr. Sudip Parikh**, Chief Executive Officer, American Association for the Advancement of Science
- **Dr. Christopher Keane**, Vice President for Research, Washington State University
- **Dr. Felice J. Levine**, Executive Director, American Educational Research Association
- **Mr. Thomas Quaadman**, Executive Vice President, Center for Capital Markets Competitiveness, U.S. Chamber of Commerce

KEY QUESTIONS

- What challenges has the research community faced in continuing research activities during the coronavirus pandemic?
- How has the COVID-19 crisis affected undergraduate students transitioning into STEM graduate programs and recent Ph.D. graduates entering the academic and private sector job market?
- In what ways, if any, are these challenges disproportionately affecting women, individuals from underrepresented minority groups, and international students?
- What are the implications of the potential loss of talent for the U.S. research and innovation ecosystem and economic competitiveness?
- What actions can the Federal Government take to help the research community recover from setbacks due to the COVID-19 crisis, ramp up research programs, and mitigate the loss of STEM talent?
- In what ways has the COVID-19 health crisis helped to catalyze and accelerate research and innovation? What actions can the Federal Government take to support these activities?

U.S. RESEARCH ENTERPRISE

The research enterprise in the United States is a complex, interconnected, and dynamic system, with the private sector, the Federal Government, universities, and nonprofit organizations all playing complementary roles. Businesses perform and fund most of the overall research and development (R&D) in the U.S. With a focus on new and improved goods, services, and processes, businesses dominate in performing and funding both applied research[1] and experimental development.[2] With a focus on generating new knowledge, fulfilling agency missions, and training a skilled workforce, the Federal Government funds the second largest share of R&D and the largest share of basic research.[3] Universities are the largest performer of basic research. The Federal Government also plays a unique role in supporting high-risk research with long-term benefits to society. In the Federal Government, six agencies provide the most support for R&D:

- Department of Defense (38%, or $44.9 billion)
- Department of Health and Human Services (28%, or $33.8 billion)
- National Aeronautics and Space Administration (11%, or $12.6 billion)
- Department of Energy (10%, or $12.3 billion)
- National Science Foundation (5%, or $5.5 billion)
- Department of Agriculture (2%, or $2.4 billion) [4]

Although competition with other nations, particularly China, has intensified in recent years, the U.S. research enterprise "continues to perform the largest share of global research and development (R&D), generate the largest share of R&D-intensive industry output globally, award the largest number of science and engineering (S&E) doctoral degrees, and account for significant shares of S&E research articles and citations worldwide".[5]

COVID IMPACT ON U.S. R&D

The coronavirus outbreak has caused major disruptions to the research enterprise. The White House imposed restrictions on travel from China on February 2, 2020 and Europe on March 13, 2020. On March 16, 2020, the White House issued guidelines[6] restricting gatherings of more than 10 people. On March 19, California was the first state to issue a state-wide stay-at-home order. By early April, more than 300 million

[1] Applied research is an "Original investigation undertaken in order to acquire new knowledge." and is "directed primarily towards a specific practical aim or objective." Source: OMB Circular A-11. Available at https://www.whitehouse.gov/wp-content/uploads/2018/06/a11.pdf

[2] Experimental development is "Creative and systematic work, drawing on knowledge gained from research and practical experience, which is directed at producing new products or processes or improving existing products or processes." Source: OMB Circular A-11. Available at https://www.whitehouse.gov/wp-content/uploads/2018/06/a11.pdf

[3] Basic research is "experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts." Source: OMB Circular A-11. Available at https://www.whitehouse.gov/wp-content/uploads/2018/06/a11.pdf

[4] National Science Board, Science and Engineering Indicators 2020, Available at https://ncses.nsf.gov/pubs/nsb20202/.

[5] National Science Board, Science and Engineering Indicators 2020, Available at https://ncses.nsf.gov/pubs/nsb20201/executive-summary

[6] The White House, The President's Coronavirus Guidelines for America: 30 Days to Slow the Spread, Available at https://www.whitehouse.gov/wp-content/uploads/2020/03/03.16.20_coronavirus-guidance_8.5x11_315PM.pdf.

Americans were under directives to "shelter-in-place" or "stay-at-home". As case numbers increased during the second wave of the outbreak during the summer, state plans to reopen were halted or scaled back. And now, as cases decline during the third wave of the outbreak, there is a nationwide patchwork of restrictions that reflects months of trial and error, with an emphasis on capacity limits, social distancing, and mandating mask use in public.

Measures taken to comply with social distancing restrictions created major disruptions at research universities across the country. While there is extensive discussion in the news and among policymakers about the status of in-person education and the related challenges unfolding on and around university campuses across the country, this hearing is focused on impacts on the research enterprise.

Impact on Research Production

The ability of faculty researchers to continue to make progress on their research remotely depends, in part, on the nature of the project and their discipline. For example, researchers working remotely may be able to perform certain tasks like scientific computations, modeling and simulation, experimental hardware design, data analysis, and drafting journal articles. In contrast, handling physical and biological samples, caring for laboratory animals, and building or operating specialized equipment require a researcher to be present in the laboratory. Research involving human subjects may be interrupted if those subjects are unavailable because of social distancing. In some cases, the extent to which research activities can continue may depend on the duration of the disruption; many researchers may have pivoted toward analyzing data and writing up findings for publication – tasks they can do from home - but eventually they will have run out of new data to analyze. Travel restrictions have impeded research across all disciplines for scientists who engage in field observation work. Data sets that require months or even years of regular observations now have an irreversible break in continuity.

COVID mitigation restrictions have forced scientific societies to cancel or move conferences online. A scientific conference is not just an avenue for a scientist to present their research to the wider community, it is also an important venue for brainstorming, networking, and developing new collaborations. Conference cancellations also cut off a major source revenue for scientific societies, putting the societies and the vital role they play at risk. While some are optimistic that virtual conferences could add value in the long run, such a radically new model will take time to perfect.

Another factor affecting research production is the closure of research facilities. While reducing staffing to maintain social distancing may be an option at some research facilities—such as telescopes or environmental sensor networks that share data with researchers remotely—other facilities require intensive on-site personnel for maintenance and operation. Closures of R&D facilities depend on the independent decisions of individual agencies, universities, and other institutions. For example, the National Aeronautics and Space Administration (NASA) decides the status of each of its centers separately, based on local conditions, according to a four-stage response framework.[7] Actions by state or local governments also factor into the decisions of some facilities. For example, shutdowns at Department of Energy (DOE) laboratories in California and Illinois followed statewide social distancing orders issued by the governors of

[7] https://nasapeople.nasa.gov/coronavirus/nasa_response_framework.pdf

those states.[8] Managing organizations and contractors operating National Science Foundation (NSF) facilities also consider local conditions and statewide orders in making operational decisions.[9]

The Council on Governmental Relations, an association of almost 200 U.S. universities and research institutes, recently released a report presenting a model for estimating research output loss and quantifying the financial impacts of the COVID-19 pandemic on research activities. The model is designed to account for factors such as reduced work, lost laboratory supplies, and inability to travel under differing impact and recovery scenarios. The report uses five case studies to illustrate the state of research under what it terms the new "pandemic normal," and projects research output losses between March 2020 and February 2021 at individual institutions ranging between 20% and 40% and a financial impact in the hundreds of millions of dollars. The report also projects a potential impact in the tens of billions of dollars across the U.S. research enterprise.[10] In the case of the National Institutes of Health (NIH), Director Francis Collins, while testifying before Congress on May 7, 2020 stated, "The estimates are something like $10 billion of NIH funded-research that is going to disappear because of the way in which this virus has affected everybody requiring this kind of distancing and sending people home."[11]

Impact on People

Across the board, campus closures and social distancing requirements have significantly altered how researchers do their work. Researchers forced to work remotely or under stringent social distancing requirements are experiencing significant delays in achieving their research aims. Students are also experiencing reduced access to professional development, networking, and hands-on training. For students, postdocs, and junior faculty, disruptions caused by the COVID crisis come at a critical juncture in their career and may have long-lasting impacts.

For example, many undergraduate students would normally have spent the summer months developing research skills through summer research internships. These programs offer students valuable research experience beyond their classroom studies and have a strong influence on student career aspirations. As a result of summer research internships being canceled, many students in their final year will not have the research experience necessary to prepare a competitive application to a graduate research program. The switch to remote classes has also made it difficult for students to fulfill their degree requirements, in particular due to the unavailability of required laboratory-based courses.

Many graduate students are struggling to complete their projects on time and publish enough papers to be competitive for postdoctoral fellowships or research positions in industry. Graduate students are also missing out on important networking and collaboration opportunities as conferences have gone all virtual. The cumulative effect of these challenges is taking its toll on graduate student mental health. A recent survey of undergraduate and graduate students at 10 U.S. research universities found that signs of depression doubled among graduate students when compared with a similar survey from last year. Indications of anxiety among graduate students increased by 50% during the same period. Rates of mental

[8] https://www.aip.org/fyi/2020/pandemic-impacts-escalating-across-federal-labs
[9] https://www.nsf.gov/news/special_reports/coronavirus/NSF%20Guidance%20for%20Major%20Facilities%20and%20Contracts%20Regarding%20COVID-19.pdf
[10] https://www.cogr.edu/sites/default/files/Research_COVID_August2020_COGR_FINAL.pdf
[11] https://news.bloomberglaw.com/pharma-and-life-sciences/virus-will-cost-nih-10-billion-in-lost-research-director-warns

distress were particularly high among low-income, Latinx, and LGBTQ students and those working in physical and biomedical sciences.[12]

The impacts of the COVID crisis on academic employment may be long-lasting. Faced with reduced revenue and unanticipated costs related to the pandemic, institutions have been forced to withdraw job offers, furlough and lay off workers, and implement hiring freezes. According to a recent analysis by *Science* magazine, faculty job openings at U.S. institutions were down by 70% in October 2020.[13] Hiring freezes in academia have substantially reduced the job prospects for early-career scientists in particular. Those failing to find an academic position are faced with the difficult decision to abandon their career goals in order to support themselves and their families. This potentially irreversible loss of talent from the research pipeline could have lasting negative consequences for U.S. innovation and economic competitiveness.

Another key factor in the ability of a researcher to be productive in carrying out their research remotely is childcare. Early analyses of submissions of draft research papers to pre-print servers suggest that the pandemic is disproportionately affecting female academics, because women often do more caregiving than men.[14,15] For example, a recent survey of approximately 4,500 Principal Investigators (PIs) at U.S. and European research institutions found that "scientists report a sharp decline in time spent on research on average, but there is substantial heterogeneity with a significant share reporting no change or even increases. Some of this heterogeneity is due to field-specific differences, with laboratory-based fields being the most negatively affected, and some is due to gender, with female scientists reporting larger declines. However, among the individuals' characteristics examined, the largest disruptions are connected to childcare. Reporting a young dependent is associated with declines similar in magnitude to those reported by the laboratory-based fields and can account for a significant fraction of gender differences."[16]

International students are also experiencing major disruptions to their research careers. The impact of travel restrictions has been particularly severe for these students. A recent Institute of International Education (IIE) report found a 43 percent drop in new international student enrollment for U.S. institutions during the Fall 2020 term.[17] Foreign students play a critical role in university research labs, and many remain in the United States after graduation and continue to contribute to our leadership in science and technology.[18]

COVID RECOVERY NEEDS

Last year, the Office of Management and Budget (OMB), in collaboration with federal science agencies, provided temporary administrative and salary charging flexibilities to protect against furloughs and layoffs. Agencies provided guidance for universities and offered no-cost extensions[19] to the term of current research grants to make up for time lost. Some agencies also extended the deadline dates for a few solicitations to give PIs more time to submit proposals or have been lenient with PIs who miss a deadline. As of September 30, 2020, however, all OMB memoranda for administrative flexibilities have expired.[20]

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[12] https://escholarship.org/uc/item/80k5d5hw
[13] https://www.sciencemag.org/careers/2020/10/amid-pandemic-us-faculty-job-openings-plummet
[14] https://www.nature.com/articles/d41586-020-01294-9
[15] https://www.nature.com/articles/d41586-020-02183-x
[16] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3608302
[17] file:///C:/Users/sdb/AppData/Local/Temp/Fall%202020%20Snapshot%20Report%20-%20Full%20Report.pdf
[18] https://www.nsf.gov/nsb/sei/one-pagers/Foreign-Born.pdf
[19] A no-cost extension extends the end date of the award without increasing funding.
[20] https://www.whitehouse.gov/wp-content/uploads/2020/06/M-20-26.pdf

While the *CARES Act*[21] provided some funding to Federal research agencies, the funding amounts fell short of the need. Significant additional federal support (through supplements and full-cost extensions[22] to existing grants, administrative flexibility, or other mechanisms) is needed to enable the U.S. research enterprise to recover after a prolonged period of profound disruption. Additional funding to support graduate students and post-doctoral researchers whose research and training have been interrupted or otherwise delayed due to the pandemic is also critical to prevent a significant loss of talent from the STEM pipeline. In January 2021, organizations representing research universities, medical schools, and teaching hospitals asked Congress to provide $26 billion in additional extramural research funding in the next pandemic recovery package.[23]

LEGISLATION

RISE Act

The *Research Investment to Spark the Economy (RISE) Act* (H.R. 869) authorizes approximately $25 billion in emergency relief across federal science agencies to award to universities and national laboratories to continue working on federally-funded research projects and ensure that years of research – and the researchers that makes it possible - are not lost forever due to the pandemic.[24, 25]

Supporting Early-Career Researchers Act

The *Supporting Early-Career Researchers Act* (H.R. 144) creates a new $250 million postdoctoral fellowship program at the National Science Foundation to support career development for early-career researchers whose employment opportunities have been impacted by the COVID-19 crisis. NSF estimates that a program established under this Act would support about 1,600 fellows. [26, 27, 28]

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[21] https://www.congress.gov/bill/116th-congress/house-bill/748/text

[22] A full-cost extension extends the end date of the award and provides additional funding to cover the costs to complete the activities.

[23] https://www.aplu.org/members/councils/governmental-affairs/CGA-library/association-letter-covid-19-research-relief-letter/file

[24] https://www.congress.gov/bill/117th-congress/house-bill/869?s=1&r=1

[25] https://degette.house.gov/media-center/press-releases/lawmakers-introduce-bipartisan-plan-to-provide-us-researchers-25-billion

[26] https://www.congress.gov/bill/117th-congress/house-bill/144

[27] https://science.house.gov/news/press-releases/chairwoman-johnson-and-ranking-member-lucas-introduce-legislation-to-support-early-career-researchers-during-and-after-pandemic

[28] In fiscal year 2019, NSF supported 5,320 postdoctoral associates through funds included in research projects, centers, or facilities awards, as well as by postdoctoral fellowships. https://www.nsf.gov/about/budget/fy2021/pdf/fy2021budget.pdf