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The Honorable Charles Schumer
Majority Leader, US Senate
S-221, United States Capitol
Washington, DC 20510

The Honorable Todd Young
US Senate
185 Dirksen Senate Office Building
Washington, DC 20510

April 7, 2021

Dear Majority Leader Schumer and Senator Young:

On behalf of the American Physical Society (APS) – the nation’s largest physics membership organization with more than 50,000 members in academia, the private sector and national labs – I want to thank you and your staffs for your efforts in crafting the *Endless Frontier Act*, which was originally introduced during the 116th Congress. Currently, an updated discussion draft is being circulated for comment. This bill is a clear indication of your commitment to work to ensure robust federal investments in scientific research, which are the fuel for our economic engine. APS appreciates the opportunity to provide input on this important piece of legislation, which comes at a time of increasing global competition in science and technology.

APS strongly supports the ultimate goal of the Endless Frontier Act – maintaining our nation’s global leadership in science, technology and innovation. The Society recognizes that to achieve this goal, we need to think broadly about the National Science Foundation’s (NSF’s) role in our innovation ecosystem and the types of research that the agency supports.

We appreciate you and your colleagues undertaking a reshaping of NSF, including considering how fundamental research and use-inspired research interact most effectively. For this effort to be a success, NSF must address the critical workforce issues outlined below – and in APS’s recent report titled [“Building America’s STEM Workforce: Eliminating Barriers and Unlocking Advantages”](#) – to ensure the United States has the STEM workforce necessary to compete globally.

For more than half a century, the US government’s commitment to funding early-stage research – through NSF and other federal science agencies – at our colleges, universities and research institutions has helped build our innovation-driven economy and ensure our position as the global leader in science, technology and innovation. But today’s global landscape is remarkably different and significantly more competitive.

For the United States to remain a global leader, simply continuing the status quo will not suffice. Doing so will result in the United States steadily losing its most

critical R&D assets – talented and diverse human capital, both domestic and international, and the innovations they generate. New approaches are required, and legislation reauthorizing NSF – and other parts of the US research enterprise – provides an opportunity to ensure that talent recruitment, development and retention is central in our competitiveness strategies going forward. As recently stated by the National Science Board in its Vision 2030, “Talent is the treasure on which America’s S&E enterprise and the nation’s prosperity, health, and security depend.”

Create a More Diverse Workforce

Developing a diverse 21st century workforce and building an inclusive innovation infrastructure – one that expands our research capacity in a way that best enables broad participation in taking a new idea from initial conceptualization all the way to the marketplace – are essential both to enhance our economic competitiveness and address societal needs. To do so, the United States must bolster both the domestic and international segments of its STEM workforce. It is not a binary decision. Decisive actions are needed to build an inclusive community that attracts and retains talent from all demographical backgrounds into STEM careers.

We must establish STEM fields as degrees of choice for all US students regardless of identity, geographic location or socioeconomic status. Ensuring long-term US leadership in science, technology and innovation demands that we create excellence and equity, while broadening participation in STEM domestically to reflect the diversity of our population. While there is not a single, simple solution to address the lack of participation of women, racial and ethnic minorities, and rural Americans in the US scientific and technical workforce, our programs and policies must aim to broaden educational and research opportunities for students from underrepresented groups.

To meet this goal, we must institute an ambitious scaling of teacher preparation programs and of teacher trainees to rectify the enormous shortage in qualified STEM high school teachers across the United States. **The Endless Frontier Act should provide increased authorizations to allow federal agencies to expand both high-quality STEM teacher preparation programs and teacher preparation scholarships and fellowships, such as NSF’s Robert Noyce Teacher Scholarship Program.** High-quality STEM high school teachers, including innovative “master teachers,” can play a critical role in inspiring young people to make science their career of choice.

We also must provide students from underrepresented groups with opportunities to participate in research, which is a high-impact practice for workforce diversification. To achieve this goal, APS supports the new pilot program outlined in the current Endless Frontier Act discussion draft that would award grants to fund partnerships between top research universities and emerging research institutions (ERIs), including minority-serving institutions (MSIs), tribal colleges and universities (TCUs), historically black colleges and universities (HBCUs), and the regional colleges and universities with smaller research activities, which are often in underserved regions. The partnerships aim to achieve a lasting increase in the research and education capacity of the ERIs, which would expand and increase our nation’s research capacity, broadening opportunity and diversity while simultaneously serving the nation’s research needs.

Historically, the majority of federal research funding has been distributed to a fraction of our country’s research universities. In 2018, for example, only 10% of federal science and engineering funding went to more than three-quarters of US institutions with research programs. These almost 500 institutions are responsible for serving nearly 60% of all students, two-thirds of the nation’s URM students and more than two-thirds of Pell grants recipients. These students are being excluded from the future STEM workforce by having either limited or no opportunity to engage in research.

In addition to unequal access to research opportunities and training, studies show that there are systemic and cultural aspects of the current R&D ecosystem that negatively contribute to an inclusive and productive

career environment. In particular, women accounted for approximately 52% of the college-educated workforce in 2017, but they only made up 29% and 16% of the physical sciences workforce and engineering workforce, respectively. This lack of representation negatively impacts innovation and cannot be solely attributed to inequities in education or the workforce pipeline. In physics, for example, a recent survey of undergraduate women in physics found that nearly 75% of respondents had experienced at least one type of sexual harassment. **To help address these issues and increase women's representation in our STEM workforce, the Endless Frontier Act should include policy provisions aimed at combatting sexual harassment in STEM.**

Bolstering our domestic workforce is only part of the solution. With an overwhelming majority of American students and early career scientists stating that foreign-born students and scholars bring with them either new ideas or new techniques that are catalysts of innovation, according to a 2021 APS report titled "Building's America's STEM Workforce," it is clear that for the United States to remain a global leader, we must have visa policies that attract, rather than repel, talented international students. **To help ensure we have a robust STEM talent pipeline, the Endless Frontier Act should include a provision that makes the F-1 visa "dual intent," which would eliminate unnecessary barriers for international students who want to pursue advanced degrees at US institutions.**

The students and postdocs supported by grants from the federal science agencies are our nation's most effective means of technology transfer. Ensuring effective development of this STEM workforce is essential to US competitiveness. Our continually increasing understanding of early-stage research and the innovations it spawns – which can ultimately translate into new transformative technologies, medical therapies, and beyond – and lead to more bountiful lives of all Americans.

The driving force behind these discoveries and innovations is people. These advances are only possible because of the talented individuals who are trained by leading and/or participating in federally funded projects, with the trainees later entering the workforce with advanced technical knowledge that enables them to contribute to our innovation ecosystem. The principal and most impactful outcome from federally funded research is the students and researchers who use the training and expertise gained from conducting fundamental or use-inspired research and apply it into the US scientific enterprise broadly. Presently, more than 60% of physics degree holders pursue careers in the private sector.

By enhancing and expanding the support for talent recruitment, preparation and retention in the Endless Frontier Act – while also continuing to invest in the scientific facilities and equipment necessary to enable leading-edge research – the federal government will help create the diverse US STEM workforce necessary to address tomorrow's challenges, enabling discoveries, innovations and technologies that will unlock a brighter future for all Americans.

Thank you again for the opportunity to provide input to this legislation. If you have questions or would like to discuss further, please do not hesitate to contact APS Interim Director of Government Affairs Mark Elsesser (elsesser@aps.org; 202.662.8710).

Sincerely,



Sylvester James Gates, Jr.
President, American Physical Society