

February 23, 2021

VIA ELECTRONIC FILING

The Honorable Drew Hirshfeld
Performing the Functions and Duties of the Under Secretary of Commerce for Intellectual
Property and Director of the United States Patent and Trademark Office
600 Dulany St.
Madison East, Concourse Level
Alexandria, VA 22314

**RE: Request for Comments on the National Strategy for Expanding American Innovation
(Docket No. PTO-P-2020-0057)**

Dear Mr. Hirshfeld,

The Pharmaceutical Research and Manufacturers of America (PhRMA) appreciates the opportunity to comment on the United States Patent and Trademark Office's (USPTO) request for comments on the National Strategy for Expanding American Innovation. PhRMA is a voluntary, non-profit association that represents the country's leading biopharmaceutical research companies. PhRMA members are devoted to discovering and developing medicines that enable patients to live longer, healthier and more productive lives. Since 2000, PhRMA member companies have invested more than \$900 billion in the search for new treatments and cures, including an estimated \$83 billion in 2019 alone.

The industry applauds the work of the USPTO to launch the National Council for Expanding American Innovation (NCEAI) with representation from the biopharmaceutical sector, and we appreciate the opportunity to provide comments on a National Strategy to Expand American Innovation. The innovation-intensive biopharmaceutical industry agrees that increasing diversity in the workforce so that the innovative community more closely reflects the underlying diversity of U.S. citizens is critical to maintaining U.S. economic competitiveness and social equity. The biopharmaceutical industry is committed to helping grow diversity in the innovation ecosystem in two main ways. From the ground up by bolstering the pipeline of young innovators and therefore increasing the pool of inventors and engineers, as well as attracting, retaining and supporting traditionally underrepresented groups to the innovation ecosystem.

The importance of a strong skills-based and diverse workforce to the biopharmaceutical industry can't be overstated. The biopharmaceutical industry employs scientists and scientific technicians, engineers, a technical sales force, and science, technology, engineering and

mathematics (STEM)-related managerial talent at rates several orders of magnitude greater than the industrial average. Reflecting this high-skilled talent base, nearly one in three employees in the biopharmaceutical manufacturing industry are in a STEM occupation (32%); this is five times the average for all industries across the U.S. economy and the sixth-highest concentration across 68 U.S. manufacturing industries.¹ In the biotechnology R&D sector specifically, the share of STEM workers is even greater, at 55.5% of the workforce.² The U.S. biopharmaceutical sector accounts for the single largest share of all U.S. business R&D, representing about 17% of domestic R&D by U.S. businesses in 2017, according to the National Science Foundation.³ STEM-intensive industries tend to generate greater levels of innovation activity, as measured by increased levels of patenting. Research from the Hamilton Project, a policy initiative of the Brookings Institution, finds that “while patents can and do come in all fields, the stereotype of a scientist or engineer generating a patent is broadly true, and industries with more STEM workers tend to patent more.”⁴ Additionally, “industries with high levels of STEM employment are also patenting more and more.” STEM occupations are distributed unevenly across industries, translating to high variation in patent intensity across industries. Among the industries studied by the authors, the biopharmaceutical industry ranks highly in both its share of STEM employment and in patent intensity.

The biopharmaceutical sector generates high-quality jobs and powers economic output and exports for the U.S. economy, serving as “the foundation upon which one of the U.S.’ most dynamic innovation and business ecosystems is built.”⁵ The U.S. biopharmaceutical sector directly supports more than 800,000 jobs, supports a total of more than 4 million jobs across the economy and contributes \$1.3 trillion in economic output when direct and indirect effects are considered. In fact, the U.S. biopharmaceutical sector has a multiplier effect – in 2017, each job in a biopharmaceutical research company supported a total of five jobs across the economy, ranging from biopharmaceutical manufacturing jobs and construction, to business services and child care providers.⁶

The industry has expertise in facilitating and supporting targeted, collaborative and well-resourced programs such as early introduction opportunities, immersive student experiences, scholarships and mentoring. Programs like the ones the biopharmaceutical industry maintains can equip currently underrepresented students and professionals in STEM with the

¹ TEconomy Partners’ analysis of U.S. Bureau of Labor Statistics (BLS), Occupational Employment Statistics (OES) Program data.

² *Id.*

³ National Science Foundation Business R&D and Innovation Survey (BRDIS), Table 26 Domestic R&D paid for and performed by the company, by industry, and company size: 2017. February 2020. <https://nces.nsf.gov/pubs/nsf20311#data-tables&>

⁴ The Hamilton Project, “Eleven Facts About Innovation and Patents,” December 2017.

⁵ Battelle Technology Partnership Practice, “The Economic Impact of the Biopharmaceutical Industry” July 2013.

⁶ The Economic Impact of the U.S. Biopharmaceutical Industry: 2017 National and State Estimates, December 2019. <https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/D-F/Economic-Impact-US-Biopharmaceutical-Industry-December-2019.pdf>

information, resources, and opportunities necessary to enter into, remain and succeed in the STEM field. This letter comments on the types of initiatives and efforts that could be included in a national strategy to make the innovation ecosystem more diverse and inclusive that build on the breadth and depth of biopharmaceutical initiatives. We appreciate the opportunity to provide comments in response to specific questions under sections I, II and III (with the numbers corresponding to questions in the Federal Register notice).

I. General

Currently, there is increased focus on enhancing the biopharmaceutical footprint in the U.S. and expanding the economic contributions of the industry. A key part of this focus is investing in the necessary infrastructure to support a twenty-first century workforce, which requires investment in universities to increase their capabilities, strengthening federal STEM programs, supporting public-private partnerships and increasing diversity and inclusion (D&I) in STEM fields. The national strategy can support broad policies to build and sustain the diverse workforce needed for continued innovation across STEM fields, including to construct, operate and support research and development infrastructure such as advanced manufacturing facilities.

One aspect of developing a twenty-first century workforce is growing the STEM talent pool, and therefore increasing the number of future innovators more broadly. This requires engaging all demographic groups in STEM education and experiential learning, particularly at early ages, and ensuring STEM classrooms are representative of the nation. For decades, a major concern in STEM education, and education more broadly, has been persistent achievement gaps based on socioeconomic status, race and ethnicity, and gender. The Congressional Research Service (CRS) has highlighted research findings that achievement gaps between underrepresented groups in primary and secondary school often generate underrepresentation in STEM majors and degrees in college and subsequent STEM career opportunities.⁷ This is why K-12 student achievement gaps and underrepresentation in the innovation and STEM workforces are so closely linked.

Supporting innovation in the U.S. begins by providing support for students of all ages. According to a 2019 PhRMA survey of members⁸, biopharmaceutical companies have:

- Initiated and supported more than 70 STEM education programs across the country that have reached 7.4 million students and 25,000 teachers,
- Proactively supported (D&I in STEM. Just over half of the reported STEM education programs are intentionally designed to engage population groups that continue to be underrepresented in the nation's STEM education programs and workforce,
- Supported programs at all geographic levels across the U.S. through ten national programs, as well as a broad range of local and state-specific programming spanning 29 states,

⁷ Congressional Research Service, "Science, Technology, Engineering, and Mathematics (STEM) Education: An Overview," June 2018.

⁸ https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEMReport_Final.pdf

- Financially invested in STEM education programs totaling \$204 million with companies and their foundations awarding nearly 2,500 STEM education grants over the last five years, and
- Had nearly 21,000 biopharmaceutical industry employees volunteer more than 123,000 hours over the last five years to support U.S. STEM education programs.

1. Having inventors and entrepreneurs from all walks of life brings value to the biopharmaceutical industry and the patients and communities it serves. The industry is utilizing a variety of ways to encourage the development and inclusion of students and professionals who have not historically been well-represented in large corporate or educational institutions. Research from economists at the Harvard-based Opportunity Insights finds that if women, people of color, and children from low-income families became inventors at the same rate as men from high-income families, innovation in the U.S. could increase as much as four-fold.⁹ While skills and ability play a role in determining future STEM workers, socioeconomic factors such as family income and neighborhood can have a significant impact on whether students grow up to invent or go into STEM fields.

Collaboration plays an important role in fostering innovation across the entire innovation ecosystem, and the biopharmaceutical industry has established partnerships in ways that generate value for all stakeholders. Partnerships across the ecosystem have the capacity to drive information and foster information sharing, help coordinate services across different parties, improve communication and establish feedback mechanisms – all of which contribute to a stronger and more sustainable innovation ecosystem. The industry is utilizing external partnerships in a variety of ways, including building a diverse talent pipeline, investing in underserved communities, increasing diversity in the industry’s supply chain and committing to drive systemic change throughout the country. It is critical the national strategy include utilizing public private partnerships as a way to increase diversity in innovation.

The national strategy may also consider including D&I programs modeled from the industry’s work to reach and support underrepresented populations, such as targeted scholarship, mentorship or experiential learning experiences to overcome geographical, financial and relational barriers to accessing the innovative ecosystem. A specific example from one PhRMA member company to bring more innovators into the ecosystem is a scholars program that aims to open the door to cutting-edge research opportunities for undergraduate students. Made possible through a global commitment from the company’s foundation, the program allows undergraduates from across the world to participate in cohort-based, full-time, independent research projects under the guidance of scientists at world-class intuitions. To date, over 4,200 students from more than 760 colleges and universities have participated and benefited from this research experience, mentorship, seminars and networking events and interaction with their peers and leading scientists. Of the alumni who have maintained contact, more than 95%

⁹ Rebecca Linke, MIT, “Lost Einsteins: The US may have missed out on millions of inventors,” February 2018.

of scholars who have graduated from colleges are now pursuing an advanced degree or career in a scientific field.¹⁰

Another member company working to build bridges to currently underrepresented students in STEM has a program that gives company employees the opportunity to mentor high school students on STEM career pathways and work together to solve “real world” STEM issues such as health literacy.¹¹ Another member company has a virtual lab experience program. As a result of economic or geographic limitations, millions of students do not have access to one of the most central aspects of being a scientist — working in a laboratory. This free online platform is dedicated to driving more inclusion in the scientific process by providing users with access to personalized instruction, virtual lab experiences and networking opportunities across the global scientific community.¹²

The biopharmaceutical industry is also using venture capital to reach and support traditionally underrepresented populations that may not be part of large academic and research institutions. PhRMA member Corporate Venture Capital (CVC) affiliates are contributing to the growth of biotech startups through both financial and non-financial support.¹³ While these capital investments allow access to expertise and advice to help biotech startups or those in smaller institutions more broadly, the national strategy could endorse strategic uses of venture capital to support innovators from historically underrepresented populations.

Despite advances in recent years and the industry’s collective efforts to reach more students, today’s STEM workforce does not reflect the nation’s population with respect to gender, race and ethnicity. A national strategy should not only advocate for organizations to reach underrepresented students and young innovators, but should also advocate for organizations to support them once they enter the workforce. Efforts such as increasing the diversity on corporate boards, directing executive-level positions to oversee D&I strategies and identifying leadership positions and additional business roles for D&I professionals are some ways to help all workplaces support underrepresented innovators and professionals.¹⁴ To increase diversity,

¹⁰ The Biopharmaceutical Industry’s Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 45. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

¹¹ The Biopharmaceutical Industry’s Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 50. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

¹² The Biopharmaceutical Industry’s Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 51. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

¹³ Strengthening Biopharmaceutical Innovation: The growing role of corporate venture capital. PhRMA. October 2018. <https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/P-R/PhRMA-CVC-Report.pdf>

¹⁴ The Biopharmaceutical Industry: Improving Diversity & Inclusion in the Workforce. PhRMA. December 2020. <https://phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/TEconomyPhRMA-DIReportFinal.pdf>

the national strategy could suggest more organizations pull from and expand upon the ideas of the biopharmaceutical industry.

Another way to support a diverse workforce is through worker training programs. The national strategy may also support policies to ensure specialized talent and training programs across relevant federal agencies, including the Department of Labor, National Science Foundation, Department of Education, etc., for vocational education, workforce training and college curricula, that are focused on developing qualified workers to fill high-wage, high-value jobs across the innovation ecosystem, from R&D to manufacturing to distribution.

2. The 2020 State of U.S. Science and Engineering Report by the National Science Board finds that women and many racial and ethnic groups continue to be underrepresented in the U.S. STEM and innovation workforces. The number of women and underrepresented people of color in STEM has grown but remains below their overall employment and population shares. Challenges to advancing broader representation of women and minorities are not only limited to entry into the innovative workforce, but also to challenges and obstacles faced on the job. In a new national survey of STEM degree holders conducted by the American Enterprise Institute, 41% think that “women face more challenges in STEM than they do in other fields” when it comes to advancement in their field.¹⁵ Similarly, 31% think that Black Americans face greater obstacles in STEM fields and 29% say Hispanic Americans face greater challenges in advancement.¹⁶

Because of challenges faced by women and other groups, there may be imbalances in the composition of corporate leadership and technical positions which may also extend to disparities in earnings. Although women outnumber men at all levels of post-secondary education, studies report that they still earn less than their male peers – even when accounting for college majors and industry sectors.¹⁷ While there has been a modest improvement over time, many well-paying fields such as engineering and management remain predominantly male, whereas women have a higher representation in many lower-paying occupations.¹⁸

A national strategy to ensure women and minorities are proportionately participating in the patenting of inventions should broadly address increasing women and minorities in all innovation-intensive industries, including STEM industries. As more data are collected on underrepresentation in the workplace, particularly focusing on leadership positions, the government and organizations can use these data to inform implementation of focused, and

¹⁵ Cox, Daniel and Brent Orrell, “STEM Perspectives: Attitudes, Opportunities, and Barriers in America’s STEM Workforce,” American Enterprise Institute. July 2020.

¹⁶ *Id.*

¹⁷ Georgetown University Center on Education and the Workforce, “Women Can’t Win: Despite Making Educational Gains and Pursuing High-Wage Majors, Women Still Earn Less than Men.” 2018.

¹⁸ *Id.*

intentional efforts to advance D&I. The national strategy should incorporate a data-driven approach to increase D&I across the innovation ecosystem.

The biopharmaceutical industry is taking a holistic approach to help women and traditionally underrepresented populations overcome barriers in the workplace and to strengthen a culture of D&I. The national strategy may include tactics modeled off of the approach by the biopharmaceutical industry. Specifically, survey results from a 2020 survey of PhRMA members show the approaches to strengthen a culture of diversity, equity and inclusion by PhRMA members include:

- Empowering and utilizing employee resource groups (ERGs),
- Enabling the infrastructure to advance D&I through leadership positions, councils and teams,
- Leveraging external partnerships to build a diverse talent pipeline,
- Setting D&I goals and tracking efforts and initiatives to assess impact and success, and
- Supporting an inclusive workplace through education and training, such as unconscious bias trainings.¹⁹

3. Researchers from Opportunity Insights find evidence that increasing exposure to innovation through activities such as mentorship programs could help expand the STEM pipeline.²⁰ The biopharmaceutical industry has seen first-hand how effective mentorship and networking can be used to encourage all students, including underrepresented populations, to join and remain in the STEM field. A national strategy to increase diversity in the innovation ecosystem could encourage organizations to utilize models or programs like these that serve as a push mechanism to grow the pool of inventors.

For example, one PhRMA member company uses mentorship and networking to build the pipeline of STEM professionals. They host a one-year summer program and afterschool internship program aimed at LGBTQIA high school students who have an interest in STEM. This company partners with the College of Physicians and the program provides mentorship, builds career awareness, and offers an accepting STEM-oriented space.²¹ Another member company has a mentorship program where students come to the company's campus once a week for an entire school year and are paired with mentors to work together on homework or hands-on science projects that build their interest and confidence in science, offering them a special

¹⁹ The Biopharmaceutical Industry: Improving Diversity & Inclusion in the Workforce. PhRMA. December 2020. <https://phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/TEconomyPhRMA-DIReportFinal.pdf>

²⁰ Rebecca Linke, MIT, "Lost Einsteins: The US may have missed out on millions of inventors." February 2018.

²¹ The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 30. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

opportunity to receive individual attention from supportive adults. More than 1,000 students have been mentored since the program began.²²

PhRMA member companies are also utilizing mentorship and networking within the workplace. In fact, 94% of PhRMA members utilize employee resource groups (ERGs) as a platform for networking events and mentorship opportunities. One member company specifically has an employee resource group for working parents that offers peer-to-peer mentoring and facilitates connections among employees to help pursue professional success.²³ Another PhRMA member company has a group specifically for women to create an environment to foster connections, mentorship and development within the workplace.

4.and 5. The biopharmaceutical industry agrees that developing both organizational and national metrics to document the effectiveness of D&I initiatives is necessary to track outcomes within and across innovative industries. According to research cited in a recent issue of the *Harvard Business Review*, setting goals, collecting data and closely monitoring changes over time are essential to maximizing impact and increasing accountability around diversity and inclusion.²⁴ Most of the PhRMA member companies surveyed in 2020²⁵ indicated that they were tracking their D&I efforts to assess their effectiveness and impacts. Based on the types of approaches taken by PhRMA members, the national strategy could include:

- Collecting data on outcomes such as increased representation of identified groups or number of members of underrepresented groups advancing to middle and/or upper management,
- Collecting data to measure impacts on employee engagement and retention,
- Collecting thorough demographic data on all employees at all levels, and
- Regularly surveying employees.

Additional key measures or approaches to track industry progress include:

- Evaluating ERGs for their effectiveness in areas such as engagement, promotions, and leadership advancement,
- Participating in external industry benchmarking of best practices using measures and reporting by groups such as the Human Rights Campaign and Working Mother, and
- Performing D&I assessments to gauge the inclusiveness of human resources processes and procedures.²⁶

²² The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 58. [https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf](https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf)

²³ The Biopharmaceutical Industry: Improving Diversity & Inclusion in the Workforce. PhRMA. December 2020. <https://phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/TEconomyPhRMA-DIReportFinal.pdf>

²⁴ Harvard Business Review, "Diversity and Inclusion Efforts That Really Work." May 2020

²⁵ The Biopharmaceutical Industry: Improving Diversity & Inclusion in the Workforce. PhRMA. December 2020.

²⁶ *Id.*

The national strategy could encourage federal agencies to consider adoption of tracking and benchmarking efforts like those the industry are using. The national strategy could encourage relevant agencies to create D&I leadership positions where key objectives and metrics are clear and accountable. The national strategy could recommend a call for federal agencies to identify gaps and challenges, and then identify ways to implement best practices modeled after the private sector to increase inclusion. The national strategy could consider working with existing organizations like the National Academies of Science, Engineering and Medicine (NASEM) to develop a study to inform best practices and policy recommendations for tracking D&I efforts.

Within the biopharmaceutical industry, many PhRMA member companies stand out and have been recognized among highly regarded national organizations in several D&I areas.^{27,28} A national strategy for increasing diversity in the innovation ecosystem can include leveraging organizations like these to measure performance within and across the innovation ecosystem.

An organization that companies can look to for D&I best practices is Diversity Best Practices (DBP), which is an organization that is part of the Working Mother Network. The national strategy could encourage organizations to utilize reports like the DBP Inclusion Index as a benchmark for their efforts. This Index is developed annually to benchmark and share best practices with industry-related organizations, and several PhRMA member companies are included in the DBP Inclusion Index.²⁹ Instead of focusing on just the availability of information, the Index goes a step further than transparency and places value on having diversity in senior levels and in areas of hiring and promotion. In partnership with She Runs It, a non-profit organization designed to encourage and promote the role of women in the advertising industry, the DBP Inclusion Index focuses on achieving standards of excellence in three areas:

- Transparency and Demographics, specifically related to data on the representation of women, people of color, and other underrepresented groups within their workforces,
- Adherence to best practices for fostering D&I in recruitment, retention, and advancement, and
- Best practices in promoting a company culture that values D&I.

Companies included on the Index are recognized for actively promoting diverse employees and are strengthened by inclusive company cultures, transparency and management accountability.

²⁷ The Human Rights Campaign's Corporate Equity Index (CEI), which for more than 18 years, has classified employers based on their support for an inclusive culture and corporate social responsibility, the extent of their non-discrimination policies across business entities and the types of benefits provided for LGBTQ workers and their families, features 18 PhRMA member companies as "Best Places to Work" for LGBTQ employees, according to the 2020 Equity Index.

²⁸ The *Working Mother* publication, which releases a list of the 100 best companies for inclusive family benefits, focusing on policies such as gender-neutral leave, gradual phase backs after parental leave, and accessible, affordable childcare, included many PhRMA member companies on the 2020 list. There is also the Best Companies for Dad's list. Nine PhRMA member companies are featured on the 2020 list.

²⁹ Diversity Best Practices, DBP Inclusion Index 2019.

The USPTO 2019 report to Congress³⁰ provides good insight into the effectiveness and lessons learned from existing programs. Just as the biopharmaceutical industry is continuously evaluating best practices and lessons learned, the national strategy may consider promoting a more integrated, comprehensive approach to coordinate, evaluate and review all federal STEM programs, including those listed below³¹, to ensure that effective programs are continued and expanded and that underperforming programs are improved.

- 2014 Inclusive Innovation Initiative ('13'), Minority Business Development Agency
- Women's Business Centers Network and Minority Enterprise Development Program, Women's Business Ownership
- 2015 InnovateHER, U.S. Small Business Administration
- 2008 Emerging Leaders Initiative, Small Business Administration
- 2015 Regional Innovation Strategies (RIS), U.S. Department of Commerce Economic Development Administration (EDA)'s Office of Innovation and Entrepreneurship (OIE)
- 2014 Minority Business Development Agency (MBDA)'s partnership with PowerMoves USA, U.S. Department of Commerce MBDA

II. Creating Innovators – Helping people obtain the skills and develop the interests necessary to become innovators, problem solvers, and entrepreneurs.

8. Beyond getting more students interested in STEM education, public-private partnerships and community institutions can supplement formal education to raise awareness of STEM topics, build skills and increase interests in STEM, inventions, entrepreneurship and IP among students of all ages, particularly students in rural and economically disadvantaged areas.

Some of the programs PhRMA member companies are utilizing to supplement formal education as well as spark student interest in STEM, invention or other innovative areas include:

- Supporting afterschool and summer education or summer camps and research activities,
- Funding scholarships for students or teachers,
- Engaging in third party partnerships for STEM programming,
- Providing support for STEM focused schools, and
- Sponsoring science fairs or STEM-related competitions

A specific example from within the biopharmaceutical industry to supplement formal education is the nation's longest-running hands-on corporate science lab and rigorous summer program. Students in this program, many of whom are from low-income households and groups

³⁰ <https://www.uspto.gov/sites/default/files/documents/USPTOSuccessAct.pdf>.

³¹ Global Review of Diversity and Inclusion in Business Innovation. LSE Consulting. 2019. Pg. 109. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/777640/Global_Review_LSE_Consulting_2019.pdf.

historically underrepresented in science, gain first-hand experience in biotechnology and learn directly and receive mentorship from leading scientists at the company and MIT.³²

In addition to summer camps, science fairs and competitions do a particularly good job of driving students to be innovators and entrepreneurs. Biopharmaceutical companies are title-sponsors and hosts of science fairs across the nation with their own employees serving as volunteer judges and mentors. One member company hosts an annual science competition for middle school students to help them develop problem-solving, teamwork and hands-on science skills.³³ Another member company showcases the STEM and ingenuity of college students who compete for a chance to receive up to \$30,000 and earn a spot as a Guinness World Record Holder.³⁴ One member company even supports a festival in California intended to connect girls to organizations that support and empower their lives, including in STEM, where employees lead a STEM educational activity.³⁵

Many programs to supplement formal education rely on a foundation of partnerships, which is why the biopharmaceutical industry supports the inclusion of collaborations with community organizations as a key tenant in the national strategy. PhRMA member companies use partnerships with the community to promote STEM education, some that are specifically targeted for underrepresented populations in STEM. For example, one member company initiative provides support for girls and women of all ages, helping them pursue STEM studies and careers regardless of their location. This company works with partners such as Girl Scouts of the USA, Smithsonian Science Education Center, JA Worldwide and FHI 360, an initiative launched with the goal of reaching one million girls through this program over five years. In March 2020, this company announced that this program had reached more than six million girls since its inception. This program seeks to cultivate STEM interests at an early age, helping students grow and develop skills in these areas on their way to pursue higher education and careers in STEM.³⁶

³² The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 42. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

³³ The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 58. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

³⁴ The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 46. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

³⁵ The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 33. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

³⁶ The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 60. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

Another model of a public-private partnership used to supplement formal STEM education is demonstrated by a PhRMA member company participating in Connecticut's STEAM Council on Girls & Women, an initiative of the Governor's office that assists with coordinated state responses to issues that impact the lives of women, girls, and their families.³⁷ Another partnership that could be used as a model for the national strategy is partnership with HBCUs. One PhRMA company has a commitment to work with HBCUs to forge stronger strategic partnerships and incorporate these colleges and universities within their D&I efforts.³⁸ The national strategy could include utilizing existing channels or creating new partnerships to bolster interest in STEM and support diversity in the innovation ecosystem.

The biopharmaceutical industry understands the importance in reaching rural areas. One member company uses their philanthropic arm to sponsor a rural education program specially for eligible farmers to nominate their local public-school districts for grants that can be used to enhance their STEM curriculum. These grants will total \$1.9 million in 2020 to enable students in rural communities nationwide to develop stronger STEM skillsets and become better prepared for their bright futures.³⁹ The national strategy could incorporate targeted programs to reach specific demographics across the country such as this. Furthermore, it is imperative the national strategy consider opportunities for schools or other organizations to improve or build the technology infrastructure, such as remote learning capabilities, needed to reach all students. For example, with the proper infrastructure, virtual visits to science museums may be possible for those in rural communities, or communities without current technological capabilities.

Any sort of program like those stated above, and additional programs that focus on topics such as the history of science, famous inventors, including inventors that were from underrepresented populations, may be the inspiration and support needed to pull more students into the STEM field and therefore increase the future pool of inventors and innovators. The national strategy could include leveraging existing USPTO programs like the Inventor Collectible Card Series or consider expanding the scope to include even more diverse inventors and be distributed more widely to reach underserved communities. The industry encourages the national strategy to include a vast array of diverse and creative program models for organizations to sponsor and/or implement.

³⁷ The Biopharmaceutical Industry: Improving Diversity & Inclusion in the Workforce. PhRMA. December 2020. <https://phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/TEconomyPhRMA-DIReportFinal.pdf>

³⁸ The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 21. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

³⁹ The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 54. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

9. The biopharmaceutical industry recognizes the critical role educators play in building the pipeline of and inspiring the next generation of innovators. A limiting factor for the growth and development of the U.S. STEM education ecosystem is a shortage of qualified STEM educators, particularly at the primary and secondary levels. Ensuring that teachers have the equipment, teaching materials on innovation and invention and access to immersive experiences are important ways to facilitate energizing students in innovation and STEM education. Each year millions of Americans of all ages and backgrounds can engage with STEM by visiting museums and science centers and have continued to engage virtually in remote learning venues. Financial and programmatic support from the biopharmaceutical industry plays an important role in pioneering innovative STEM programs as well as work to scale successful educational activities. It is imperative that the national strategy includes new or leverages existing professional development opportunities, resources and programs for educators.

The national strategy can consider applying models of programs or initiatives like the ones the biopharmaceutical industry is sponsoring for teachers to help implement concepts of innovation such as:

- Supplementing curriculum with classroom (or on site) visits for learning opportunities and career awareness,
- Supporting teacher workshops and other professional development, and
- Assisting and providing curricula development.

For example, one member company provides an annual event for teachers to discover new ways to provide students with the best opportunities to realize potential careers in STEM, and another PhRMA member company hosts local high school students to raise awareness of and interest in STEM careers.^{40, 41} Another member company has an annual conference to bring together educators, business leaders and government officials from across the state to share ideas and resources for STEM education.⁴² Professional development programs like these could be utilized to incorporate invention education concepts into teachers' instruction.

The national strategy could also incorporate or leverage existing channels and organizations to support teachers implementing concepts of innovation, such as:

- the Intellectual Property Owners Education Foundation (IPOEF), which works to scale programs and resources that are accessible to all teachers; and

⁴⁰ The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 60. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

⁴¹ The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 32. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

⁴² The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 33. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

- the National Inventors Hall of Fame, which works to connect inventors with the innovators of tomorrow, promote creativity and advance the spirit of innovation and entrepreneurship.

III. Practicing Innovation – Harnessing Skills and Interests to the Act of Innovation

10. Recent progress made in developing STEM graduates is evident by the 53% growth in overall STEM graduates since 2000.⁴³ However, achievement gaps still exist. Though Blacks and Hispanics make up 13.2% and 20.4% of the national population between the ages of 20 and 34, respectively, these groups are underrepresented in science and engineering fields at the undergraduate, graduate and post-graduate levels.⁴⁴ It is important that any improvements in graduation rates translate into improvements in the diversity and inclusion in the workforce, as well as the rates of invention and entrepreneurship by underrepresented groups.

Throughout sections I and II, we addressed the ways in which the industry is working to drive interest in STEM to grow the STEM talent pipeline. Perhaps tactics such as these can be utilized to achieve similar rates of invention and entrepreneurship. Growing the STEM pipeline includes using partnerships with schools, universities, teachers, families and community organizations to support a wide range of activities that address many of the key challenges facing the growth of STEM graduates. To ensure that all students have access to the opportunities and resources needed to hone their STEM skills, most of these industry-supported initiatives target populations that have been historically underrepresented in STEM fields. Through intentional support for female learners, communities of color, and students from economically disadvantaged homes, these activities help ensure that the future STEM workforce is reflective of the nation’s increasingly diverse demographics.

11. Innovators and inventors thrive when cultural and institutional barriers within workplaces are minimized and removed. The biopharmaceutical industry, as mentioned in sections I and II, has a multipronged approach to making the workplace more diverse and inclusive. Specifically, the biopharmaceutical industry is focusing on education and training to help minimize cultural and institutional barriers. The national strategy should consider including education initiatives such as unconscious or implicit bias training for organizations throughout the innovative ecosystem.

⁴³ The Biopharmaceutical Industry’s Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 19. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

⁴⁴ The Biopharmaceutical Industry’s Sustained Commitment to Inspiring and Advancing Tomorrows STEM Workforce. PhRMA. October 2020. Pg. 23. https://www.phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/STEM-Report_Final.pdf

An evaluation of 40 years of research on diversity training finds evidence of a positive impact on changing knowledge, attitudes, and behaviors of different populations.⁴⁵ Notably, the analysis also shows that the most impactful diversity trainings were complemented by other D&I initiatives, were targeted to both awareness and skills development, and were conducted over a significant period of time. PhRMA member companies are proactively training employees to advance diversity and inclusion, especially on subjects such as overcoming unconscious or implicit biases and increasing understanding of and appreciation for cross-cultural collaboration benefits. The national strategy could follow in the footsteps of the biopharmaceutical companies who are developing cultural competencies, anti-discriminatory behaviors and company-wide trainings for all employees as well as trainings for management-levels specifically.

A 2020 report on PhRMA member's efforts to increase D&I in the workforce demonstrates these efforts.⁴⁶ For example, one PhRMA member company who redesigned its D&I training to be inclusive of topics such as unconscious bias, physiological safety, and supporting an "Upstander" mindset, which denounces all acts of racism, discrimination, and violence in order to initiate positive actions that promote meaningful, cultural change, and reinforce a safe environment of belonging via internal and external communications.

Beyond explicit training designed to raise awareness of unconscious bias and different cultures, advance anti-discriminatory behaviors, and other related areas, numerous member companies promote training among their underrepresented employees to help support their career advancement and develop cohorts of leaders. This can help increase the number of diverse managers and leaders within the industry. The national strategy could include recommendations for companies to consider trainings and development opportunities like these.

For example, one member company has a professional development program for women and multicultural employees who demonstrate strong leadership potential. The program is designed to accelerate the movement and improve the readiness and visibility of high-performing and traditionally underrepresented employees into positions with more responsibility.⁴⁷ Another member company leverages its women in leadership program to increase the gender diversity of leadership by creating a pipeline of high-potential mid-manager talent, increasing retention of these women and creating more opportunities for their advancement.

⁴⁵ The Biopharmaceutical Industry: Improving Diversity & Inclusion in the Workforce. PhRMA. December 2020. <https://phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/TEconomyPhRMA-DIReportFinal.pdf>

⁴⁶ The Biopharmaceutical Industry: Improving Diversity & Inclusion in the Workforce. PhRMA. December 2020. <https://phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/TEconomyPhRMA-DIReportFinal.pdf>

⁴⁷ The Biopharmaceutical Industry: Improving Diversity & Inclusion in the Workforce. PhRMA. December 2020. <https://phrma.org/-/media/Project/PhRMA/PhRMA-Org/PhRMA-Org/PDF/S-U/TEconomyPhRMA-DIReportFinal.pdf>

V. Other/Conclusion

PhRMA and its members share the commitment outlined in this request for comments to enhance D&I in the innovation ecosystem. Prioritizing D&I across federal agencies, convening expertise from across high R&D-intensive sectors known for high levels of patenting as well as bringing together leadership from across federal agencies is key to assessing challenges and barriers, best practices, and potential models for public-private collaboration to make progress. A national strategy outlining clear metrics and identifying best practices, such as some of the efforts by the biopharmaceutical industry to grow the STEM talent pipeline and support underrepresented populations within the workforce can help improve the diversity of entrepreneurs, inventors and innovators across the ecosystem.

Sincerely,

/s/

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/s/

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