

# The Biopharmaceutical Industry's Sustained Commitment to Inspiring and Advancing Tomorrow's STEM Workforce



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# Executive Summary

It is difficult to overstate the importance of a population and workforce that is both literate and proficient in the “STEM” fields of science, technology, engineering, and math.

Research finds strong linkages between STEM-intensive industries and desirable innovation and economic outcomes, including the creation of high-growth, high-quality jobs with bright career prospects; new inventions as reflected in patent filings; the development of vibrant technology-driven startups; and ultimately, sustained economic growth and global competitiveness. The innovative biopharmaceutical industry demonstrates these characteristics by leveraging STEM talent throughout every aspect of a medicine's life cycle, and with a STEM workforce concentration more than five times that of other industries.

Yet despite the recognition of the critical role of the STEM workforce to the nation's innovation economy and growth and amid calls to bolster the country's manufacturing capacity, the U.S. continues to lag behind other countries in terms of STEM literacy and expertise. Recognizing these challenges, the biopharmaceutical industry has made a significant, sustained commitment to enhancing the nation's STEM education and talent pipeline by inspiring and developing the next generation of scientists, engineers, and technology professionals. PhRMA member companies have dedicated significant

resources to these pursuits and are reaching an impressive, nationwide scale.

A recent survey of PhRMA member companies and their corporate foundations finds that the industry's support for STEM takes many forms and is creatively addressing major challenges related to the nation's STEM workforce. Support for STEM is targeted toward all education levels, engaging K-12 students as well as those at U.S. colleges and universities. These activities help develop fundamental, industry-relevant skills; address biases that may limit which students pursue STEM fields; and promote high-demand postsecondary STEM credentials. Additionally, these efforts help narrow gaps in the geography of STEM talent, and advance diversity and inclusion in STEM.

Key findings from the survey include the following accomplishments and impacts over the last five years:

- 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.

- The industry is proactive in its support for advancing diversity and inclusion 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.
- STEM programming is supported at all geographic levels across the U.S. through 10 national programs, as well as a broad range of local and state-specific programming spanning 29 states.
- Industry financial support for STEM education programs totaled \$204 million and companies and their foundations awarded nearly 2,500 STEM education grants during this 5-year period, in addition to substantial "in-kind" contributions.
- Half of all STEM education programs involve some form of in-kind support from industry, which includes employee volunteering, and/or the use or donation of company facilities, labs,

or other equipment. Over the last five years, nearly 21,000 biopharmaceutical industry employees volunteered more than 123,000 hours to support U.S. STEM education programs.

It is clear the biopharmaceutical industry sustains substantial, enduring commitments to supporting STEM education across the United States. However, the industry's ongoing dedication is insufficient in and of itself to fill the growing skill gaps between the U.S. and other countries. Now more than ever, as the nation finds itself lagging in STEM achievement and performance and facing increased competition from abroad, these private sector commitments are crucial.

In order for the U.S. to continue its global leadership in biopharmaceutical R&D and grow its advanced manufacturing capabilities and infrastructure, policymakers must place a focus on strengthening the STEM pipeline. As a nation, there is also a need to identify how the public and private sectors can build upon and expand successful STEM-related partnerships. Ultimately, without ongoing attention to investing in, inspiring, and advancing the future STEM workforce, the U.S. risks falling further behind.



# Introduction:

## Fueling Future Economic Growth by Enhancing STEM Education in the U.S.

“Increasingly, the United States is seen globally as an important leader rather than the uncontested leader [in the global Science & Engineering enterprise].”

-National Science Board, January 2020

The science, technology, engineering, and math (“STEM”) workforce plays a significant, outsized role in the growth and stability of the United States’ economy, and particularly within its innovation-driven industries. Although the U.S. remains an international leader in many STEM fields, there are ongoing concerns about the nation’s global economic competitiveness. As the President of the National Academy of Sciences noted last year in testimony before the House Committee on Science, Space, and Technology, “In an increasingly complex global economy, we simply cannot afford to let U.S. leadership in science slip away. In some cases, it already has. Given the often-long lag time from research to applications, we may not realize the impacts of being behind until we are far behind, watching other nations reap the economic rewards and strategic advantages of early science and technology investment.”<sup>1</sup>

The biopharmaceutical industry demonstrates the critical importance and foundational need for STEM talent, as every aspect of a medicine’s lifecycle relies on a diverse range of technical skills and experiences. As a reflection of this skilled employment base, nearly one in three workers in the biopharmaceutical manufacturing industry are in a STEM occupation, a concentration more than five times the average for all industries across the U.S. economy. Providing access and inspiring students to pursue high-quality STEM education is critical to ensuring the U.S. remains economically competitive and preserves its status as a global leader in STEM literacy, innovation, and employment.

Innovation is a fundamental driver of economic progress, and according to one estimate, advancements in science and technology have driven 85% of U.S. economic growth since World War II.<sup>2</sup> This innovation requires

<sup>1</sup> “Maintaining U.S. Leadership in Science and Technology” Statement of Marcia K. McNutt President, National Academy of Sciences National Academies of Sciences, Engineering, and Medicine before the Committee on Science, Space, and Technology U.S. House of Representatives March 6, 2019.

<sup>2</sup> Comments by Julia Phillips, Chair of the National Science Board’s Science Policy Committee in Washington Post, “Science and Engineering Report Shows Continued Loss of U.S. Dominance,” March 23, 2020.

“Today, more than ever before, the United States’ economic prosperity and national security rests upon its capacity for continued scientific and technological innovation. That capacity depends on our ability to ensuring that all Americans have lifelong access to high-quality education in science, technology, engineering, and mathematics (STEM).”

- National Science and Technology Council, Committee on STEM Education

STEM expertise and is reflected in strong, persistent demand for talent. The STEM workforce has grown faster than the overall U.S. labor force for decades, and the demand for STEM jobs is expected to continue to grow significantly faster compared with non-STEM jobs to meet the ever-growing demands and dynamism of an innovation-led economy. Growing and developing a diverse talent pool of STEM workers will be essential for maintaining the innovation base needed to fuel scientific discoveries and create the technologies of the future.

Yet despite the recognition of the critical role of the STEM workforce to the nation’s innovation economy and growth, the U.S. continues to lag other countries in terms of STEM literacy and expertise. It is more critical than ever that the public and private sectors work together to chart a course to improve STEM literacy and develop the STEM workforce needed to ensure U.S. economic competitiveness.

Earlier this year, the National Science Board stated that the U.S. is no longer “the uncontested leader” in science and engineering.<sup>3</sup> In the United States, investments in STEM-related education and workforce training have diminished, while China and other Asian nations in particular have continued


to expand investments by their government not only in STEM-related education, but also in research and development (R&D) and manufacturing infrastructure. China, for example, continues to make significant infrastructure investments as part of its long-term economic and national security goals, and is rapidly expanding capacity and capabilities in biopharmaceuticals and biotechnology as well as robotics, aerospace, and renewable energy. To regain its status as the world leader in science, engineering, manufacturing and innovation, U.S. investments in the STEM workforce are imperative.

Indicators of achievement, literacy, and proficiency in STEM among U.S. students reveal modest gains in some areas, but largely show stagnation and a lack of improvement. The data also show that the demographics of the nation’s STEM classrooms and workforce do not reflect the diverse U.S. population, with a continued underrepresentation of women and several racial and ethnic groups. This suggests a vital missed opportunity to expand the STEM talent pipeline.

Recognizing these challenges, as well as shifting talent dynamics and potential ramifications for U.S. competitiveness, the private sector, including the nation’s leading biopharmaceutical companies, is leading

<sup>3</sup> National Science Foundation, National Science Board, 2020 Science & Engineering Indicators, “The State of U.S. Science & Engineering,” January 2020.





## The Third in a Series of Biopharmaceutical Industry-focused STEM Education Reports

**Source:** Bayer

the way in growing a diverse and inclusive STEM talent pipeline. This study, the third in a series conducted by the Pharmaceutical Research and Manufacturers of America (PhRMA) (see text box), highlights findings from a new survey of PhRMA member companies and finds the United States' innovative biopharmaceutical industry is proactively working to advance STEM education and inspire the next generation of STEM talent.

PhRMA member companies support more than 70 programs and initiatives across the country that are inspiring and impacting millions of U.S. students each year. These programs are directly addressing the fundamental factors leading to the nation's STEM talent gaps, while also focusing on broader societal aims of advancing scientific literacy across the population, inspiring young people in technologically innovative pursuits, and advancing social equity by fostering STEM literacy among underrepresented populations, and providing support throughout their STEM careers.

This report first sets the context with an overview of the current state of U.S. STEM education and talent dynamics, and then details how the nation's biopharmaceutical industry is advancing STEM education as an exemplar of its innovative potential to save lives and enhance quality of life for patients worldwide.

The principals of TEconomy Partners, LLC (TEconomy) have collaborated with PhRMA to conduct two prior studies inventorying the support that the biopharmaceutical industry's companies and foundations provide for U.S. STEM education and training programs and initiatives. The first was a 2013 survey and inventory of corporate support for STEM-related education programs and initiatives at local, state, and national levels, and across the full Pre-K through Postsecondary continuum. The resulting report, *STEM: Building a 21st Century Workforce to Develop Tomorrow's New Medicines*, published in 2014, measured and highlighted an impressive breadth and depth of support for education programs and initiatives over a 5-year period, spanning support for more than 90 initiatives impacting 1.6 million students and 17,500 teachers across the nation.

The second inventory had a more refined focus, that of the industry's partnerships with U.S. colleges and universities for postsecondary STEM-related education and training. Published in 2015, *Enhancing Today's STEM Workforce to Ensure Tomorrow's New Medicines*, found support and engagement by companies occurring across all levels of the postsecondary pipeline from certification and associate's programs through master's and doctoral programs. Nationally, the study identified 75 educational programs with direct ties to biopharmaceutical companies. These took various forms from advising curriculum and developing programs, to internships, providing facilities and equipment, and other areas of interaction and support.

# The Outsized Importance of STEM Talent and Skills to the U.S. Economy

STEM workers matter as a critical innovation driver for the U.S. economy, contributing significant and expanding impacts on economic competitiveness and growth. Despite making up a modest overall share of the nation's employment base (6.3%), this workforce of 9.1 million demonstrates the following key characteristics:

**STEM careers generally pay substantially higher wages than non-STEM jobs and are expected to continue to see strong employment growth that reflects robust, accelerating demand for their skills and expertise.** STEM jobs pay more than twice as much in wages and are projected to grow much more quickly than non-STEM jobs over the next 10 years. The median annual wage for U.S. STEM jobs in 2018 was \$84,880, compared with \$38,640 for all occupations and \$37,020 for non-STEM jobs (Figure 1). In the latest 10-year employment projections, STEM occupations are projected to grow 8.8%, compared with 5.2% for all occupations and 5.0% for non-STEM jobs. Importantly, the wage premium for STEM workers has been found to be significant even when controlling for the level of education – the Pew Research Center finds that STEM workers tend to out earn their non-STEM counterparts with the same levels of education.<sup>4</sup>

## What are “STEM” jobs?

While definitions can vary, STEM occupations generally include computer and math; architecture and engineering; life and physical sciences; as well as managerial and postsecondary teaching related to these areas, and sales occupations requiring STEM knowledge.

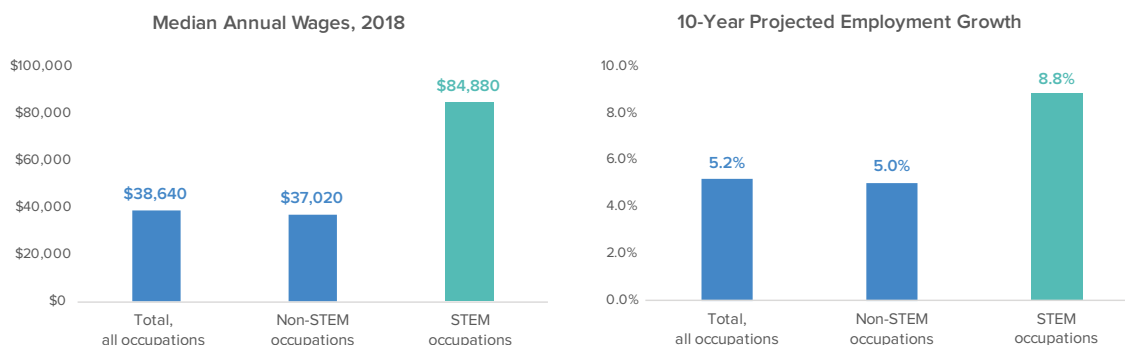


The STEM occupational definition adopted by the U.S. Bureau of Labor Statistics (BLS) is used in analysis presented herein.

**STEM jobs generate greater economic impacts.** One result of their higher wages is that STEM jobs have a higher economic “multiplier” effect than their counterparts

<sup>4</sup> Pew Research Center, “7 Facts About the STEM Workforce,” January 2018.

**FIGURE 1: ANNUAL WAGES AND PROJECTED EMPLOYMENT GROWTH FOR TOTAL, STEM, AND NON-STEM JOBS**



**Source:** U.S. Bureau of Labor Statistics (BLS), Occupational Employment Statistics (OES) Program and Employment Projections Program. Employment Projections are for the 2018-28 period.

in other fields, because each STEM job typically supports several others in an area. In STEM-intensive industries such as biopharmaceuticals where there are very high “multipliers”, broader economic impacts and positive economic ripple effects are felt in state, regional, and local economies throughout the nation.<sup>5</sup>

**STEM-intensive industries generate greater levels of innovation activity, as measured by increased levels of patenting.** Industries that employ more STEM workers are found to generate more patents. 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.”<sup>6</sup> Additionally, “industries with high levels of STEM employment are also patenting more and more.” STEM occupations are distributed very unevenly across industries, which translates to high variation in patent intensity. Among the industries studied by the authors, the

pharmaceuticals sector ranks highly in both its share of STEM employment and in patent intensity.

**STEM-intensive, technology-based startups provide outsized contributions to employment, innovation, exports, and productivity growth.** Although technology-based startups, which tend to have a STEM-intensive workforce, represent a small share of total young companies and an even smaller share of total U.S. firms, these startups play a crucial role in economic growth and competitiveness. Research from the Information Technology & Innovation Foundation (ITIF) finds that the number of technology-based startups have grown at a faster rate than other startups and have a higher survival-rate.<sup>7</sup> Their analysis also finds that startups in the pharmaceutical industry offered the highest wages (\$140,000) of all technology-based industries. Biotechnology startups play a key role in the innovation pipeline for biopharmaceuticals and often merge with larger pharmaceutical manufacturers as products reach the marketplace.

<sup>5</sup> TEconomy analysis of U.S. IMPLAN Input/Output models.

<sup>6</sup> The Hamilton Project, “Eleven Facts About Innovation and Patents,” December 2017.

<sup>7</sup> Information Technology and Innovation Foundation, “How Technology-Based Start-Ups Support U.S. Economic Growth,” November 28, 2017.

## Broad Support for STEM Education

The common focus to build the next generation of innovators, ensure U.S. economic competitiveness, and address humanity's greatest challenges has made support for STEM education a bipartisan issue. According to a 2018 national survey among 1,500 registered voters, nearly all respondents across the political spectrum valued the importance of American leadership in STEM, with majorities agreeing that American improvement in STEM education should be a national priority.<sup>1</sup> Influential voices in and around the nation's capital, from both sides of the aisle, have also emphasized the importance of STEM:

- “My Administration will do everything possible to provide our children, especially kids in underserved areas, with access to high-quality education in science, technology, engineering, and math.”<sup>2</sup>  
-President Donald J. Trump
- “The pace of innovation is accelerating globally, and with it the competition for scientific and technical talent. Now more than ever the innovation capacity in the United States – and its prosperity and security – depends on an effective and inclusive STEM education ecosystem.”<sup>3</sup>  
-America's Strategy for STEM Education (2018)
- “Few things are as important to America's prosperity as how our schools fare when it comes to teaching science, technology, engineering, and mathematics.”<sup>4</sup>  
-Frederick Hess, American Enterprise Institute
- “Research drives innovation, and innovation drives long-run economic growth – creating jobs and improving living standards in the process. The United States can't rest on its laurels. To once again lead the world in innovation, policymakers must make the necessary investments in university research.”<sup>5</sup>  
-Rob Atkinson, ITIF
- “Science is not partisan; nor are the wonderful STEM students who will keep fueling American innovation -- they deserve to be celebrated.”<sup>6</sup>  
-Kumar Garg, former member of Office of Science and Technology Policy

1 Echelon Insights and Hart Research Associates, “Voters' Attitudes toward Science and Technology Research and the Role of the Federal Government: Key findings from online national survey among 1,500 registered voters conducted September 28 to October 8, 2018.”

2 President Donald J. Trump is Working to Ensure All Americans Have Access to STEM Education, December 2018.

3 Charting a Course for Success: America's Strategy for STEM Education (December 2018) <https://files.eric.ed.gov/fulltext/ED590474.pdf>

4 American Enterprise Institute “US STEM practices: How does America compare abroad?” December 2019.

5 Information Technology & Innovation Foundation, “U.S. Funding for University Research Continues to Slide,” 2019.

6 The Scientist, “Trump to Hold Annual Science Fair,” April 2017.

# The Leading Role of STEM Jobs in the Biopharmaceutical Industry

The nation's economic competitiveness is dependent upon innovative industries powered by STEM talent. For decades, the United States' strengths in research and development and innovation-driven industries have helped fuel economic growth.

This is especially true for the biopharmaceutical industry, where investments in R&D and manufacturing not only lead to new treatments and potential cures, but also support the employment of millions of jobs nationally, and billions of dollars in economic output. Central to the success of this industry – and other sectors that comprise the nation's knowledge economy – is a workforce that with a high degree of STEM literacy and proficiency.

The innovative biopharmaceutical industry has an outsized demand for STEM skills and expertise, as every element of a medicine's life cycle requires STEM talent. From preclinical and clinical research to manufacturing and efforts to ensure continuity in the drug supply chain, these steps and processes involve a broad spectrum of scientists, engineers, IT professionals, and data scientists. These professionals

work alongside production workers, technicians, and distribution teams, which play a critical role in helping to see new therapies and vaccines reach the patient. Biopharmaceutical industry employees both develop and deploy innovation.

Reflecting this high-skilled talent base, nearly one in three employees in the biopharmaceutical manufacturing industry are in a STEM occupation (32%, see Figure 2). This is more than five times the average for all industries across the U.S. economy (6.3%) and the sixth-highest concentration across 68 U.S. manufacturing industries. Complementing this manufacturing industry is a separate industrial classification specific to commercial R&D in biotechnology and the broader life sciences, of which biopharmaceutical R&D activities are a major component. In this R&D industry the

share of STEM workers is even greater, at 55.5% of the workforce.

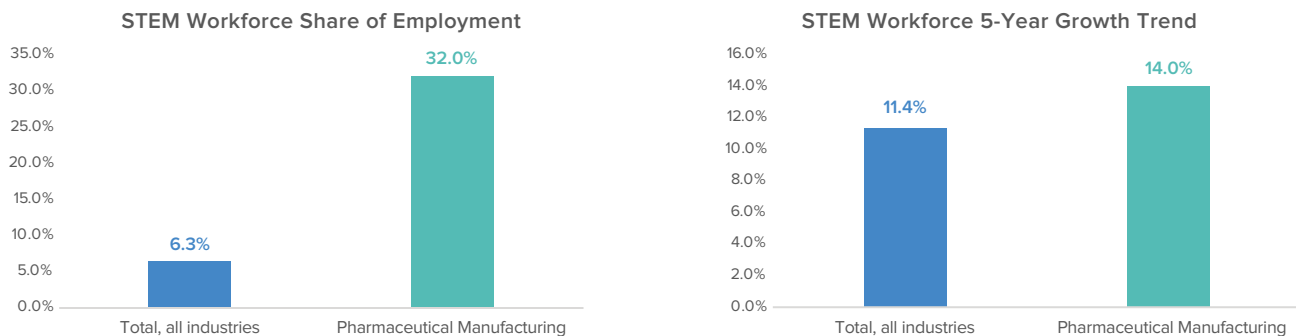
The STEM-intensive nature of the biopharmaceutical industry stands out across all major occupational groupings when compared with the overall U.S. economy (Figure 3). The industry employs more scientists and scientific technicians, engineers, technical sales, and STEM-related managerial talent at rates several orders of magnitude greater than the industrial average.

While the majority of the STEM occupations typically require a bachelor's degree or higher for entry, it is important to understand that the biopharmaceutical industry utilizes a number of workers in other roles

that typically require an associate's degree, such as industrial engineering technicians and electrical and electronics engineering technicians. Certificate programs and other forms of "stackable" credentials made available through programs at community colleges, vocational schools, and via other service providers are essential to building this technically skilled workforce. Additionally, flexible work-based learning programs such as apprenticeships, internships, and co-ops are important for further workforce development.

Figure 4 illustrates just some of the varied STEM professions and specific skills and expertise utilized throughout the drug development process.

**FIGURE 2: STEM WORKFORCE IN PHARMACEUTICAL MANUFACTURING VS. ALL U.S. INDUSTRIES, 2018 AND TREND, 2013-18**

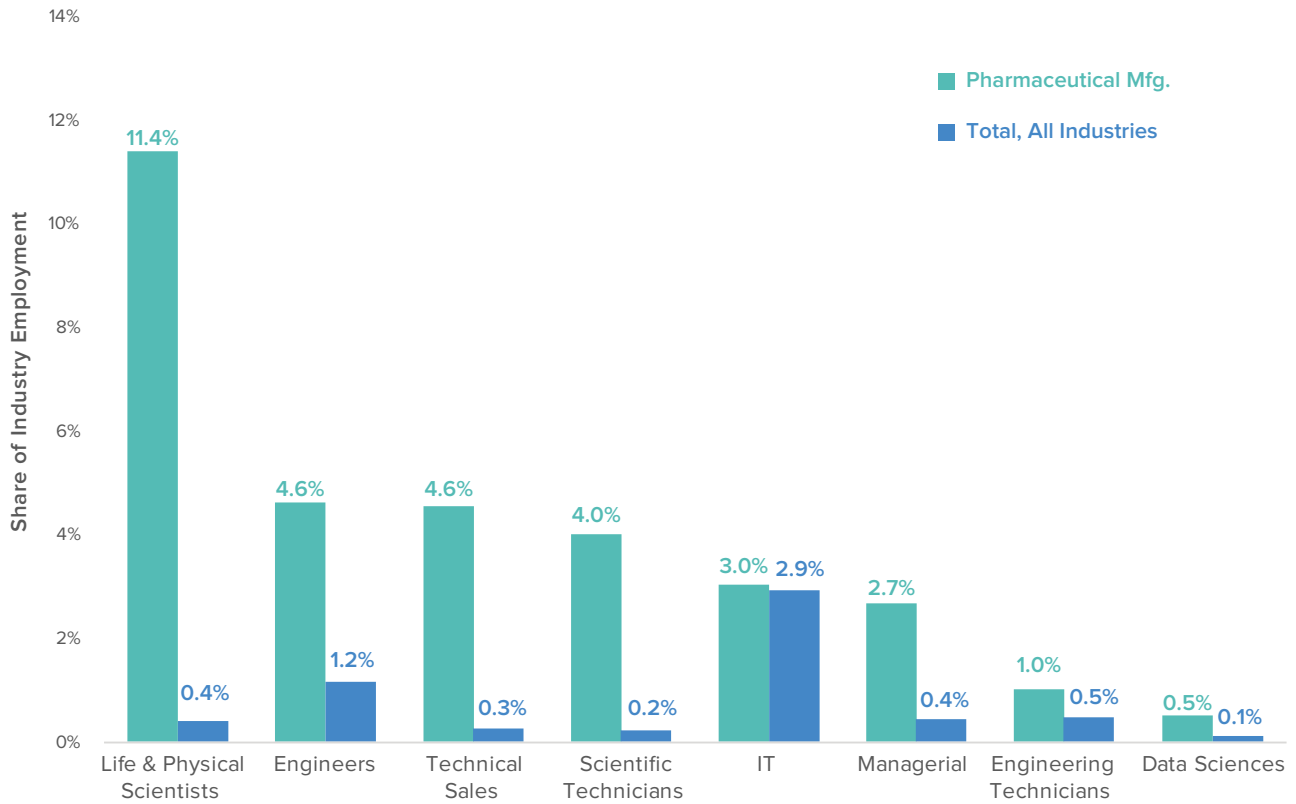


**Source:** TEconomy Partners' analysis of U.S. Bureau of Labor Statistics (BLS), Occupational Employment Statistics (OES) Program data.



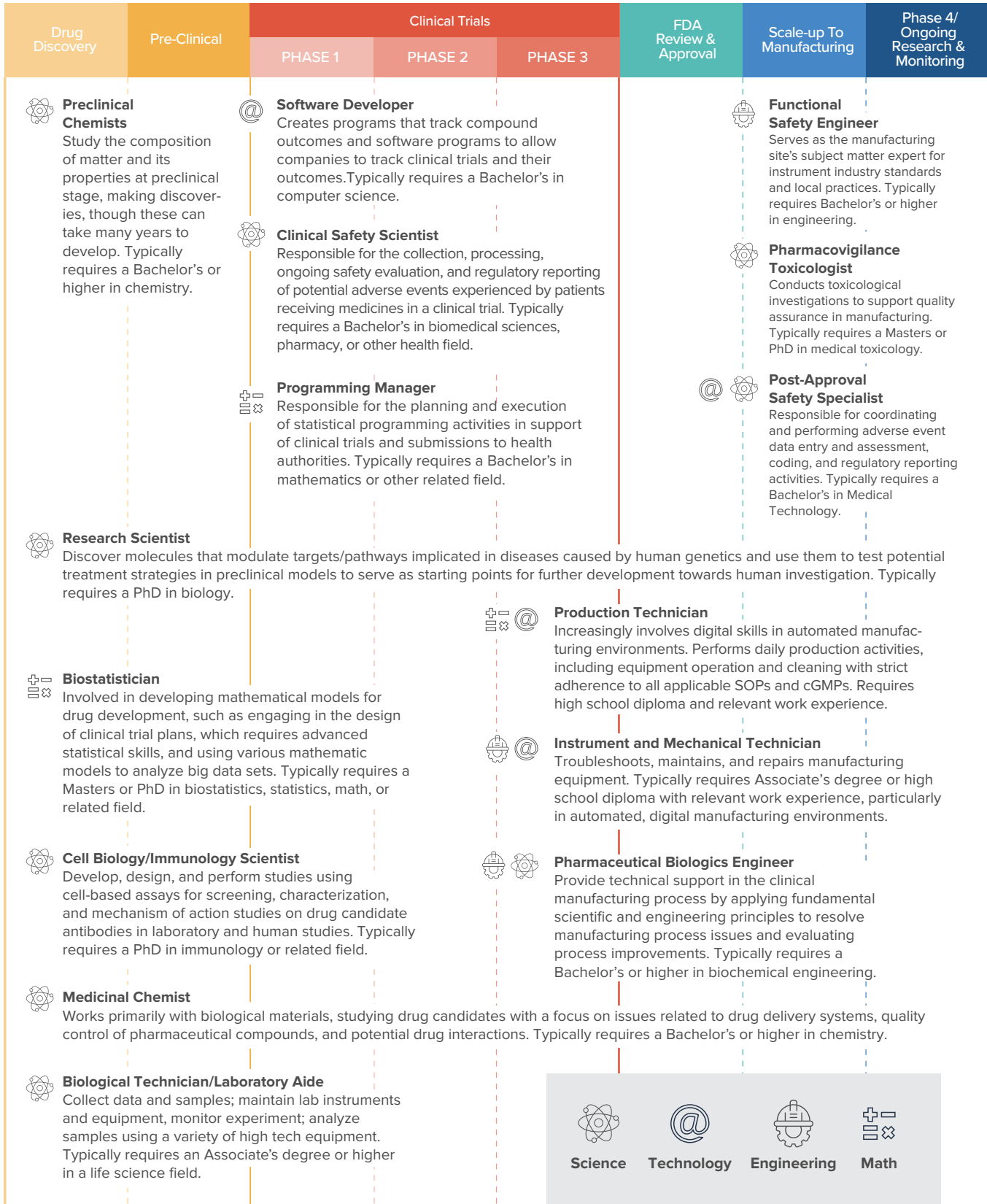
Source: Amgen

FIGURE 3: DEPLOYMENT OF STEM WORKFORCE BY OCCUPATIONAL GROUPING, 2018



Source: TEconomy Partners' analysis of U.S. Bureau of Labor Statistics (BLS), Occupational Employment Statistics (OES) Program data.

FIGURE 4: STEM-RELATED JOBS ACROSS THE DRUG DEVELOPMENT PROCESS



Source: PhRMA and TEconomy Partners, LLC.



# Despite the Clear Importance of STEM Talent to U.S. Global Competitiveness, the U.S. Lags Behind Other Countries in Key STEM Areas

The long-term economic prosperity of the U.S. is inextricably linked to growing the size and quality of its STEM workforce.

The findings from this section of the report, however, reveal a nation making some positive strides but largely falling short in the development of its STEM education and talent pipelines, resulting in persistent gaps in meeting workforce demand. These challenges also make the U.S. less competitive versus other countries that are seeking to attract R&D- and manufacturing-intensive industries by investing in their own STEM workforce infrastructure.

## Insufficient Levels of STEM Talent to Meet Industry Demand

At its core, the extremely R&D-intensive and science-driven biopharmaceutical industry is a leading advanced manufacturing sector – producing lifesaving therapies and vaccines for patients around the world in an increasingly sophisticated and highly-regulated production environment. Deloitte and The Manufacturing Institute have shone a spotlight on the challenges of filling U.S.

manufacturing jobs in their regular assessments of the industry's national skills gap. In their 2018 study, the fourth in a series, they find a widening gap between the jobs that need to be filled and the skilled workers able to fill them.<sup>8</sup> The study projects that more than half of the open jobs in U.S. manufacturing by 2028 (2.4 million jobs) could go unfilled as there are insufficient numbers of qualified workers, including those with STEM skillsets, to fill the gaps. Manufacturers struggle with recruiting younger workers due to outdated stereotypes and misperceptions of working in manufacturing. At the same time, there are significant retirements among the baby boom generation placing a strain on the supply of qualified workers. All the while, the nature of manufacturing is shifting, as the increasingly digital and automated manufacturing environment requires new skill sets.

PwC, in its recent annual Global CEO Survey, recognizes this shift in the modern production environment that directly relates to STEM skills:

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<sup>8</sup> Deloitte and The Manufacturing Institute, "2018 Deloitte and The Manufacturing Institute Skills Gap and Future of Work Study."

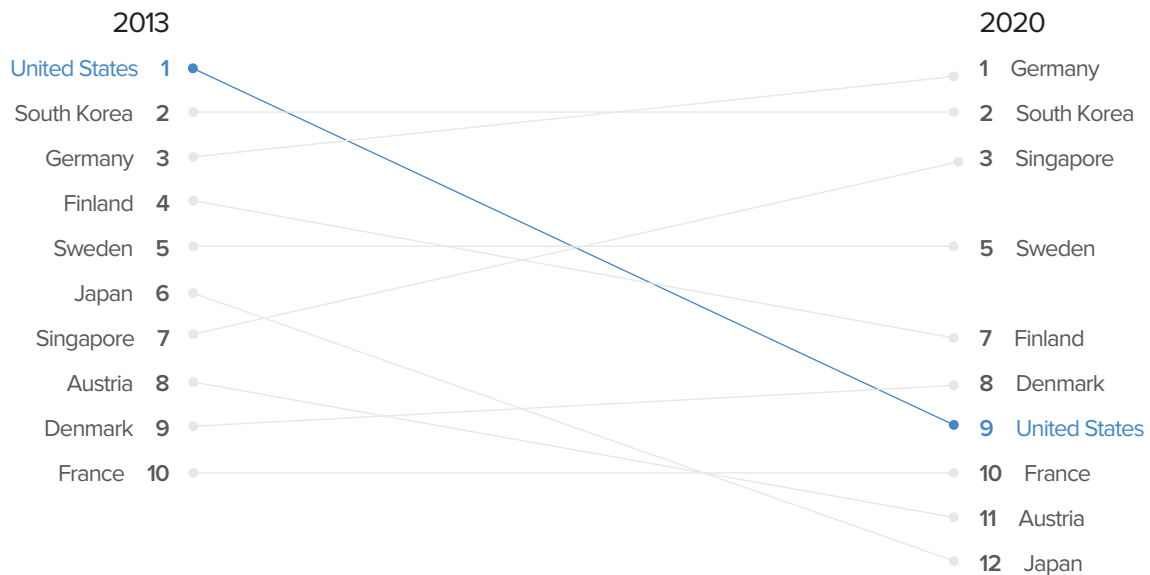
*“Blue-collar jobs will be replaced by ‘new collar’ jobs that require a combination of digital, technical and soft skills that are going unfilled in today’s tight global labour market. Unemployment rates continue to fall in OECD countries. And the supply of people possessing STEM (science, technology, engineering, math) skills and the uniquely human skills (e.g., creativity, empathy, collaboration) increasingly prized in today’s job market cannot keep up with demand.”<sup>9</sup>*

Research from Harvard economists finds rapid technological progress drastically changes the nature of STEM jobs, and in turn, the increased demand for new skills leads to shortages in the number of workers with those skills. Their study suggests that it is not just STEM workers that are in short supply, but rather the new

job-relevant STEM skills needed for these new jobs are increasingly scarce.<sup>10</sup>

Analysis of Burning Glass job openings data in 2017 found that over a 6-year period during the economic expansion the ratio between STEM job postings and the number of available, trained professionals more than doubled.<sup>11</sup> In 2010, a time of high unemployment, there were 5.4 STEM jobs posted online for every unemployed STEM professional. By 2016, this ratio grew to 13 to 1, amounting to roughly 3 million more jobs than the number of available, trained professionals who could fill them. In the next ten years the demand for STEM professionals will only continue to grow, with their growth expected to well outpace that for their non-STEM counterparts at nearly 9% growth versus 5%. Factors such as very low unemployment among STEM

**FIGURE 5: NATIONAL RANKINGS IN THE BLOOMBERG INNOVATION INDEX, 2013 AND 2020**



**Source: Bloomberg Innovation Index.**

<sup>9</sup> PwC, 23rd Annual Global CEO Survey: Navigating the Rising Tide of Uncertainty.

<sup>10</sup> David Deming and Kadeem Noray (2018) “STEM Careers and Technological Change,” NBER

<sup>11</sup> New American Economy, “Sizing Up the Gap in our Supply of STEM Workers: Data & Analysis Examining Job Postings and Unemployment Data from 2010-2016,” March 2017.

“Economic competitiveness is driven by scientific innovation of the nation’s top achievers.”

- Center for Excellence in Education

workers and the high demand for STEM talent and skills in non-STEM industries like finance help intensify these challenges.

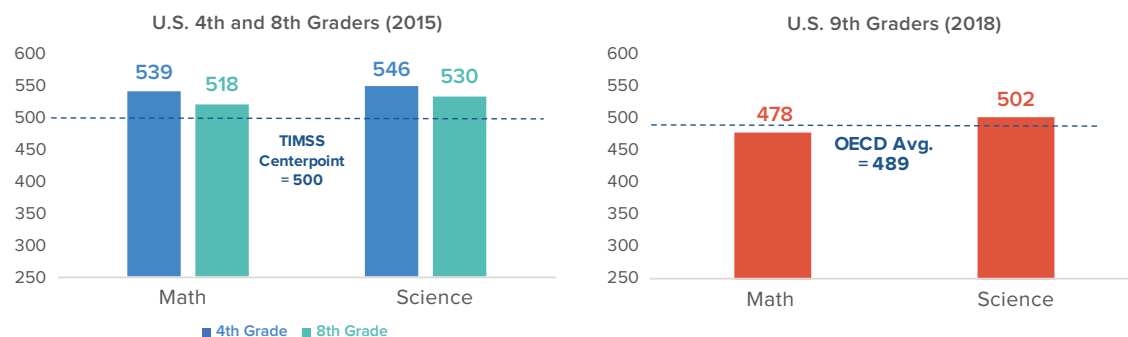
The Bloomberg Innovation Index, which looks at more than 200 global economies on criteria related to R&D spending, advanced manufacturing, and the concentration of high-tech firms, ranks the United States 9th in its 2020 ranking, a considerable drop from its 1st place ranking when the Index premiered in 2013 (Figure 5). The U.S. ranks just 47th in post-secondary efficiency, which considers factors such as college enrollment rates, graduation rates, educational attainment, and science and engineering graduates as a share of all degree-earners, and the workforce as a whole.

## U.S. Continues to Lag China and Other Nations in Key STEM Indicators

Elementary and middle school students in the United States place among the lower end of a top tier of students internationally in math and science assessments. In math, U.S. fourth and eighth graders ranked 11th and 9th, respectively, in the latest international assessments known as the Trends in International Math and Science Study (TIMSS). These rankings put students in the lower end of the top quintile for fourth grade and the lower end of the top quartile for eighth grade.<sup>12</sup> Both grade levels have demonstrated long-term improvement over a 20-year period in the international study. Fourth graders, however, showed no measurable difference since the prior results in 2011. Eighth graders, on the other hand, showed marked improvement in 2015, with higher average scores relative to any prior year.

In science, U.S. fourth and eighth graders ranked 8th, similarly placing them among the top tier of their international

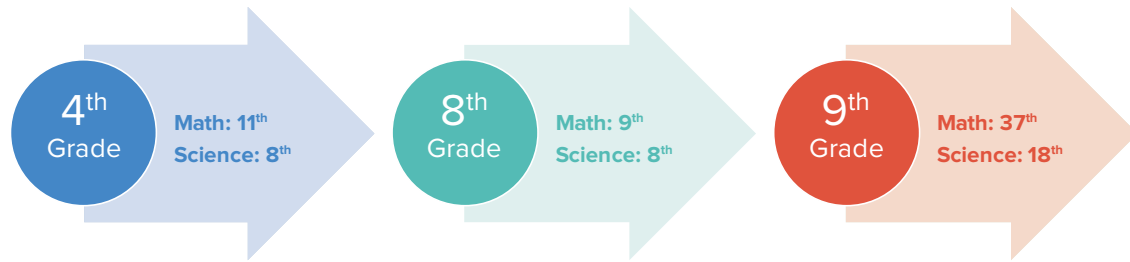
**FIGURE 6: PERFORMANCE OF U.S. FOURTH, EIGHTH, AND NINTH GRADERS ON INTERNATIONAL MATH AND SCIENCE ASSESSMENTS**



**Source:** Data for fourth and eighth grades from National Center for Educational Statistics, *Trends in International Math and Science Study (TIMSS), 2015*; 9th grade from Organization for Economic Cooperation and Development (OECD), *Programme for International Student Assessment (PISA)*.

<sup>12</sup> The *Trends in International Math and Science Study*, also known as “TIMSS,” is used to compare the math and science knowledge and skills of fourth and eighth graders over time and across the globe. Conducted every four years, the latest assessment data available are from 2015. The latest study included 49 IEA member countries and 6 other education systems at grade 4, and in 38 IEA member countries and 6 other education systems at grade 8.

FIGURE 7: U.S. STUDENTS' INTERNATIONAL RANKINGS ON MATH AND SCIENCE ASSESSMENTS



**Source:** Data for fourth and eighth grades from National Center for Educational Statistics, *Trends in International Math and Science Study (TIMSS), 2015*; 9th grade from Organization for Economic Cooperation and Development (OECD), *Programme for International Student Assessment (PISA)*.

counterparts. Students in fourth grade have not shown significant improvement in their average scores for science over time. Meanwhile, eighth grade students have seen their average scores increase over a 20-year period though there were no measurable differences against the prior (2011) assessments.

In both math and science, elementary and middle school students are consistently performing behind several Asian nations and regions, on average, including Singapore, South Korea, Japan, and Hong Kong, as well as Russia and other international peers and competitors.

The Programme for International Student Assessment (PISA) is an international, triennial evaluation of 15-year-old students that focuses on the core subjects of reading, math, and science. PISA is touted as providing “the most comprehensive and rigorous international assessment of student learning outcomes to date.”<sup>13</sup> In 2018, the latest assessment year, U.S. ninth graders performed above the OECD average in science but below the average in math (Figure 6).<sup>14</sup> The nation’s students rank 18th in science among all participating countries and 37th in math. Trends in U.S. student performance in these STEM subjects have been stable, with average performance among U.S. students showing

“We are at a pivotal moment in humankind, where the future advances in science, biology, engineering, and mathematics are going to shape our world in ways that we can’t even imagine. Empowering the next generation of scientific leaders is critical to that mission.”

- José Baselga, Executive Vice President, Oncology R&D, AstraZeneca

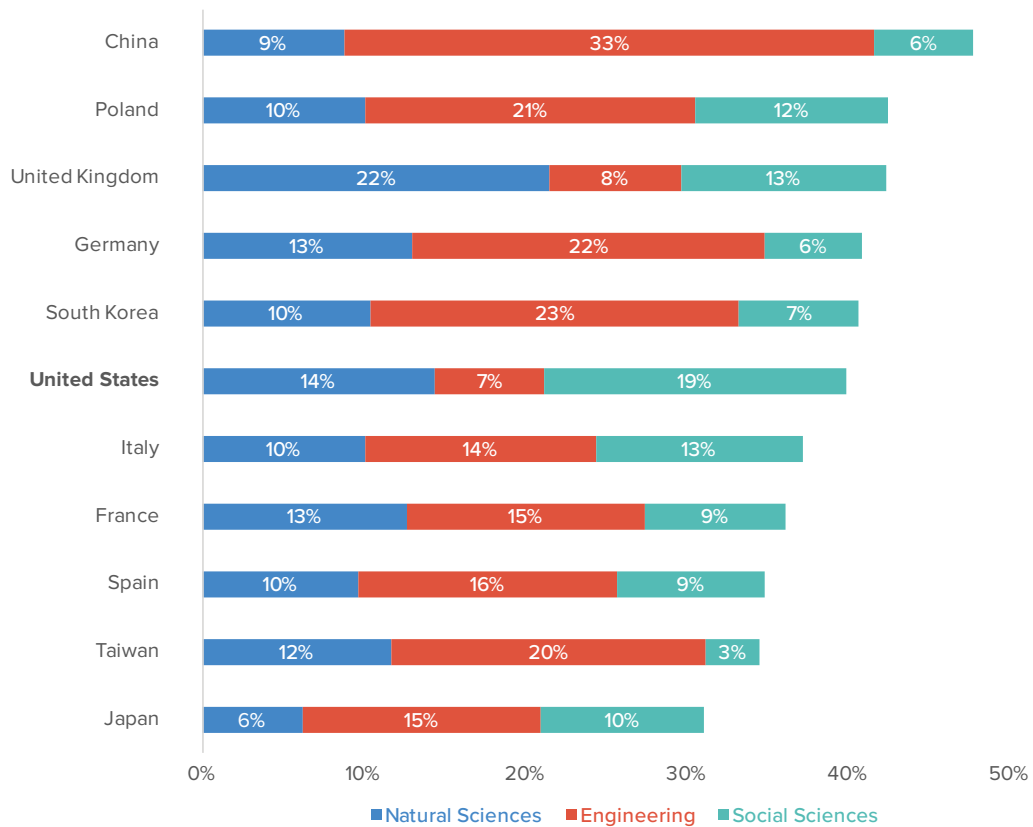
<sup>13</sup> OECD, “PISA 2018 Results,” December 2019

<sup>14</sup> OECD, “United States PISA 2018 Results Country Note,” December 2019

“In most other countries, the government funds Olympiad programs, including training and other resources for teachers and students, but that is not the case in the U.S. China is pouring resources into these competitions, and that can be a significant advantage for China beyond the Olympiads. It’s important to note that China is also investing heavily in innovation, like R&D, an effort that has declined in Europe.”

-Joann P. DiGennaro, President, Center for Excellence in Education

**FIGURE 8: SHARE OF FIRST UNIVERSITY DEGREES IN SCIENCE AND ENGINEERING FIELDS, BY SELECTED COUNTRY, 2016**



**Note:** data for China are for 2015. Natural sciences include agricultural sciences; biological sciences; computer sciences; earth, atmospheric, and ocean sciences; and mathematics.

**Source:** National Science Foundation (NSF), National Science Board, Science & Engineering Indicators, 2020.



*Source: Amgen*

no significant improvements or declines since the early- to mid-2000s.

In terms of the highest levels of proficiency, a greater share of U.S. students scored at these high levels in science relative to the OECD average, but a smaller share scored at these levels in math. Just 8% of U.S. students scored at the highest level in math, compared with 44% in the Coastal areas of China. In the case of low-performing U.S. students, performance has not improved over the past three decades.

Despite recent improvement, research shows that U.S. students continue to trail Chinese students in Science Olympiad competitions. An index of STEM education preparedness, which looks at outcomes of international competitions like the Biology, Chemistry, and Mathematics Olympiads, finds that China has dominated these events for the last 30 years.<sup>15</sup> Although the U.S. has exhibited improvement, moving from approximately 6th place to 2nd or 3rd, the nation still trails China by a considerable margin.

**As the STEM talent pipeline moves into colleges and universities, the U.S. lags other developed nations in the share of bachelor's degrees awarded in STEM fields.** Approximately 40% of the nation's degrees are in STEM-related fields, a lower share than for a sampling of countries including China (nearly 48%), the U.K. (42%), Germany (41%), and South Korea (41%).<sup>16</sup> Exacerbating these differences, and important to understand in comparing these figures, are two factors:

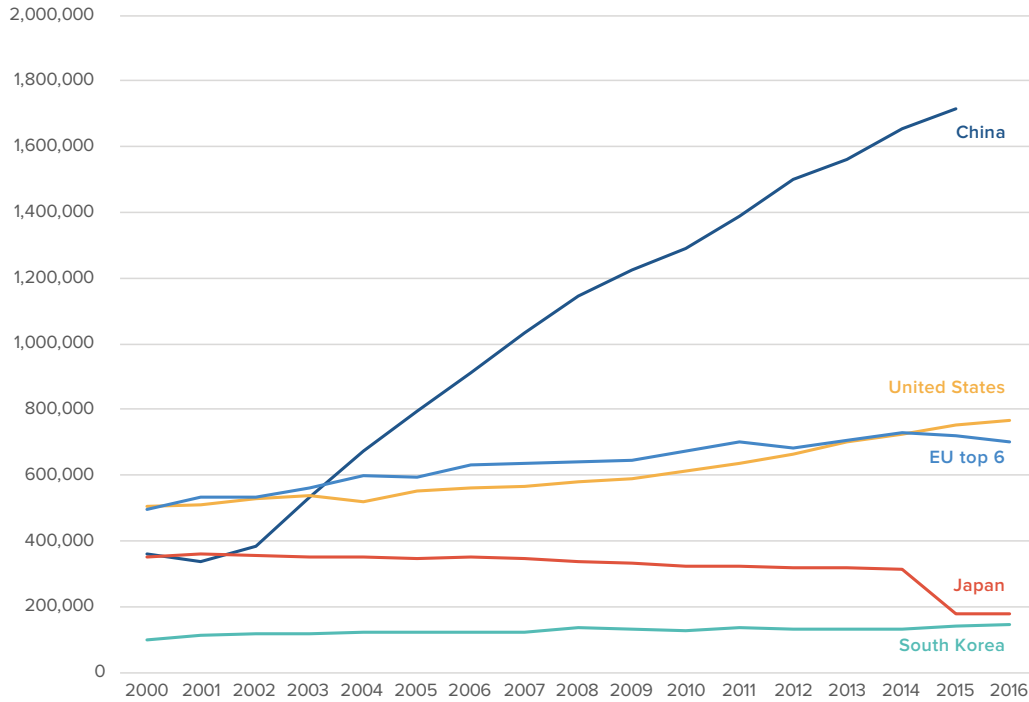
- The sheer size of Chinese university enrollment, where the raw number of graduates reaches more than 1.7 million in the latest year, a figure more than twice the total number of U.S. STEM graduates.
- The number of international students included in the U.S. graduate totals. In 2018, there were more than 804,000 international students enrolled in U.S. higher education institutions of whom 413,040 were enrolled in degree programs in science and engineering fields.<sup>17</sup>

<sup>15</sup> Center for Excellence in Education, "New Index of Excellence in STEM Education," November 2019.

<sup>16</sup> National Science Foundation, National Science Board, 2020 Science & Engineering Indicators, "The State of U.S. Science & Engineering," January 2020.

<sup>17</sup> Ibid.

**FIGURE 9: TREND IN NUMBER OF FIRST UNIVERSITY DEGREES IN SCIENCE AND ENGINEERING FIELDS, BY SELECTED COUNTRY, 2000-2016**



**Note:** data for China are for 2015.

**Source:** National Science Foundation (NSF), National Science Board, Science & Engineering Indicators, 2020.

Among the countries shown in Figure 8, the U.S. awards the highest share of degrees social science fields, but the lowest in engineering, in stark contrast to countries in Asia where engineering degrees are significantly higher.

More impressive than current STEM degree levels in China is the nation's rapid growth to reach this level of STEM graduates. In 2000, China awarded just 359,000 STEM degrees at the undergraduate level.<sup>18</sup>

Today the number of STEM undergraduate degrees has increased to more than 1.7 million – a nearly 400% increase representing a focused, intentional increase as a national priority (see Figure 9). While the U.S. and top EU countries once had higher levels of STEM graduates, China's growth rate has far outpaced what might otherwise be seen as impressive growth in its own right – U.S. growth of 53%, and EU growth of 41% since 2000.

<sup>18</sup> National Science Foundation (NSF), National Science Board, Science & Engineering Indicators, 2020.

## Teacher Shortages Hinder Widespread, High-Quality STEM Education

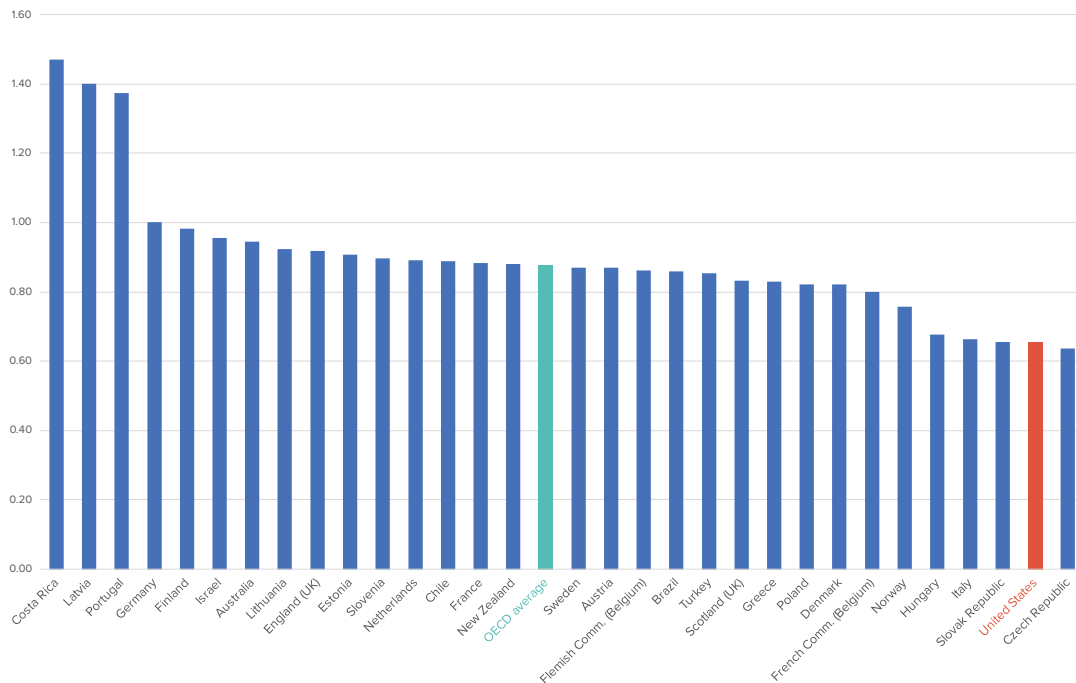
**A limiting factor for growth and development of the United States' STEM education ecosystem is a shortage of qualified STEM educators, particularly at the primary and secondary levels.** The OECD finds that 26% of U.S. 9th grade students attend a school whose principal reports the school's instructional capacity is hindered by a lack of teaching professionals – a situation that is many times more prevalent among underserved schools.<sup>19</sup> Further, an analysis of federally-designated teacher shortage areas finds that nearly every state

reports a teacher shortage in either science or mathematics.<sup>20</sup>

Multiple other factors also suggest the U.S. will not see significant near-term improvements in key STEM indicators:

- **The pipeline of U.S. educators in general is diminishing.** Education degrees accounted for one in every five bachelor's degrees in the U.S. in 1970-1971, and now account for just 4% of degrees.<sup>21</sup>
- **Interest in STEM teaching is low.** Analysis shows that very few ACT-tested graduates – only about 6,000 of the more than 970,000

**FIGURE 10: TEACHERS' SALARIES RELATIVE TO EARNINGS FOR COLLEGE-EDUCATED WORKERS (2017)**



**Source:** OECD data; TEconomy Analysis.

<sup>19</sup> OECD, PISA 2018 Results, December

<sup>20</sup> TEconomy analysis of Department of Education, Teacher Shortage Area program.

<sup>21</sup> National Center for Education Statistics, Digest of Education Statistics, Table 322.10. Bachelor's degrees conferred by postsecondary institutions, by field of study: Selected years, 1970-71 through 2016-17.





Source: Biogen

STEM-interested students in the U.S. (0.6%) – planned to major or pursue a career in math education (0.43%) or science education (0.17%).

- **U.S. teacher salaries are far lower** than those for their OECD counterparts when compared to workers with similar levels of educational attainment (Figure 10).<sup>22</sup>

The subject-matter expertise of teachers is critical, particularly in the technical fields of STEM where many teachers did not complete a college degree corresponding with

the main study they teach. A study conducted by the U.S. Department of Education examined the credentials and qualifications of public high school teachers and found math and science teachers were less likely to have a college major in the field they teach. The share of teaching professionals without an educational background in math was 30%, almost 26% in biology/life sciences, and 54% in physical sciences, compared against an average of 21% of teachers without a corresponding degree in other core subject areas such as English and social sciences.<sup>23</sup>

<sup>22</sup> OECD Indicators: Education at a Glance 2019, Table D3.2a. Actual salaries of teachers and school heads relative to earnings of tertiary-educated workers (2017)

<sup>23</sup> U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), "Public School Teacher Data File," 2011–12.

## The STEM Education Pipeline: Persistent Achievement Gaps and a Lack of Diversity

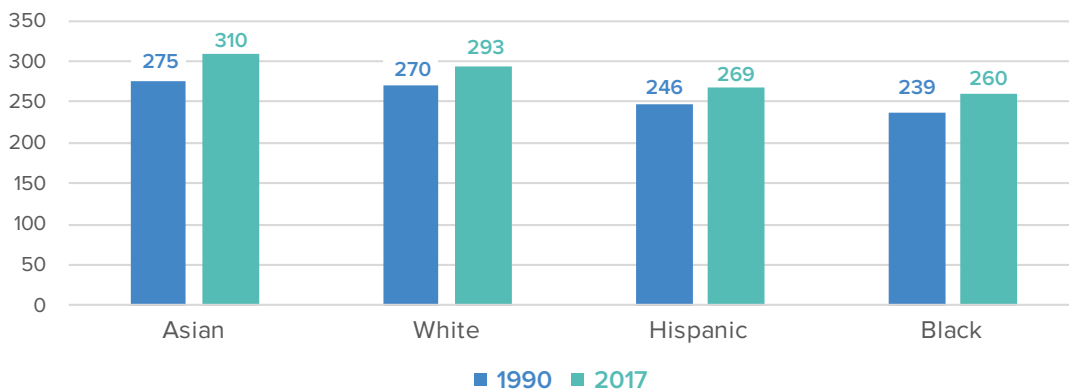
**Growing the STEM talent pool for economic competitiveness and social equity requires truly engaging all demographic groups in STEM education and experiential learning, particularly at early ages, and ensuring STEM classrooms are representative of the nation.** For decades, a major concern in STEM education, and education more broadly, has been persistent achievement gaps based on socioeconomic status, race and ethnicity, and gender. Research finds that achievement gaps between underrepresented groups during primary and secondary schooling often generate underrepresentation in STEM majors and degrees in college and subsequent STEM career opportunities.<sup>24</sup> This is why student achievement gaps and underrepresentation in the STEM workforce are so closely linked.

“Everyone needs science, and science needs everyone.”

- Robert A. Bradway, Chairman and CEO, Amgen

**Achievement gaps are seen at all educational levels in STEM subjects.** Among U.S. fourth and eighth graders, current gaps between white students and their Black and Hispanic classmates in math performance have narrowed slightly, but the performance gaps remained at significant levels over the last three decades in the National Assessments of Educational Progress (NAEP).<sup>25</sup> For example, 2017 data shows that the NAEP math scores for eighth graders that were Black (260) and Hispanic (269) were well below the national average (283).<sup>26</sup> Despite test-score improvement across all races from 1990 to 2017, the average NAEP math scores among Black and Hispanic eighth graders in 2017 were

FIGURE 11: NAEP EIGHTH GRADE MATH SCORES BY RACE AND ETHNICITY, 1990-2017



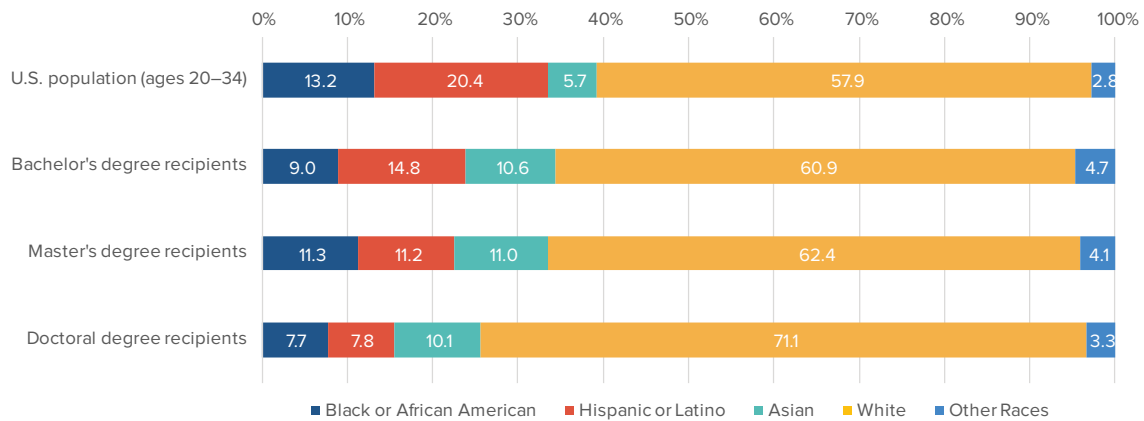
**Source:** NSF analysis of NAEP mathematics assessments

<sup>24</sup> Congressional Research Service, “Science, Technology, Engineering, and Mathematics (STEM) Education: An Overview,” June 2018.

<sup>25</sup> U.S. Department of Education, National Center for Education Statistics (NCES), *The Nation’s Report Card, National Assessment of Educational Progress, 2019*.

<sup>26</sup> National Center for Science and Engineering Statistics, National Science Foundation, *Special Tabulations (2018) of the 1990–2017 NAEP mathematics assessments, National Center for Education Statistics, Department of Education (Table 1-2)*.

**FIGURE 12: REPRESENTATION OF RACIAL AND ETHNIC GROUPS IN THE U.S. POPULATION AND AMONG SCIENCE AND ENGINEERING DEGREE RECIPIENTS, 2017**



**Source:** NSF analysis of Integrated Postsecondary Education Data System (IPEDS) data; TEconomy Partners analysis.

lower than the average scores for White and Asian students in 1990 (Figure 11).

**Disparities are especially prevalent at higher levels of education.** An analysis of data from the College Board finds that Blacks and Hispanics are far less likely than others to take advanced placement (AP) courses in math and science, and the students that do, tend to score lower than their white and Asian counterparts.<sup>27</sup> Although Black students represent 8.8% of all AP exam takers, just 4.3% of exam takers who earned a 3 or higher on at least one exam were Black.

Meanwhile, a study by ACT, the only nationally recognized college readiness assessment that includes a separate, dedicated science test, finds further evidence of the relationship between STEM performance and socioeconomic status. Students who were an underrepresented minority (race/ethnicity is Black, American Indian/Alaska Native, Hispanic/Latino, or Native Hawaiian/other Pacific Islander), came from a low-income household (combined parental

income is less than or equal to \$36,000), or who had parents without college degrees, accounted for just 11% of high school graduates who met the ACT STEM Benchmark. Approximately 5% of STEM-proficient graduates reported two of these traits, while just 2% of STEM-proficient graduates reported all three traits.

**A lack of diversity in college-level STEM courses is a key result of these K-12 achievement gaps.** Without targeted interventions, the achievement gaps in STEM subjects between students of color and white students in K-12 will manifest as underrepresentation in STEM courses at a collegiate level. 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 bachelor's, master's, and doctoral levels (Figure 12).<sup>28</sup> Among these underrepresented students of color, social sciences and psychology were the most common S&E bachelor's degree fields.

<sup>27</sup> *Inside Higher Ed*, "More AP Success; Racial Gaps Remain," February 2019.

<sup>28</sup> *National Science Foundation, National Science Board, 2020 Science & Engineering Indicators, "The State of U.S. Science & Engineering," January 2020.*

“Johnson & Johnson is committed to its WiSTEM2D (Women in Science, Technology, Engineering, Math, Manufacturing and Design) program igniting the power of women – inside and outside of our company – to improve human health and the health of society. We want to increase representation of women in science and technical fields by building partnerships to open new doors, creating inspiring moments to honor women in STEM2D, playing the part of role models, and mentoring women throughout the fundamental stages of their lives.”

-Johnson & Johnson

## The Underrepresentation in STEM Education Exacerbates Workforce Challenges

Despite advances in recent years, today’s STEM workforce does not reflect the nation’s population with respect to gender, race, and ethnicity, which indicates decades of missed opportunities for social equity and addressing the nation’s STEM challenge. Women and many racial and ethnic groups continue to be underrepresented in the U.S. STEM workforce. The number of women and underrepresented people of color (including Blacks, Hispanics, American Indians, or Alaskan natives) in STEM has grown but remains below their overall employment and populations shares.

Analysis by the National Science Board finds that women, who make up 52% of the college-educated workforce, account for just 29% of Science and Engineering (“S&E” and essentially synonymous with STEM) employment.<sup>29</sup> This share has risen,

<sup>29</sup> *Ibid.*



Source: Johnson & Johnson

however, from 26% since 2003. Women are much more likely to work in the life sciences, psychology, and social sciences, where they account for almost half or more of the occupational employment. Among mathematical and computer scientists (27%), engineers (16%), and physical scientists (29%), women have much lower levels of representation.

In addition to women, other underrepresented populations have also seen gains in STEM employment since 2003 – increasing the combined employment share from 9% to 13% in 2017. This, however, continues to be below their share of the college-educated labor force, which stands at 17%.

Research from economists at the Harvard-based Opportunity Insights project finds that persistent inequality in STEM outcomes could be hindering U.S. innovation, and as a result, broader economic prosperity. Their research shows 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 4 times.<sup>30</sup>

While ability plays 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. Socioeconomic status is a strong predictor of performance in mathematics and science across the globe, explaining sizable variation in math and science

performance for U.S. students in the PISA.<sup>31</sup> Researchers from the Opportunity Insights project find evidence that increasing exposure to innovation through activities such as mentorship programs could help expand the innovation pipeline.

Further, OECD analysis of PISA assessments finds a career expectations gap among U.S. 9th graders:

*“Amongst high-performing students in mathematics or science, about three in ten boys in the United States expect to work as an engineer or science professional at the age of 30, while only one in ten girls expects to do so.”<sup>32</sup>*

Challenges to advancing broader representation in the STEM workforce are not limited to entry, but also to limitations 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.<sup>33</sup> Similarly, 31% think that Black Americans face greater obstacles in STEM fields and 29% say Hispanic Americans face greater challenges in advancement.

Broadening participation in STEM fields to groups historically underrepresented is critical to strengthening America’s innovation economy and cultivating economic prosperity. As the next section finds, this is a major focus of biopharmaceutical industry support for STEM education.

<sup>30</sup> Rebecca Linke, MIT, “Lost Einsteins: The US may have missed out on millions of inventors,” February 2018.

<sup>31</sup> OECD, “United States PISA 2018 Results Country Note,” December 2019

<sup>32</sup> *Ibid.*

<sup>33</sup> Cox, Daniel and Brent Orrell, “STEM Perspectives: Attitudes, Opportunities, and Barriers in America’s STEM Workforce,” American Enterprise Institute, July 2020.

## The Biopharmaceutical Industry's Role in Inspiring and Developing a Robust and Diverse STEM Workforce

Recognizing the many significant challenges facing STEM education and workforce development in the U.S., PhRMA member companies are proactively developing and implementing novel STEM education initiatives, as well as collaborating with and supporting numerous existing educational organizations and programs.

The industry is supporting these initiatives not simply because of their own interest and needs in accessing a highly-skilled STEM workforce, but with motivations such as enhancing the scientific literacy of the population, inspiring young people in technologically innovative pursuits, and advancing social equity by steering underrepresented populations into STEM jobs with especially bright career outlooks and economic opportunities. The industry is making a significant impact across the United States through its impressive array of programming and support.

Based on a detailed survey completed by 63% of PhRMA members regarding their U.S.-based STEM education support and programming, **71 specific STEM-related programs or activities** were identified throughout the nation. This section of the report features:

### STEM Education Survey of PhRMA Members

TEconomy Partners surveyed member companies in the December 2019 through February 2020 time period. Seventeen member companies and/or foundations completed the survey and reported that they or their foundations support at least one U.S.-based STEM-related education program. Data presented in this section are based only on these survey responses. Information on additional programs supported by PhRMA member companies were identified through company websites, publicly available reports, and press releases.

- The types of programs and initiatives supported, including specific examples;
- The focus and makeup of program participants across students and teachers and education levels, including a major focus on advancing diversity and inclusion in STEM fields;
- The geographic distribution of supported programs and activities;
- The approaches used to support programs (funding support, extensive volunteering, in-kind contributions including facilities and equipment); and,
- The impacts and reach of supported programs.

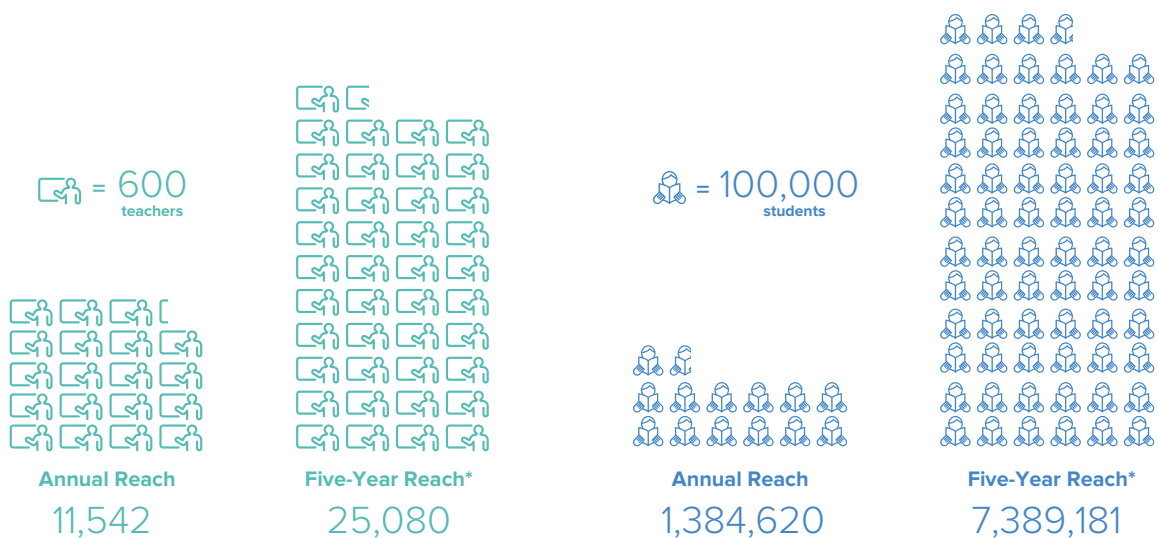
## Key Findings on Industry Support for U.S. STEM Education

The United States’ innovative biopharmaceutical industry has placed a major emphasis on enhancing the nation’s STEM education and talent pipeline to inspire and develop the next generation of scientists, engineers, and technology professionals. PhRMA member companies have dedicated significant resources and are reaching an impressive, nationwide scale in these pursuits.

Key findings from the industry survey include the following accomplishments and impacts over the last five years:

- Biopharmaceutical companies have initiated and supported U.S. STEM education programs that have included 7.4 million students and 25,000 teachers (Figure 13).
- While the majority of the initiatives are designed to engage K-12

**FIGURE 13: THE REACH OF INDUSTRY-SUPPORTED U.S. STEM EDUCATION PROGRAMS – STUDENT AND TEACHER PARTICIPANTS IN 2019 AND 5-YEAR CUMULATIVE**



*\*Note: 5-year totals do not include the significant reach and impacts of the STEM education programs supported by Monsanto prior to its acquisition by Bayer.*

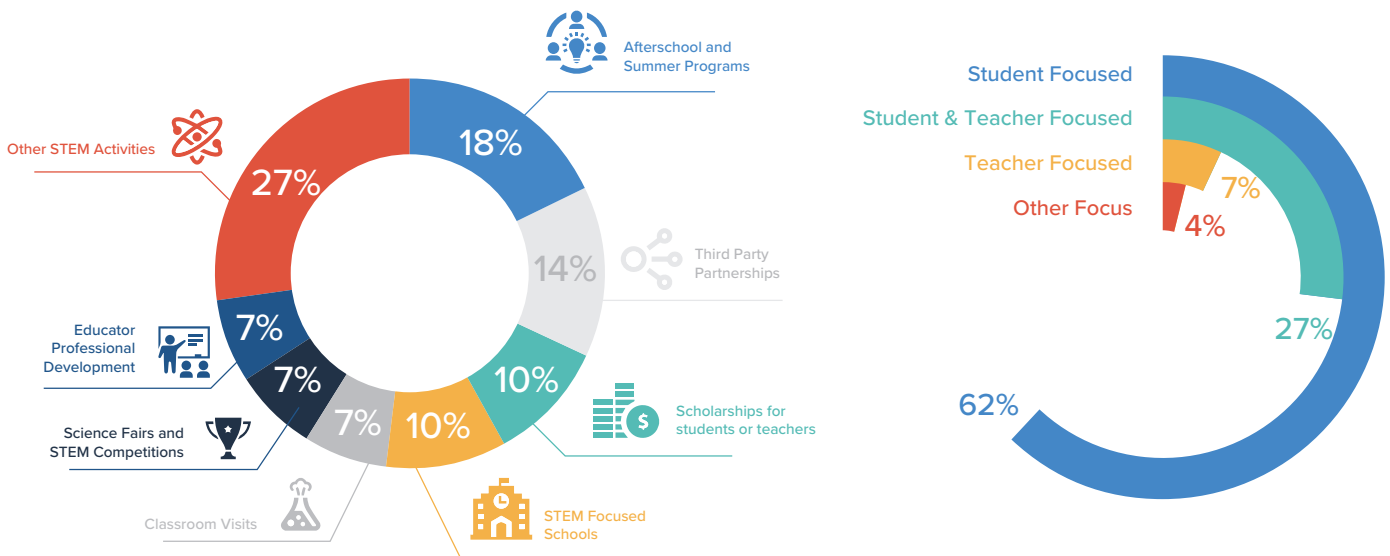
students (73%), programs are targeted toward all education levels, including partnerships with U.S. colleges and universities.

- The industry is proactive in its support for advancing diversity and inclusion in STEM. Just over half (37 programs or 52%) of the reported STEM education programs are intentionally designed to engage population groups that continue to be underrepresented in STEM fields.
- STEM programming is supported at all geographic levels across the U.S. with 10 national programs identified as well as local and state-specific programming spanning 29 states, DC, and Puerto Rico.
- Industry-supported programming takes many forms and is addressing the major aspects of the nation’s STEM workforce gaps, including: developing fundamental,

industry-relevant skills; addressing biases in which students should pursue STEM fields; promoting postsecondary high-demand STEM credentials; narrowing gaps in the geography of STEM talent; and advancing diversity and inclusion in STEM.

- Industry financial support for STEM education programs totaled \$204 million over the last five years.
- Half of all STEM education programs involve some form of in-kind support from industry, which includes employee volunteering, and/or the use or donation of company facilities, labs, or other equipment. Over the last five years, nearly 21,000 biopharmaceutical industry employees volunteered more than 123,000 hours to support U.S. STEM education programs.
- Companies and their foundations awarded nearly 2,500 STEM education grants during this five-year period.

FIGURE 14: TYPES OF STEM EDUCATION PROGRAMS SUPPORTED AND PARTICIPANT FOCUS





## Industry Supports a Breadth of STEM Programming for Students and Teachers

Industry support for U.S. STEM education takes many forms and addresses multiple facets of student and teacher development. While a majority of the 71 programs supported by industry are student-focused in their design (62%, see Figure 14), a sizable share of programs (27%) are designed to serve both students as well as professional development for teachers. Other activities are designed solely for teacher participation (7% of total programming) or include families and/or the broader community (4%). Figure 14 breaks down both the types and participant focus of programs implemented and supported by the biopharmaceutical industry.

The types of programs supported are impressively varied – companies and their foundations are supporting students and teachers through afterschool and summer STEM camps and research experiences; through partnerships with organizations such as museums, City Year, or Junior Achievement; through scholarships; through support for STEM schools and academies; through classroom visits; at science fairs; in teacher workshops; and other programs. This range of support occurs not only across the industry but within individual companies, where for every company that reported more than one program supported in the survey, they have multiple types of initiatives underway. For example, companies may support STEM education by visiting classrooms, while simultaneously funding scholarships and hosting after-school programs.

Specific programmatic examples are included below to illustrate the types of support industry provides. These are representative examples and are not exhaustive of all programming supported. The section that



Source: Amgen

follows provides more complete descriptions and programmatic vignettes for additional activities.

**Support for afterschool and summer education and research activities.** These activities represent the largest single share of programs supported by industry and include a breadth of efforts to connect students with STEM learning and/or training opportunities.

- The Amgen Foundation offers the Amgen Scholars Program, an undergraduate summer research program hosted at 24 institutions across the U.S., Europe, Asia, Australia, and Canada where students work on a biotech-related research project with top faculty, engage in seminars and networking.
- The Lilly Foundation provides funding for programs and operations for three

summer camps in the Indianapolis area that have STEM components.

- Teva sponsors the Out4STEM Internship Program, a one-year, summer and after-school internship program aimed at LGBTQIA high school students in Philadelphia who have an interest in STEM. In partnership with the College of Physicians of Philadelphia, the program provides mentorship, builds career awareness, and offers an accepting, STEM-oriented space.
- Astellas historically supports Stellar Girls, an after-school science program offered to more than 600 girls in the Chicago region. Activities include a 20-week after-school STEM program for girls in grades three through eight, as well as STEMgirls Summer Camps in high-needs communities.
- UCB hosts North Carolina high school teachers as part of WakeEd's SummerSTEM immersion program, an eight-day professional development program designed to enrich educators' understanding of the knowledge and skills necessary to succeed in STEM.

**Third-party partnerships for STEM programming.** Biopharmaceutical companies are collaborating with various public and/or private sector organizations on STEM-related initiatives.

- GlaxoSmithKline (GSK) partners with the Philadelphia Education Fund and the Philadelphia STEM Ecosystem to develop The Philadelphia STEM Equity Collective, an ongoing 10-year collective impact strategy with a goal of increasing access to STEM career pathways for city students from

groups who are traditionally under-represented in these fields.

- Teva supports STEM programs to encourage students to pursue careers in healthcare, including a partnership with City Year, the only national organization placing full-time, trained young adults in schools to provide individual attention to targeted students. Through City Year's school-based model, highly trained teams of corps members perform a year of full-time service tutoring students and serving as an additional resource to improve student achievement. AbbVie's support for City Year helped bring updated technology and STEAM-based afterschool programming to more than 1,000 students across a dozen schools in California's Bay Area.
- Multiple member companies, including Bayer, Amgen, BioMarin, Boehringer Ingelheim, Genentech, and Gilead, sponsor and support Biotech Partners, an independent non-profit organization which focuses on helping students underrepresented in the field of biotechnology attain personal, academic, and professional development experiences through in-classroom instruction and paid internships within the biotech and health industries.
- EMD Serono engages with STEM education providers throughout Massachusetts, offering support for organizations such as MassBioEd, Junior Achievement of Northern New England, Science Club for Girls, as well as numerous other educational initiatives.

“We take a comprehensive approach to our partnership with Perspectives because we understand that equipping these mostly disadvantaged students for STEM success requires more than donated Bunsen burners and lab facilities. Many Perspectives students face intense challenges in their daily lives – one out of 10 is coping with housing instability, and many receive free breakfast and lunch at school. Our support extends to necessities like school supplies and a transportation fund for students who cannot afford the cost of getting to school. We also support emotional health education programming, and our colleagues act as mentors and career counselors. We want these kids to succeed, and we know that with resources and opportunities, they can.”

- Sally Benjamin Young, Sr. VP, Public Affairs, Lundbeck US

#### Scholarships for students or teachers.

- The Genentech Foundation provides scholarships for postsecondary studies and early-career physicians and scientists. The Genentech Foundation Dissertation Scholars program supports five high-performing 2nd year Master of Science students at San Francisco State University with a stipend for supplies and travel support to allow them to excel in route to pursuing a doctoral degree. Genentech also provides charitable support for advanced study by clinical and research professionals early in their careers, with a recent focus on those that have been traditionally underrepresented in medicine and biomedical research.
- Lundbeck annually awards college scholarships to three high-achieving students from Perspectives/IIT Math & Science Academy, a tuition-free STEM-focused charter school on Chicago’s South Side. Applicants submit an essay on their passion for STEM and what they hope to do with a STEM education, and recipients may use the funds for any school-related expenses, including books.

#### Support for STEM-focused schools.

- Lundbeck maintains an ongoing community partnership with Perspectives/IIT Math & Science Academy, a charter school on Chicago’s South Side. Beyond donating STEM equipment and facilities, Lundbeck provides wrap-around services to students at the school, and each year a group of employees participates in their Career Day, participating in panels, sharing their career stories and offering encouragement to students interested in health and science careers.
- The Boehringer Ingelheim Cares Foundation offers activities at the Danbury STEM Academy in Western Connecticut, including a Job Shadow program where eighth graders from the STEM Academy visit the BI campus for a day and participate in hands-on team activities to cultivate an interest in STEM learning. One day each year, BI employee volunteers also teach curriculum at the Academy.
- Sunovian partners with The Advanced Math & Science Academy Charter School (AMSA) in Marlborough (MA), helping students understand potential

STEM life science career paths within the pharmaceutical industry. Through this program, a cross-functional team at Sunovion helped develop lesson plans and laboratory experiences to teach seventh graders at AMSA about neuroscience as part of their capstone project.

*“Sunovion has an ongoing commitment to STEM education and we are proud to partner with AMSA to encourage the next generation of innovators to explore potential career paths and new frontiers in life sciences...our team enjoyed coaching and collaborating with the AMSA students and seeing results of their impressive work with their classmates to ignite further interest in the field of neuroscience.”*

*- Ken Koblan, PhD, Head of Global Translational Medicine & Early Development (TMED) and Head of Discovery Sciences, Sunovion*

- Abbvie supports the Neal Math & Science Academy, North Chicago’s only middle school. A significant donation from AbbVie was pivotal in the recent re-build of the school, which resulted in a new state-of-the-art middle school that provides access to a 21st Century learning environment.

*“At AbbVie, we understand that education is essential to help young people succeed inside and outside of the classroom...By rebuilding North Chicago’s middle school, we can help ensure students have the right physical learning environment to help them gain the confidence and tools they need to succeed, recognizing that their potential is limitless and their futures are bright.”*

*- Laura Schumacher, Vice Chairman, External Affairs and Chief Legal Officer, AbbVie*

### **Classroom (or on site) visits for learning opportunities and career awareness.**

- Lilly provides “Chemistry is a Blast!” presentations at K-12 schools throughout Indiana, a one-hour program where Lilly scientists execute exciting chemistry experiments with proper safety precautions and educate students on the scientific method as they observe and then participate. Offered free of charge as a service to science education, these programs are tailored based on the ages of the children and the size of the audience.
- Boehringer Ingelheim hosts students from local high schools to participate in its “Partners in Science” program. Offered for more than 30 years, the goal of the program is to raise awareness about types of STEM careers in the pharmaceutical industry and encourage students to pursue them.
- Pfizer offers a pre-college Digital for Girls program, which educates young women at middle and high schools near their locations in Pennsylvania, Connecticut, and New Jersey. Through day-long, bi-annual events featuring interactive and educational breakout sessions, this program helps spark interest in STEM and teach potential workplace applications for technology.
- Incyte hosts students at their offices, and employees frequently volunteer at events related to STEM education.

*“I volunteer with Serviam Girls Academy to help them identify opportunities to*

*introduce underserved young girls and teens to STEM (Science Technology Engineering Math) subjects... Seeing how involved Incyte is in the community here in Delaware has inspired me to become more involved as well."*

*- Musa Nsereko, Executive Director of Biostatistical Programming, Incyte*

### **Sponsoring science fairs or STEM-related competitions.**

- Alexion is the title-sponsor of the biotechnology category at the Connecticut Science and Engineering Fair (CSEF).
- UCB hosts a booth at the Atlanta Science Festival staffed by employee volunteers to educate students about the science of medicine. As part of UCB's engagement, the company has also hosted Chief Science Officers to be guest volunteers at their booth.
- Boehringer Ingelheim supports the annual Westchester (New York) Science and Engineering Fair and other science fairs, and employees frequently serve as volunteer judges and mentors.
- Otsuka sponsors the Mercer Science and Engineering Fair, which is open to all students in grades 4-12 that attend school in Mercer County (NJ).
- Gilead supports the WorldWideWomen Girls' Festival in San Francisco. More than 30 volunteers from Women in Science, an employee resource group, and others from the Gilead STEM community volunteered at the festival to lead an educational activity using cotton candy to teach about chemical reactions.

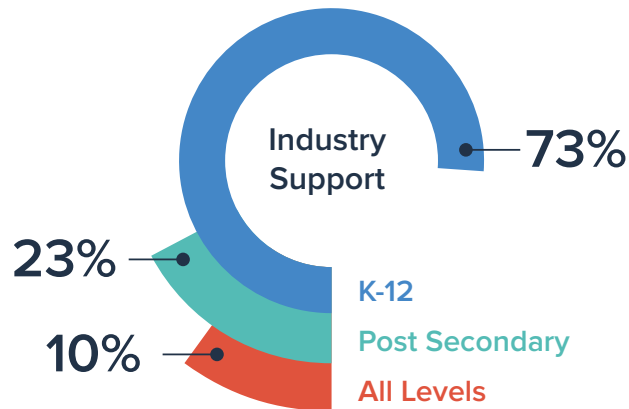
"STEM is about cultivating curiosity for our children...It's also about developing critical thinking and problem-solving skills that are useful in your career and beyond. When you look at potential career paths in a place like Lilly, we have scientific and non-scientific opportunities for everyone with those skills."

*- Al White, Advisor, Corporate Responsibility and Community Relations, Eli Lilly and Company*

**Supporting teacher workshops and other professional development.** Staying current regarding the latest advances in science and other STEM fields is challenging for teachers. To ensure the nation's teachers are up to date on dynamic and ever-changing technology fields, companies are supporting numerous engagements with teachers.

- The Lilly Foundation provides the Lilly Experience for Teachers in STEM (LETS), a unique event conducted annually in partnership with the Indiana STEM Resource Network, a network of public and private higher education institutions, K-12 schools, governments, and businesses. This two-day program brings together Lilly employees and teachers from throughout Central Indiana to discover new ways to provide students with the best opportunities to realize potential careers in STEM.
- Biogen sponsors "Bridging the Gap," an annual conference with the goal to strengthen K-16 STEM education

FIGURE 15: INDUSTRY SUPPORT FOR THE FULL STEM EDUCATION PIPELINE



throughout North Carolina. As a title-sponsor, Biogen helps bring together educators, business leaders, government officials and others who play a role in STEM education to share ideas and resources. The conference is organized by the North Carolina Association for Biomedical Research.

The aforementioned programs, and others reported by the industry, support STEM education across all levels of the STEM talent pipeline. The majority – nearly three in four programs – are primarily targeted toward students and/or teachers in grades K through 12 (figure 15), with programs offered across all grade levels in a relatively smooth distribution across elementary, middle, and high school ages.

These focus areas and programs are directly addressing five thematic areas highlighted in a recent report by

“Looking beyond our company and even the biotech industry, we need an educated workforce to ensure that scientific innovations continue. Innovation does not happen in a vacuum. It requires creativity, content expertise, and a willingness to take risks and think outside the box. While we must support those who will drive innovation in the future, we also need to deepen scientific understanding among all citizens – as they will be the ones to ultimately support it.”

- Eduardo Cetlin, President, Amgen Foundation

STEMconnector, which sought to better diagnose and unpack the many layers of the STEM workforce talent gaps seen in the U.S. today.<sup>34</sup> These findings are presented in the following table, along with examples of how the biopharmaceutical industry is addressing these gaps.

34 STEMconnector, *State of STEM: Defining the Landscape to Determine High-Impact Pathways for the Future Workforce*, 2018.

**TABLE 1: IDENTIFIED GAPS IN THE STEM-READY WORKFORCE AND EXAMPLES OF INDUSTRY-SUPPORTED STEM PROGRAMMING ADDRESSING EACH**

Identified STEM Gaps	Examples of Industry-Supported STEM Programming Addressing Gap
<p><b>Skills:</b> not enough students or young people are developing the fundamental skills needed to succeed in STEM careers.</p>	<p>Deep summer learning and research experiences, hands-on lab experiences, science fairs, and industry-grade equipment donations all contributing toward scientific “hard” skills required in STEM careers.</p>
<p><b>Biases or “Belief” Gap:</b> students and the adults around them, including school counselors and teachers, hold incorrect biases about the aptitude or traits young people must have to belong and thrive in STEM fields. Low-achieving students often overlooked.</p>	<p>Biopharmaceutical companies are engaging students at all achievement levels, especially in formative K-12 years of schooling. Hands-on engagements in science fairs, classroom and industry site visits designed to demonstrate students from all backgrounds have a potential future in the industry or in broader STEM fields.</p>
<p><b>Postsecondary Education:</b> the knowledge economy requires credentials beyond a high school diploma, but not enough young people are earning those credentials, nor are they earning credentials that are relevant to industry needs.</p>	<p>Industry is sponsoring numerous scholarships for post-secondary degree programs in industry-relevant academic fields.</p>
<p><b>Geographic Gap:</b> access to jobs in high-growth and well-paid fields often depends on geography. Hubs of economic growth may be far from large concentrations of qualified job seekers, or they may be far from population centers.</p>	<p>The industry supports a breadth of national programs offered regardless of state or locality, in addition to programs offered across 29 states, DC and Puerto Rico. These programs provide valuable resources to families and schools in urban, suburban, and rural areas alike.</p>
<p><b>Demographics:</b> there is a well-documented, disproportionate lack of participation in STEM education and careers among people of color and women, despite a significant focus on diversity and inclusion.</p>	<p>37 industry-supported programs, or just over half of those reported in the survey, are designed to intentionally inspire and engage underrepresented population groups.</p>

## Industry-Supported Programs Advance Diversity of STEM Fields

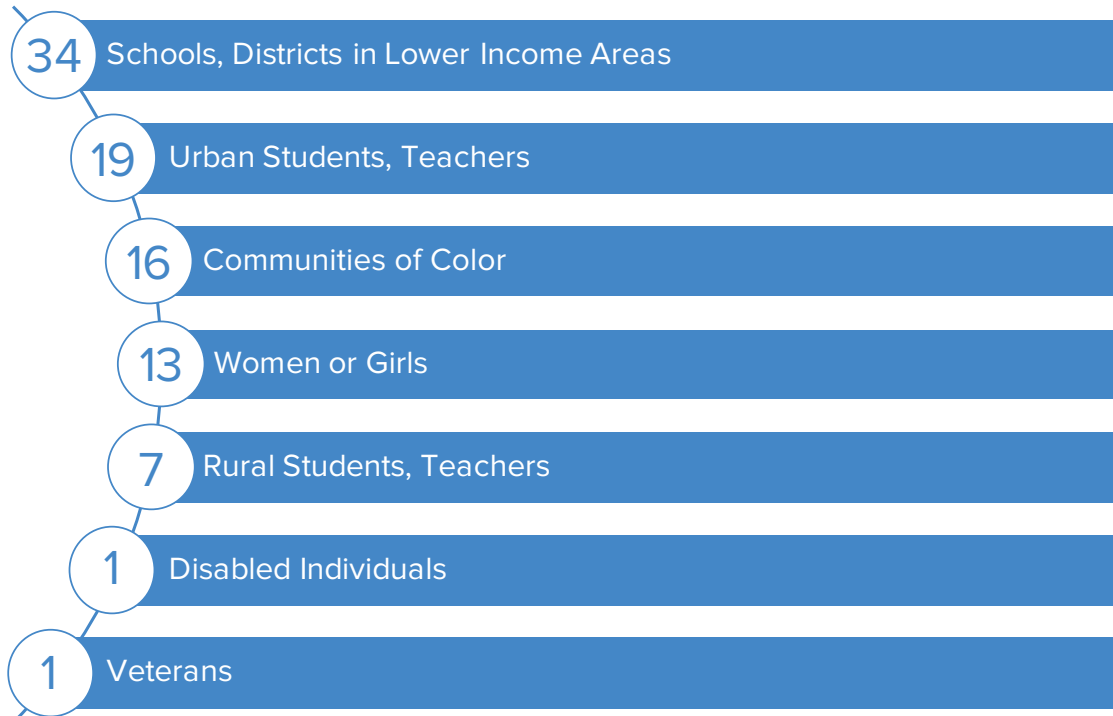
**The biopharmaceutical industry is proactive in its support for advancing diversity and inclusion in STEM.** While there are many definitions and concepts around diversity and inclusion, for context, provided here are some general meanings. Any individual company or organization may have varying definitions, but they are most often in line with those provided below.

- **Diversity** is often referred to as the quality or state of race/ethnicity, gender and identity, age, physical ability, and sexual orientation represented within a defined group.
- **Inclusion** generally refers to the practices that involve and empower

individuals to participate, be recognized, and realize their potential.

- Diversity in the workplace often refers to cultivating talent and promoting the full inclusion of excellence across the social spectrum. This includes people from backgrounds that are traditionally underrepresented in areas such as the scientific and STEM workforce, as well as those from backgrounds that are traditionally well represented. Diversity refers to difference. Workforce diversity refers to cultivating talent and promoting the full inclusion of excellence across the social spectrum.

FIGURE 16: PROGRAMS TARGETING POPULATION GROUPS TYPICALLY UNDERREPRESENTED IN THE STEM WORKFORCE







Source: Biogen

In the survey, companies were asked whether their STEM education programs are intentionally designed to engage population groups that have traditionally been, and continue to be, underrepresented in the nation's educational programs and workforce. **Just over half (37 programs or 52%) of the reported STEM education programs supported by industry are intentionally designed to engage one or more of these population groups.** These groups are listed in Figure 16, along with the number of programs that are designed to engage that particular group. Many of these programs are aimed at participants from multiple population groups (e.g. women or girls in lower income, urban school districts).

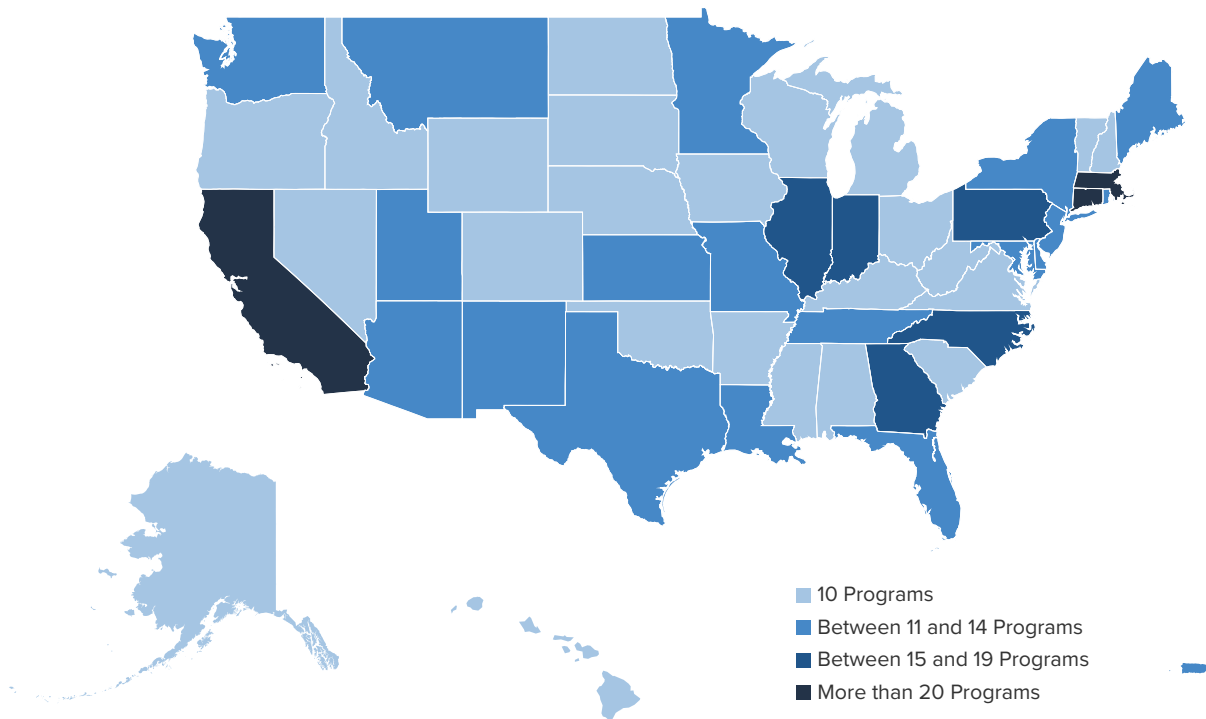
Many of the programs advancing diversity in STEM, described in detail in several of the vignettes within this report, are achieving impressive scale. Programs targeting underrepresented population groups account for a majority of the student participants across all industry-supported STEM education programs – nearly 6.5 million students across the U.S.

## The Nationwide Reach of Industry's STEM Education Support

Biopharmaceutical companies are supporting STEM education at all geographic levels across the U.S. with programs and initiatives designed to operate at varied scales from local and state levels, to regional and national focus. Ten programs operate on a national scale and form a foundation for students, teachers, professionals, parents, and others in all parts of the country to engage (Figure 17). Programs at the state and local levels have a geographic footprint spanning 29 states, as well as Washington, D.C., and Puerto Rico. In general, larger concentrations of company support reflect the industry's deeper presence in those states.

The industry is actively investing in local educational initiatives in the communities in which companies operate. Biopharmaceutical companies report 44 programs that support STEM education at the local level (neighborhood, city, county, or metro region).

FIGURE 17: GEOGRAPHIC COVERAGE OF U.S. INDUSTRY-SUPPORTED STEM EDUCATION PROGRAMS







## Financial and In-Kind Support for STEM Education Programs

Support for STEM education programs takes several forms, with companies and foundations providing financial, in-kind, volunteering, and donations of equipment and/or facilities.

- Financial support for educational programs reached nearly \$30 million annually in 2019 (Table 2).<sup>35</sup> During the last five years, this support totaled \$204 million.**
- Half of all STEM education programs involve some form of in-kind support from industry, which may include employee volunteering, and/or the use or donation of company facilities, labs, or other equipment. Over the last five years, nearly 21,000 bio-pharmaceutical industry employees volunteered over 123,000 hours to support U.S. STEM education programs.**

<sup>35</sup> Companies and foundations were asked to report on support based on the most recent calendar year for which data/information was available. Note that given the timing of the survey period beginning late in calendar year 2019, some companies reported data for 2018 and others for 2019.

TABLE 2: FINANCIAL AND IN-KIND SUPPORT BY INDUSTRY  
FOR U.S. STEM EDUCATION PROGRAMS

Support Type	Annual Support (2019)	Cumulative Support (Last 5 Years)
 <b>Financial</b>	\$29.8M	\$204.4M
 <b>Employee Volunteers (number)</b>	2,271	20,852
 <b>Employee Volunteers (hours)</b>	16,963	123,105
 <b>Other Support: Lab Equipment Donations, Use of Company Facilities</b>		

## Biopharmaceutical Industry Support for STEM Education: Examples of Programs and Initiatives

As the previous section highlights, activities to advance STEM education supported by the biopharmaceutical industry span a wide range of geographic regions, subject areas, and points of emphasis.

While the preceding examples offer some insight into the activities of PhRMA member companies, the vignettes featured in this section provide additional details including background, impacts, and testimonials.

First, this section explores three thematic areas where multiple companies are providing support for STEM education: summer programs, partnerships with museums, and collaboration with colleges and universities. Second, this section highlights two notable programs – STEM Scholars and Students2Science – where companies from across the biopharmaceutical industry and other sectors are working together to encourage success in STEM fields. Lastly, this section explores more than 10 other examples of company- and foundation-led initiatives that support STEM education. Many of these examples focus on encouraging access to quality STEM programming for populations currently underrepresented in STEM fields, including women, communities of color, and low-income populations.

### **STEM in the Summer: Encouraging Year-Round Youth Development and Advancing Diversity, Inclusion in STEM**

In what is oftentimes referred to as the “summer setback” or the “summer slide,” student learning can sputter during warmer months when school is out of session. For example, research cited by the Brookings Institution finds that, on average, students’ achievement scores declined over summer vacation by one month’s worth of school-year learning.<sup>36</sup> They also find that declines were sharper for math than for reading, and that the extent of loss was larger at higher grade levels. These setbacks can be more pronounced in lower-income students and those from historically disadvantaged groups, as explained by the “faucet theory:”

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<sup>36</sup> Brookings Institution, “Summer learning loss: What is it, and what can we do about it?” 2017.

*“According to the theory, the ‘resource faucet’ is on for all students during the school year, enabling all students to make learning gains. Over the summer, however, the flow of resources slows for students from disadvantaged backgrounds but not for students from advantaged backgrounds. Higher-income students tend to continue to have access to financial and human capital resources (such as parental education) over the summer, thereby facilitating learning.”<sup>37</sup>*

PhRMA members understand these challenges and offer targeted support to students during the summer months. While some companies or foundations operate their programs and activities on their own, they are often in partnership with local school systems or anchor institutions such as museums or universities.

- **The AbbVie Foundation** has supported the National Inventors Hall of Fame Camp Invention Program since 2015, with a focus on STEM curriculum for K-6 graders. This support helps provide nearly 200 children near AbbVie’s office locations in North Chicago, Worcester (MA), San Jose (CA), and in Puerto Rico with the opportunity to attend this STEM-based summer camp. While many in-person summer camps have been cancelled in response to COVID-19, National Inventors Hall of Fame launched Camp Invention Connect, a hybrid program that offers imaginative, hands-on learning at home.
- **The Amgen Foundation** supports the Biomedical Engineering Internship at the Stanford Institutes of Medicine Summer Research Program (SIMR), an eight-week program that helps high school students from diverse backgrounds develop interest in biological sciences and medicine and understand how scientific research is performed. This internship exposes high school students to the intersection of design thinking and engineering skills to create solutions for medical problems. Students work in teams



Source: Biogen

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<sup>37</sup> Ibid.

“STEM programs, like the Biotech Immersion Program, SummerSTEM, and local science festivals, are key aspects of developing future generations of scientists and innovators through knowledge sharing and resources for both students and educators. UCB is proud to support continuing STEM education in the communities where we live and work.”

- Patty Fritz, Vice President, Head of U.S. Corporate Affairs at UCB

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to identify real-world clinical needs, use patient-centered design to create prototypes, and learn engineering design processes while being exposed to innovative bioengineering research.

- **The Biogen Community Lab** is the nation’s longest-running hands-on corporate science lab, and rigorous summer programs have been essential to this success. At its labs in Cambridge (MA) and Research Triangle Park (NC), high school students that have completed 9th grade participate in week-long sessions. Through this program, students get an inside view of the industry by learning about the drug development process, exploring laboratory techniques, and engaging with Biogen employees from a wide range of departments. Although all students are eligible to apply, preference is given to those students living in urban neighborhoods, coming from low-income households, or part of groups that are historically underrepresented in STEM careers. The Biogen Community Labs, which also offer programs throughout the year, have served more than 54,000 students to date. Launched in Summer 2020, the Biogen-MIT Biotech in Action: Virtual Summer Lab is offering five free week-long virtual lab programs for 400 high school students. These students, many of whom are from low-income households and groups historically underrepresented in science, are gaining first-hand experience in biotechnology, and are learning directly and receiving mentorship from leading scientists at Biogen and MIT. The virtual program is an example of an initiative adapting to different venues to increase access to students in a variety of settings.
- **Boehringer Ingelheim (BI) supports the Broadening Access to Science Education (BASE) Camp at Fairfield University**, a two-week program designed to engage 24 high school, female students from underrepresented groups in STEM in hands-on, research-based experiences related to natural sciences and mathematics. As part of this program, the group visits the BI campus for an employee-led program that includes a tour of laboratories and R&D facilities, exposure to many different career paths, and personal interaction with female scientists at BI.

The camp is free of charge to accepted students, and all meals and lodging on campus are included. To date, 94% of participants have applied, or plan to apply, to college; 84% indicated that they will pursue (or have pursued) a STEM or health-related academic field of study in college; and 87% indicated an interest in pursuing a STEM or

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health-related career after college.<sup>38</sup> Finally, 100% of survey respondents said that BASE camp helped to encourage them to pursue a career in one of these fields.

*“BASE Camp really taught me to push my limits as a learner,” according to one recent participant. “I met new people, got along with my team, and managed to learn more than I ever thought I could. I’ve always loved science, and BASE Camp just contributed to my growth as a student. My counselors and professors all showed me what it’s like to be professional, all while preparing me for what college will be like. Thank you for enhancing my experience, it was one of the best two weeks of my summer.”*

- Through its corporate foundation, **Lilly supports three summer camp programs** that encourage students to explore STEM fields. More than 1,300 students participate in these camps, which Lilly supports through funding for operational and programmatic work. Many of these participants are students of color living in Indianapolis’ urban neighborhoods.
- **Pfizer’s Digital Scholars program** offers an eight-week summer internship for recent high school graduates at its facilities in Groton (CT) and Collegeville (PA). Participating students must be entering college with a technology-focused major (with emphases on computer sciences) and be nominated by a local STEM teacher.
- **UCB supports summer programs for STEM teachers in both Georgia and North Carolina.** Like their students, teachers can also benefit from additional educational programming during summer months. As the lead-sponsor of the Georgia BioEd Institute Summer Biotech Immersion program, UCB helps teachers learn the skills and confidence needed to provide meaningful biotech laboratory experiences for students. Using the context of Georgia’s bioscience industry, teachers practice everything from preparing solutions and using sterile technique, to extracting DNA, and more. UCB supports the SummerSTEM program, a professional development program for teachers in Wake County (NC). Over an eight-day period each summer, teachers are exposed to industry practices and college-level applied STEM instruction. In 2020, UCB supported their STEAM-Powered Communities education initiative.

“At a time of skyrocketing demand for STEM skills in our nation’s workforce, GSK Science in the Summer continues to bridge a gap in access to science education where it is widest.”

- Becki Lynch, Director U.S. Community Partnerships, GSK

<sup>38</sup> Phelan, Harding, and Harper-Leatherman, “BASE (Broadening Access to Science Education): A Research and Mentoring Focused Summer STEM Camp Serving Underrepresented High School Girls,” 2017.

## Curating Experiences: Leveraging Museums to Encourage STEM Education

Each year, millions of Americans of all ages and backgrounds engage with STEM by visiting museums, science centers, public gardens, zoos, and aquariums. Financial and programmatic support from the biopharmaceutical industry plays an important role in pioneering innovative extracurricular STEM programs, as well as working to scale successful educational activities.

- **Boehringer Ingelheim** provides financial support through its foundation to the **Connecticut Science Center in Hartford**. Specifically, the BI Cares Foundation supports an interactive Genomics program at the museum. Through informal interactive sessions, BI employee volunteers also donate their time and skills to talk with students at the center about their work and career path.
- **The GSK Science in the Summer program** targets students early in their STEM learning, providing students grades two through six with active, hands-on educational opportunities, preparing them with the basic STEM skills that can lead to academic and professional success. By targeting younger students, particularly those from underserved populations across the country not widely represented in the scientific community, GSK is able to reach populations who would not otherwise have access to these high-quality STEM experiences – especially during summer breaks, when school is out of session. More than 250,000 students have participated in the program since it began in 1986. In partnership with The Franklin Institute in Philadelphia and the University of North Carolina Morehead Planetarium and Science Center, the GSK Science in the Summer program is offered in 27 locations across the country.



*Source: GSK Science in the Summer*



- **Takeda** partners with the Museum of Science and Industry (MSI) in Chicago to inspire the next generation of inventors and innovators with programs that empower teachers, engage the community, and excite students. Takeda supports **MSI's Science Minors Clubs**, the most extensive after-school science resource in Chicago. This program engages over 12,000 children aged 8-13 at more than 130 clubs across the greater Chicago area each year. Takeda also supports the Institute for Quality Science Teaching (IQST), which helps elementary teachers from under resourced schools learn new science curricula to take back to their classrooms.
- **Teva provides backing for the Supporting and Enriching Natural Science Education in Schools (SENSES) program**, which provides free or reduced-cost museum visits, lessons, and outreach programs for Title I schools from throughout the Philadelphia region. The Academy education programs address key aspects of science, technology, engineering, and math (STEM) education and are designed to meet or exceed local, state and national curriculum standards. SENSES is especially effective with students who do not thrive in a traditional classroom setting.
- **UCB supports STEM-specific museum programs at Fernbank**, Atlanta's local science and natural history museum. UCB served as the science sponsor of the "Secret World Inside You" special exhibit in 2018, providing the public with an approachable, in-depth, hands-on look at the human biome. In 2019, UCB supported Fernbank's monthly Family Discovery Day Series of special activities for families at the museum.

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## Partnering with Colleges and Universities to Broaden Access to STEM Careers

For high school graduates with an elevated interest in STEM, a variety of new challenges await once they reach the university level: larger workload, difficult classes, and increased expectations, to name a few. Many of these challenges can be especially daunting for students coming from low-income backgrounds or other populations that are underrepresented in STEM classes and careers. Ensuring that these college students have the resources available to leverage their interest and aptitude in STEM into a fulfilling career is essential to building a more inclusive STEM pipeline.

Helping students reach their full potential is a priority of PhRMA members. While internships are one way to expose students to career opportunities, other services are needed to broaden participation in STEM fields. By targeting students at colleges and universities, companies in the biopharmaceutical industry help retain interest in STEM, build relationships with future workers, and ensure a more representative STEM workforce.

- **The Amgen Scholars Program** aims to open the door to cutting-edge research opportunities for undergraduate students. Made possible through a 16-year, \$74 million global commitment from the Amgen 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 institutions (participating U.S.

research universities include Yale, CalTech, Duke, Johns Hopkins, Stanford, UCLA, and Harvard). Over 4,200 students from more than 760 college and universities have participated to date, benefitting from this research and mentorship, seminars and networking events, and interaction with meet their peers and leading scientists. Of the alumni who have maintained contact, more than 95% of Scholars who have graduated from colleges are now pursuing an advanced degree or career in a scientific field.

- Undergraduate students from across Puerto Rico are eligible to participate in **The Amgen Biotechnology Training and Learning Enhancement for Students (Amgen BioTalents) program**. The program features three tracks (biomanufacturing, industrial environment, and management leadership), and utilizes a strong hands-on and interdisciplinary approach, with modules covering genetic engineering and bioreactor monitoring, regulation, and quality control, as well as strategic planning and life science career paths. By providing comprehensive, in-depth training in biomanufacturing, the program helps strengthen undergraduate education and prepare students to become part of the highly educated workforce needed for a knowledge-based economy.
- **Bayer's Alka-Rocket Challenge** showcases the chemistry, physics, and engineering skills of college students, who compete for a chance to receive up to \$30,000 and earn a spot as a Guinness World Record Holder. An internationally recognized panel of judges review student submissions and choose four teams as finalists based on the design, execution and creativity of their effervescent fueled rockets. The competition, which is open to teams of students attending U.S.-based four-year accredited universities, is held annually at The Kennedy Space Center Visitor Complex in Florida.
- **BI employees engage in STEM education through Business Resource Groups**, such as the network of pharmacists called "Pharmacists Across BI" or "PhAB." In partnership with University of Connecticut's School of Pharmacy and other pharmacy schools, PhAB members participate in programs to show students the range of career opportunities in the biopharmaceutical industry.
- **The Genentech Foundation's** grantmaking helps develop an inclusive STEM pipeline through support of higher education. **The Summer Research Scholars program** is designed to allow students of color to participate in summer research programs at major research universities across the country. Funding allows universities to cover costs such as summer tuition, food, housing, travel expenses, and stipends. Selected students do not attend these institutions during the year and without the program's support would be unable to participate in these research opportunities that are critical to continuation in advanced STEM degrees. The Genentech Foundation also supports biotech internship programs at two Bay Area Community Colleges, which aim to promote the educational and career advancement of students who may lack four-year college degrees.

- High-performing MS students at San Francisco State University are eligible for **The Genentech Foundation Dissertation Scholars program**, which provides five individuals with stipends for supplies and travel that allows them to excel in route to entering a quality PhD degree program. SFSU has a long-standing commitment to develop and prepare under-represented students for PhD level careers in the Biomedical Sciences. They support a range of MS applicants who have demonstrated promise for research careers, including students who, due to difficult circumstances, did not necessarily graduate with high undergraduate GPAs. With the support of the Genentech Foundation Dissertation Scholars program, many of these students excel in the university's MS programs and go on to complete PhDs.
- **Sanofi** supports dozens of programs aimed to further the knowledge and experience of students from the undergraduate through the post-doctoral levels. Sanofi supports the **Student Success Center (SSC) at UMass Boston**, a program that supports undergraduate students in the College of Science and Mathematics (CSM) through professional academic advising, access to academic and career development resources and programming, and connections to opportunities for learning and development beyond the classroom. These activities seek to increase the number and diversity of graduates, shaping the STEM workforce of the future and building the next generation of university, innovation, and research leaders. Sanofi's support helped with operations and expansions for existing programs, as well as to develop new innovative approaches to improving retention and graduation rates and student research experiences.
- For individuals with a Doctor of Pharmacy, **Sanofi offers two long-time fellowship programs** that are designed for post-PharmD individuals to further their experience in the pharmaceutical industry through work experience and clinical research. Sanofi US and Sanofi Genzyme have partnered with Rutgers University and the Massachusetts College of Pharmacy & Health Sciences to offer one and two-year fellowships in several areas such as Global Medical Information, Global Health Economics and Outcomes Research, Global Regulatory Affairs, Global Medical Affairs, Strategic Marketing, US Trade & Market Access, Patient Advocacy & Public Affairs, Vaccine Epidemiology & Modeling, Global Pharmacovigilance, and US Consumer Healthcare Research & Development. In 2019, 53 fellows were a part of these two programs at an investment of nearly \$4.5 million.
- **UCB provides support for multiple programs that offer undergraduate and graduate scholarships and fellowship funds in STEM fields** in Georgia, North Carolina, and Boston. Since 2017, UCB has supported numerous programs including the Georgia Tech Petit Scholars Undergraduate Research Program, the Mercer University School of Pharmacy, the UNC School of Pharmacy, and the Department of Epidemiology at the Harvard T.H. Chan School of Public Health, among others.

## STEM Scholars: Offering Underserved Students Mentorship, Attention, and Support

Far too many students with a curiosity in STEM struggle to convert this interest into college matriculation or relevant careers. This disparity can be especially stark for incoming high school students in under resourced school systems. During high school, these students face challenges to their development from both inside and outside of the classroom.

To help address these concerns, several PhRMA members – including **AstraZeneca, GSK, and Teva** – have previously or are currently supporting the **STEM Scholar program**, which works to enhance STEM subject knowledge and problem-solving skills. STEM Scholars targets underserved students who show interest and promise in STEM subjects in middle school and works to further develop their skills over the next four years, when skills can stagnate or decline drastically.

As part of this program, students work intensively with instructors and with each other to supplement their high school educations with science and technology programming. Based at the Franklin Institute in Philadelphia, these programs and activities help students to discover what careers they want to pursue, and how their work will help change the world. For example, an ongoing STEM Scholars project is exploring how to create a vaccine. Examining real-world problems and talking with actual scientists is an important part of this program that provides unique opportunities for its participants, the majority of whom come from underserved communities.

Retention is extremely important to the program: all new STEM Scholars sign a contract signifying their commitment to the program for four years, and content builds upon each previous year and evolves as students' progress through the program. STEM scholars meet weekly during the academic year and four days per week during the five-week summer session. Over the course of the program students receive resources such as STEM career immersion experiences, college preparation, including SAT/ACT tutoring, career and technical education, entrepreneurial education and experiences, and paid research experiences.

*“Being in STEM Scholars has given me the opportunity to learn about things of my interest that I cannot learn in a classroom,” said a recent graduate of the program. “It has also boosted my confidence in getting into colleges that I know I will prosper at as well as made me more aware of professionalism and responsibilities. These things are very important and has aided in making me aware of my actions because now I see how small things can weigh into how you carry yourself and how you set your goals.”*

## Students 2 Science: A Collective Approach to Building Tomorrow's STEM Leaders

Each year, students and teachers in New Jersey and across the nation have an opportunity to develop practical STEM skills through the **Students 2 Science (S2S)** program, whose mission is to inspire, motivate and educate elementary, middle and high school students to pursue careers in STEM subjects. A wide range of PhRMA member companies and their corporate foundations support this unique initiative, including **Bayer, Bristol Myers Squibb, Daiichi Sankyo, Johnson & Johnson, Merck, Novartis, Pfizer, and Sanofi.**

Through the ISAAC (Improving Student Affinity and Aptitude for Careers in STEM) program, middle and high school students have the opportunity to participate in multiple visits to the Students 2 Science Technology Center located in East Hanover (NJ). Here, middle school students receive nearly 20 hours of skills development covering a wide range of topics from STEM fields including chemistry, biotechnology, physics, and engineering. Meanwhile, high school students engage in highly technical one-day experiences focusing on topics such as pharmaceuticals, biotechnology and environmental science that present them with real-world problems and encourage them to find solutions. Through these laboratory experiences, students also interact with professional scientists who educate them on the value of a STEM career. In recent years, S2S has expanded these activities to include a Virtual Laboratory (V-Lab) program that allows students, teachers, and volunteers from all over the country to participate.

S2S also offers Teacher Professional Development training that helps educators build their capacity to teach lab sciences. Teachers are provided with instructional resources and opportunities to observe and/or serve as Assistant Instructors in the ISAAC program. This experience counts toward educator professional development requirements and is aligned with Next Generation Science Standards.

Beyond these thematic examples and noteworthy industry partnerships, many companies in the biopharmaceutical industry support other initiatives and activities to enhance participation and proficiency in STEM fields. These examples, listed alphabetically by company name, cover a wide range of topics, including support for rural STEM education, educator professional development, and strategic partnerships within local communities.

## AbbVie: Engaging Employees in STEM Education

With an overall focus on empowering employees to help address gaps in access to education in their communities, AbbVie and The AbbVie Foundation support a variety of programs to encourage participation in STEM learning.

Through the AbbVie Foundation's SEEK (Science, Engineering, Exploration, Knowledge) program, AbbVie employees around the globe volunteer their time and knowledge to students ages 5-14 years, with an emphasis on Title 1 schools with large concentrations of low-income students. The SEEK program provides opportunities for students to conduct investigations, gather data, design solutions and practice literacy skills, all with the aim of promoting a lifelong appreciation of scientific pursuits.

Since launching the program at a handful of U.S. and Ireland sites in 2014, SEEK has grown to a global program spanning over 73 sites across 21 international locations. To date, the program has reached over 8,900 students and over 1,800 AbbVie volunteers have contributed over 5,000 hours to this effort. Notably, PR News named this program the top-ranked "global employee volunteer program" in their 2019 CSR Awards.

STEM education is also an important part of AbbVie's annual volunteering event, The Week of Possibilities. As part of this event, AbbVie has renovated 55 STEM learning spaces in 54 schools and community centers across the United States since 2012. These schools are in 23 cities (representing 13 states, Puerto Rico, and the District of Columbia). The annual event brings in local employees to renovate these spaces, typically in a single day.

Many of AbbVie's Chicago-based employees also participate in the ISTI STEM Challenge. Launched in 2015, this program is an opportunity for AbbVie employees to mentor students from North Chicago Community High School's career pathways program. More than 100 high schoolers partner with dozens of AbbVie employees to solve "real world" STEM issues, such as health literacy. The program ends with a competitive poster session where students defend their work to AbbVie employees, while the top teams present their final projects to AbbVie and community leadership.

## Amgen: Changing the Way Students Learn About STEM

The Amgen Foundation places a strong emphasis on strengthening science education and is committed to investing in meaningful, evidence-based initiatives that make a difference at the local, national, and international levels. To that end, the Amgen Foundation has contributed more than \$175 million to advancing science education programming globally.

### LabXchange

In 2020, the Amgen Foundation and the Harvard University Faculty of Arts & Sciences launched LabXchange, a purpose-built online platform dedicated to driving more inclusion in the scientific process. 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, which is working in a laboratory. LabXchange is a free online science education platform that provides users with access to personalized instruction, virtual lab experiences and networking opportunities across the global scientific community. Integrating the best of both digital instruction and virtual lab experiences, LabXchange brings together high-quality content from a variety of sources in the form of online learning assets, including videos, assessments, and simulations. As the founding sponsor, the Amgen Foundation has awarded \$11.5 million in grant funding to Harvard University to develop, launch and grow the LabXchange platform for students and educators globally, with contributions from a variety of other world-class education organizations.

“Too many high school and college students lack the opportunity to directly explore the scientific process – where you build a hypothesis, understand a method, and determine how to apply it to an appropriate experimental problem,” said Robert Lue, Ph.D., principal investigator of LabXchange and professor of the Practice of Molecular and Cellular Biology at Harvard. “For many students, science can feel like a collection of facts to memorize – which is contrary to what the scientific process is – it’s a journey that requires bold thinking and deep imagination. With LabXchange, more students can come together and experience the joy of discovery.”

On LabXchange, students, educators, and researchers may create profiles, share their learning pathways, discuss their hands-on research experiences, and mentor one another. With the ability to share custom-designed learning pathways with others, the platform also fosters communities of instructional practice. Based on principles of openness and accessibility, LabXchange takes the next step in the evolution of the open, broadly available, online learning concept, in an environment that fosters social connectivity and community building.

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“At a time of remarkable scientific progress, we’re excited by the potential of LabXchange to educate and inspire both students and lifelong learners of all ages.”

- Robert A. Bradway, Chairman and CEO, Amgen

LabXchange also has strong partnerships with Khan Academy and the Amgen Biotech Experience, two other programs receiving Amgen Foundation support.

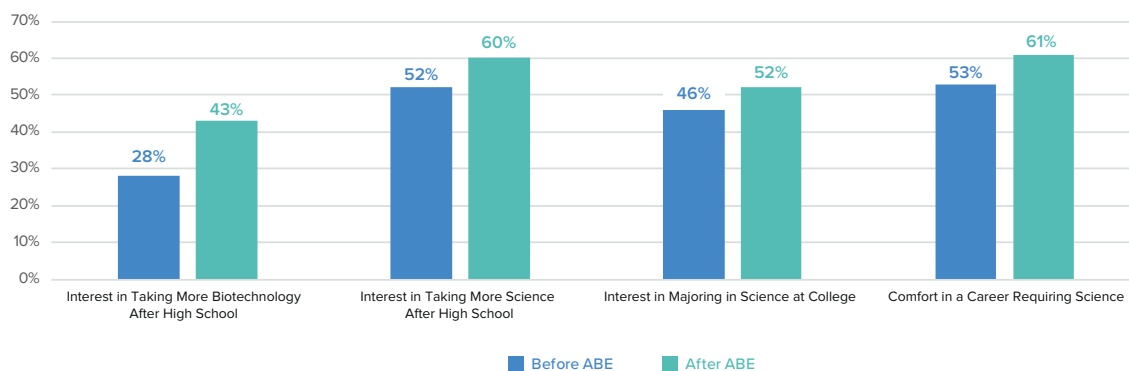
### Amgen Biotech Experience

Making sure that teachers have innovative materials to bring into their classroom is an important way to energize students in science education. Through the Amgen Biotech Experience (ABE), teachers and schools receive professional development, innovative materials, and research-grade lab equipment. Working with universities and local partners, more than 90,000 students and 1,500 science teachers explore the methods scientists use to create biotechnology medicines through Amgen Biotech Experience labs each year. To date, the Amgen Foundation has committed more than \$25 million to provide hands-on molecular biology curricula to over 800,000 students. The program is currently available in 10 sites throughout the United States, and on four continents across the globe. The labs are also now available virtually on LabXchange.

ABE's unique curriculum allows students to learn about the core technologies used by scientists in the discovery of human therapeutics, so that they will better understand the role of genetics, molecular biology, and biotechnology, and the potential impacts of these fields on the future. Curriculum is easily adaptable to a variety of schools, course subjects, learning-levels, classrooms, and teacher contexts. Nearly half (45%) of U.S. students in ABE schools were eligible for free or reduced lunch, almost two-thirds of U.S. students (63%) in ABE schools were non-White, according to an independent evaluation of the program.

Students exposed to the program report significant and substantial increased interest and confidence in science and biotechnology. Prior to participating in the program, just 28% of students agreed they were interested in taking more biotechnology after high school, compared to 43% of students surveyed afterwards. Similarly, results show an 8% gain in students' interest in taking more science after high school (52% before and 60% after), a 6% gain in interest in majoring in science at college (46% before and 52% after), and an 8% gain in career confidence (53% said they would be comfortable with a job or career that requires using science before ABE, compared to 61% of students after).

**FIGURE 18: IMPACTS OF AMGEN BIOTECH EXPERIENCE ON STUDENT INTEREST IN STEM**



Source: 2018 Amgen Biotech Experience Evaluation Report





*Source: Amgen*

### **Khan Academy**

Bringing science education to new audiences is also an important part of Amgen Foundation's role as Khan Academy's Science Content Partner. Amgen Foundation funding has supported the development of Khan Academy's biology resources, which range from ninth-grade biology content through to Advanced Placement Biology courses. These offerings include more than 380 videos, 150 exercise sets and 250 articles to support mastery-based learning at the pace of each individual student. Khan Academy has launched a formal partnership with LabXchange, collaborating as one of the many world-class education organizations contributing content and resources, and incorporating simulations from LabXchange into relevant Khan Academy lessons. This partnership strengthens science learning across the globe by bringing virtual lessons and lab experiences to learners across the two platforms.

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### **AstraZeneca: Linking Student Health with Science Education**

**AstraZeneca** is a founding partner of **Generation Health: How Science Powers Us**, an initiative that aims to make the connection between students' health and the science behind the prevention and treatment of disease. Working with Learning Undeafated and Discovery Education, this new program offers standards-aligned experiential learning resources for middle school students, helping them investigate both preventative measures and innovative solutions to key health concerns in the areas of oncology, cardiovascular, and respiratory. For example, students use augmented reality discovery stations to learn about cancer screening, while interactive courses look at topics such as the causes of lung cancer, how doctors work to identify the subtype of cancer that a patient has, and how this information can be used to inform the development of a treatment plan.

In addition to courses for students, AstraZeneca employees are encouraged to share their passion for STEM and innovative healthcare solutions. Generation Health provides training for employee volunteers, giving them the tools they need to connect with today's students and inspire the next generation.

## Bayer: Ensuring a Rural Connection to STEM

**Bayer Fund, a philanthropic arm of Bayer, sponsors the America's Farmers' Grow Rural Education program, a bottom-up approach to improving STEM education in the country's rural school districts.**

Through this program, eligible farmers nominate their local public-school districts for grants, and once nominated, school districts submit applications to compete for \$15,000 grants that fund projects that enhance their STEM curriculum. These grants – which will total \$1.9 million in 2020 – enable students in rural communities nationwide to develop stronger STEM skillsets and become better prepared for their bright futures ahead.



Source: Bayer

Each year, the program funds many different types of projects focused on STEM, and school districts are encouraged to write grant applications that will target the specific needs of the district and their goals for its students. Examples of support include, but are not limited to, creating makerspaces, updating science lab equipment, purchasing technology for math or science classrooms, and renovating greenhouses or school gardens. More than 50,000 students participate in the program annually.

In a related effort, **Bayer and 4-H have teamed up to deliver Science Matters**, a multi-faceted program to foster a love of scientific exploration in students around the country. Through a variety of hands-on learning experiences, more than 250,000 students receive the tools and support they need to deepen their understanding of how science plays a key role in their everyday lives. Bayer's generous support enables science curriculum to reach and impact diverse youth who otherwise would have limited access to STEM exploration opportunities.

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## Bayer: Improving Science Literacy and Family Connections to STEM

**Making Science Make Sense is Bayer's company-wide science, technology, engineering, and math (STEM) education initiative.** MSMS advances science literacy across the United States through hands-on, inquiry-based learning, purpose-driven volunteerism, community-focused partnerships, and a public education campaign. Through this initiative, Bayer's employees spend significant time assisting students, teachers and families with hands-on learning experiments and interactive workshops.

One notable activity to support STEM literacy is Science Studio by Bayer, a science-focused Alexa skill for children and their parents that offers step-by-step instructions for five different kid-friendly science experiments. The Science Studio by Bayer also features a

“Encouraging young people to engage in science in new and innovative ways is just one way that Bayer reinforces its commitment to STEM education.”

-Raymond F. Kerins, Jr., Senior Vice President of Corporate Affairs of Bayer.

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Homework Helper tool that can teach students about topics such as atomic bonds, cell composition, and electromagnetism, among others.

Bayer collaborates with foundations, school districts, nonprofits, and corporations to foster science literacy through additional program support, community giving, and employee volunteerism. For example, Bayer Fund is a Founding and Presenting sponsor of the STEM+ Families Initiative, National PTA's initiative to increase access to STEM education and careers, especially among under-represented youth.

Through this alliance, 30 local PTAs from 26 states received grants in 2019 to host a STEM + Families Science Festival. These festivals are especially helpful at bringing STEM education opportunities to diverse and low-income families: nearly two-thirds (63%) of grant recipients serve a Title 1 school, and approximately 43% of festival attendees were students of color. Over 200 “STEM @ Home” kits, each including five take-home science experiments, were dispersed to PTAs and relevant parties nationwide through this initiative.



Source: Bayer

## Biogen: A Holistic Approach to Catalyzing a Local STEM Ecosystem

### **The Biogen Foundation's STAR Initiative (Science, Teacher Support, Access & Readiness)**

is designed with an understanding that enrichment opportunities that prepare young people for success in STEM education are limited, and primarily directed towards students already equipped with strong academic skills and access to professional networks. To overcome these disparities, STAR supports the development a coordinated ecosystem of organizations that help low-income students develop and sustain their interest in STEM, gain necessary STEM exposure and enrichment opportunities, and successfully transition into post-secondary education in pursuit of STEM careers.

With a focus on serving students historically underrepresented in STEM – especially students of color – STAR provides a holistic approach to strengthening STEM education opportunities for middle- and high school students in the Cambridge and Somerville (MA) public school systems. The initiative partners with six high-performing nonprofit organizations to strengthen STEM learning opportunities for students by launching new pilot programs, expanding services to reach additional students, and enhancing and deepening existing programming. Beyond student-focused activities, the STAR initiative also helps teachers throughout Cambridge and Somerville Public Schools learn to deploy new and enhanced STEM curricula, and supports a partnership between math teachers in Somerville and Lesley University to create hands on classroom activities that support the district's new curriculum.

The Biogen Foundation began the STAR Initiative in 2018 with a four-year, \$10M commitment to its local community. As a result of their support, an additional 729 students have been served by grantees, with 1,541 total students benefitting from improved program quality & experiential learning.<sup>39</sup>

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“Our success as an industry should be measured not only by our accomplishments today, but by our efforts to inspire and empower a new generation of young scientists and engineers to help solve the health challenges of tomorrow. Prioritizing STEM education, particularly for those young people from diverse backgrounds who are historically underrepresented in science, is critical to the biotech industry, and our society as a whole.”

- Michel Vounatsos, CEO, Biogen

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<sup>39</sup> Biogen, “STAR Initiative Year 1 Report,” November 2019

## Bristol Myers Squibb: Inspiring the Next Generation of K-12 STEM Educators

**Bristol Myers Squibb Centers for Science Teaching and Learning** are changing the way teachers encourage, motivate, and educate K-12 students. Located at Rider and Montclair State Universities in New Jersey, and Quinnipiac University in Connecticut, these centers work with public school districts and private schools in their respective geographies to help in-service and pre-service K-12 educators learn to teach STEM subjects. In addition to promoting the use of the scientific method as a tool for inquiry and exploration, the centers help teachers develop stronger content knowledge, understand how scientific concepts at various grade levels fit into a larger context, and use technology to improve learning outcomes.



*Source: Bristol Myers Squibb*

## Genentech: Encouraging Diverse Students to Engage in STEM

**Genentech and the South San Francisco Unified School District (SSFUSD) partner to operate FutureLab**, a valuable resource that gets students excited to learn about science, improves their college readiness, and inspires them to pursue careers in STEM fields. Inclusion is at the heart of the FutureLab, as more than 30% of SSFUSD students are English language learners and 40% come from low-income families. FutureLab features three unique programs for students of different ages:

- **Gene Academy** is a mentorship program where students come to Genentech's campus once a week for an entire school year. Each student is paired with two Genentech mentors to work together on homework and hands-on science projects that build their interest and confidence in science, offering them a special opportunity to receive individual attention from supportive adults. More than 1,000 students have been mentored since the program began.
- **Helix Cup** is an annual science competition designed to engage all eighth-grade students from South San Francisco middle schools to help them develop problem-solving, teamwork and hands-on science skills. With support from Genentech volunteers, students participate in educational challenges that rooted in real-world, hands-on applications of science.
- **Science Garage** is a four-year biotech pathway designed to give all South San Francisco Unified School District (SSFUSD) high school students an opportunity to explore the exciting field of biotechnology. In 9th grade, students participate in Genentech's four-week biotech unit through their biology courses. In subsequent years, students can take up to two additional years of elective biotech coursework and complete an independent study. The Science Garage biotech lab and classroom – opened in 2017 with a \$7.8 million grant from the Genentech Foundation – gives students access Science Garage provides access to specialized, state-of-the-art equipment that is typically available to professional or academic scientists and researchers.

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“We designed our Futurelab programs with the goal of inspiring students to pursue careers that are needed for the jobs of today and tomorrow, right in their own backyard...These students are the future of science, and we want to arm them with the skills needed to solve some of the greatest unmet needs in medicine and beyond. Through Futurelab, our mission is to develop a center of science education excellence in South San Francisco for all students in kindergarten through 12th grade, and create a pipeline for future talent.”

-Carla Boragno, Genentech Foundation Board Chair and Global Head of Engineering and Facilities, Pharma Technical Operations

More than 700 students from South San Francisco visit Genentech each year to engage with employee mentors, learn about the company and its work, and tour the campus. Through Futurelab, Genentech also supports area teachers by funding Next Generation Science Standards curriculum development, classroom supplies, and professional development training. High school seniors are eligible for scholarships that help them pursue a degree in STEM, including two four-year scholarships of \$50,000 per year to exceptional students.

Based on its lessons learned in South San Francisco, Genentech is now working to scale FutureLab so that the program can reach even more students and teachers. In particular, Genentech is funding and participating in the design and execution of a brand-new high school biotech curriculum and science teacher professional learning experience. With the hope of empowering and supporting teachers and students and providing more equitable access to explore and engage in a vast range of valuable science skills and careers, Genentech has funded an ecosystem of complementary organizations, all with specific roles and responsibilities in this collective action: Ignited Education, Bay Area Bioscience Education Community, JFF (formerly known as Jobs for the Future), Discovery Education, California Academy of Sciences, and Labster.

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## Johnson & Johnson: Championing Women in STEM

**Johnson & Johnson's WiSTEM2D initiative (Women in Science, Technology, Engineering, Math, Manufacturing and Design)** provides support for girls and women of all ages, helping them pursue STEM2D studies and careers no matter where they are located. Working with partners such as Girl Scouts of the USA, Smithsonian Science Education Center, JA Worldwide, and FHI 360, the initiative originally launched with a goal of reaching 1 million girls through WiSTEM2D programs over five-years. **In March 2020, J&J announced that the WiSTEM2D initiative has exceeded this goal by more than 6x, reaching more than 6 million girls since its inception.**

This program seeks to cultivate females' STEM2D interests at an early age, helping them grow and develop in these areas on their way to pursuing higher education and careers



*Source: Johnson & Johnson*

in STEM2D. For example, the Student Activity Series includes interactive, fun, hands-on activities for girls and young women, ages 5-18, across the globe. Recently, the program has developed educational online events, interactive videos, e-books, student and parent activity tip sheets, and other virtual resources, as well as a four-part series of videos to discuss learning from home and careers in STEM2D.

All activities are aligned with research-based theory and the STEM2D philosophy, and each activity targets one or more of the STEM2D subjects. The curriculum also offers “ignite” activities, which use everyday materials, typically take 5 to 15 minutes to complete, and are intended for use at career fairs, science fairs, exhibits, or any type of booth event.

Additionally, WiSTEM2D programs offer resources for adults, such as educators, STEM professionals, or other potential mentors, which helps them be a role model, share personal stories, and relate to young learners. Johnson & Johnson also supports programs at the university level, offering ongoing mentorship programs and financial backing to help women in STEM2D fields increase their graduation rates and pursue STEM2D careers.

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## Lilly Foundation: Working with Educators to Align Curricula with Industry Needs

Lilly understands the important role that teachers play in developing and inspiring the future STEM workforce. **The Lilly Experience for Teachers in STEM (LETS)** is a unique event conducted annually by the Lilly Foundation and the Indiana STEM Resource Network, a partnership of public and private higher education institutions, K-12 schools, governments, and businesses. This two-day program brings together Lilly employees and teachers from throughout Central Indiana to discover new ways to provide students with the best opportunities to realize potential careers in STEM.

Through this partnership, Lilly employees and STEM teachers collaborate and share learnings with each other, exploring potential links between the region’s math and science curriculums and industry content and perspectives. Teachers receive STEM lesson plans drawn from actual examples, as well as other tools and resources that enable students to “make the connection” between what they are learning, possible careers, and real-world applications.

Lilly also plays a financial and advisory role in support of Indianapolis Public Schools’ (IPS) vision that 100% of IPS high school students will graduate on-time and prepared for their next steps, whether it’s enrollment in post-secondary education, enlistment in the armed services, or employment at a livable wage. Lilly’s unique expertise and interest in growing STEM careers led to the selection of two high schools implementing industry-relevant pathway programs around fields such as advanced manufacturing, engineering, logistics, and others.

The future is bright for students who may decide to pursue STEM careers, and the opportunities through these programs are endless. By helping to support teachers in their critical work and providing clear pathways to STEM skills, students can succeed in education, careers, and life.



## Lundbeck: Immersing Students in STEM

Lundbeck understands that there is more to boosting engagement in STEM than just enhancing curriculum. Through its decade-long partnership with **with Perspectives IIT Math & Science Academy (Perspectives MSA)**, a STEM-focused charter school, Lundbeck engages with Chicago high school students from some of the city's most underserved areas. Based in Bronzeville, a historically Black neighborhood on the city's South Side, more than 90% of the 500 students in grades 7-12 served by Perspectives MSA are low-income, and more than 98% are from populations presently underrepresented in STEM fields.

“Because of Lundbeck, I am the first person in my immediate family to receive a four-year degree.”

-Recent Lundbeck Scholarship Recipient

Central to the partnership between Perspectives MSA and Lundbeck is a goal of inspiring students to pursue an interest in STEM and ensuring that students have the necessary resources to meet their full potential. At a high-level, Lundbeck supports Perspectives MSA's general operating budget, and funds infrastructure improvements, including the conversion of a kindergarten classroom into a fully functional quality lab facility so that students could participate in AP-level science courses.

Lundbeck provides meaningful out-of-school experiences for Perspectives students through its internship program. As interns, more than 20 high school students have learned about the pharmaceutical industry and how a therapy goes from idea to patient. Some employees serve as direct mentors, acting as role models, developing deep relationships with students, and providing frequent guidance. With a goal of teaching students about



Source: Lundbeck

“Lundbeck’s generosity has inspired me to help others and give back to the community...I hope one day I will be able to help students achieve their goals not only in their desired career but also in their education and leadership.”

-Recent Lundbeck Scholarship Recipient

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aspects of the company (e.g., therapeutics, product marketing), other employees serve as subject matter experts, helping spark further student interest in STEM.

Students at Perspectives MSA are presented with a variety of challenges, both inside and outside of the classroom. Most students (90%) come from low-income backgrounds, and some students face significant challenges just getting to school. Lundbeck initiated a public transportation fund for students who do not have the financial resources to purchase bus/train tickets to get to and from school each day.

Employees at all levels, including the executive team, help ensure the success of this partnership. Each year, a group of Lundbeck employees visits the school to participate in their Career Day, speaking on panels, sharing their career stories, and offering encouragement to students interested in health and science careers. Through a unique device buy-back program, employees can also donate directly to Perspectives as a way to “purchase” retired mobile phones or tablets. Since its launch, the buy-back program has generated nearly \$75,000 in donations to the school, reflecting these employees’ strong connection to Perspectives and its students.

One area where Lundbeck helps directly support promising STEM students is through an annual scholarship program. Over the past 5 years, Lundbeck has awarded 15 scholarships of \$5,000 to college-bound Perspectives seniors that meet certain requirements, such as strong academics and an interest in STEM. The scholarships help these promising students and future STEM leaders defray the costs of their college education and can be used to cover school-related expenses such as books. Lundbeck colleagues are actively involved in the selection process, reviewing submitted applications and welcoming the winners each spring at a celebration honoring their accomplishments.

## Novartis: Providing a Community Home for STEM Education

Hands-on experimentation and minds-on problem solving are great ways to build excitement about STEM, especially biomedical sciences and drug discovery. With the support of the Novartis Institute for Biomedical Research (NIBR), teens and adolescents in Cambridge (MA) can engage in these activities in their own neighborhoods through **The Community Exploration & Learning Lab (CELL @ Novartis)**.

Engaging local science teachers, school administrators, after-school programs, and other educators in the process CELL @ Novartis has developed a science curriculum that connects Cambridge Public School science lessons with NIBR research activities. From basic science and lab skills to lessons on genetics and molecular biology, CELL @ Novartis courses cover a range of topics over two- to four-hour periods. These interactive lessons are guided by volunteer scientists.

In 2019, CELL @ Novartis hosted approximately 700 students from over 20 different schools and programs. These students worked with 100 Novartis scientist volunteers who provided mentorship and coaching during the lessons. Importantly, these volunteer scientists helped provide authentic stories about their education and career paths, which helps give these lessons further context and encourages further excitement in STEM.

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## Sanofi: Building STEM Capacity in Local Schools

**Sanofi provides support for community-based STEM education initiatives throughout New Jersey**, helping expose students who might have limited resources or access to STEM opportunities and igniting their passion for STEM subjects. For example, Sanofi's US Corporate Social Responsibility team has partnered with its Inclusion & Diversity colleagues and its Women's Employee Resource Group (WISE – Women Inspiring Sanofi Excellence) to support Junior Achievement NJ's activities. One such initiative, the Girl Empowerment STEM Workshop, gives more than 450 high school girls the opportunity to connect with business professionals in STEM and learn about career pathways.

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“Sanofi is pleased to be able to bring the Students 2 Science program to Somerset County students, home to our US headquarters and many of our employees... Encouraging students to pursue careers in STEM fields is critical to support New Jersey's innovation economy and ensure our country's economic competitiveness.”

- Diana Blankman, Head of U.S. Corporate Social Responsibility, Sanofi

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Sanofi also supports the Hispanic Scholarship Fund's STEM Summit, where attendees are given the opportunity to interact with some of the nation's leading STEM professionals and gain insights on how to achieve excellence, both academically and professionally.

At local schools near its New Jersey headquarters, Sanofi makes multiple investments to encourage STEM programming. For example, Sanofi supports STEM initiatives at the Matheny School, a local school serving students with medically complex disabilities, where many students require full-time nurses or paraprofessional support. Sanofi contributed funds for the purchase of 3D equipment to enable the science and technology teacher and her students to create models that enhance learning and development. Sanofi also supports STEM-related programs at Raritan Valley Community College (RVCC), which serves the region where the company's New Jersey campus is located. Sanofi has contributed nearly \$300,000 over the past 5 years to key RVCC projects such as Galileo scholarships for students majoring in STEM fields, a nurse simulation lab, and college campus experience sessions for STEM high school students.

# Conclusions and Lessons Learned

Overall, it is clear the biopharmaceutical industry has maintained significant, sustained support for STEM education across the United States.

Now more than ever, as the nation finds itself lagging in STEM achievement and performance, and facing increased competition from abroad, these private sector commitments are crucial. Without ongoing attention to inspiring and advancing the future STEM workforce, the U.S. risks falling further behind. This report should serve to reinvigorate collective efforts to enhance STEM education in the U.S.

Economic prosperity in the United States is tied to the ability to remain globally competitive in innovation-led industries that leverage high concentrations of STEM talent. In order to continue leading the world in the development of lifesaving and quality-of-life improving inventions and discoveries, a skilled technical workforce is paramount to the nation's success. Yet despite the importance of STEM talent, the U.S. continues to fall behind countries such as China in STEM literacy and proficiency.

In partnership with schools, teachers, families, and other organizations committed to student success, PhRMA member companies are supporting a wide range of activities that address many of the key challenges facing the growth and development

of the future STEM workforce. With a truly national footprint stretching from the nation's urban neighborhoods to its rural counties, these programs and initiatives are building excitement and interest in STEM, growing science literacy, and encouraging the development of the fundamental skills needed to succeed in STEM careers.

To ensure that all students have access to opportunity and the 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.

PhRMA's member companies and their foundations have a lengthy track record of supporting and delivering STEM education programs and initiatives, and with this experience comes a variety of lessons learned. Follow-up interviews with a sample of these organizations illuminated the following key takeaways and lessons:

- Maximizing impact by ensuring the education programs have a specific focus and clear goals.
- Emphasizing the importance of listening to school/district/community needs and not assuming what is needed. In other words, “one-size-fits-all” approaches do not work.
- Leveraging the knowledge and expertise of educators and professional scientists to form a true partnership, recognizing educators know the classroom and how to develop curriculum and approaches that will resonate and work with students.
- Soliciting and listening to employee input about what they want to participate in and support. The perspectives they can bring as motivated employees are critical to volunteering, mentoring, and contributing to educational programming.
- Creating sustained visibility within the community and “showing up” often for career days, classroom events, festivals, and other ongoing support enhances critical community relationships.

As a whole, the biopharmaceutical industry has learned valuable lessons for refining program support and maximizing impact, and this has contributed to the overall success of the initiatives described and profiled herein. However, the continued challenges facing the nation’s STEM pipeline speak to the enormity of the work ahead. While the biopharmaceutical industry is clearly committed to ensuring the success of the future STEM workforce, broader investments and creative partnerships and programming from both the public and private sectors are needed. In order to fuel economic growth and global competitiveness in the long-term, a comprehensive long-term strategy and investment and commitment from both the public and private sectors is required.







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