



Presented by:

PILMA
Pharmaceutical Industry
Labor-Management Association

ICERES
Institute for Construction Economic Research

AN ANALYSIS OF CONSTRUCTION SPENDING IN THE PHARMACEUTICAL & BIOTECH INDUSTRY, 2012-2017

Russell Ormiston, Ph.D.

Associate Professor of Economics, Allegheny College
Research Scholar, Institute for Construction Economic Research

December 2018

Introduction

The medical and research innovations of America's pharmaceutical and biotech industry have extended the boundaries of modern-day science to develop critical life-saving and life-enhancing treatments and cures for people worldwide. In advancing public health for individuals and communities around the globe, the industry has also become an important economic engine in the United States. With thousands of research, development, and manufacturing facilities across the country, the pharmaceutical and biotech industry employs hundreds of thousands of hard-working Americans in good-paying jobs that represent the backbone of thriving local and regional economies.¹

Breakthroughs in global public health—and the economic impact that it generates for American communities—are made possible by billions of dollars of private-sector investment made annually by the pharmaceutical and biotech industry to construct state-of-the-art science and medical facilities. Pharmaceutical and biotech plants, however, require construction that meets exacting specifications. This has led to a unique partnership between the industry and the highly-skilled construction workers of North America's Building Trades Unions. The union sector's long-established—and highly effective—training and apprenticeship programs have developed the country's most educated, skilled and experienced construction labor force, one that is capable of meeting the high-tech construction demands that are required of the next generation of world-class pharmaceutical and biotech facilities.

1. According to the Bureau of Labor Statistics, there were over 4,000 pharmaceutical manufacturing companies employing 292,116 people in 2017, with an annual payroll of \$33.6 billion and workers' earnings averaging \$114,949 per year. Earnings appear to be even higher among research and development companies. BLS data suggests that there were 7,644 firms engaged in biotechnology R&D, employing 179,459 people in 2017 with an average salary of \$165,951. Note that this ignores the thousands of other R&D workers in the broader pharmaceutical and biotech industry for which data are unavailable: chemical, biological and health researchers are combined with many other non-pharmaceutical researchers by the BLS, making sector-wide statistics somewhat inapplicable.





The partnership between the pharmaceutical and biotech industry and construction unions has enormous economic benefits for local workers, families, and communities. In addition to the economic impact of newly-constructed science and medical facilities, the employment of union construction workers provides “good” jobs for thousands of local residents, including respectable wages, health insurance, and pension benefits. The decision to hire union workers and contractors also supports skilled craft worker training and apprenticeship programs, strengthening workforce development for a region while promoting a pathway to the middle class for its blue-collar workers. All of this is done without a nickel of student debt or a dime of taxpayers’ money.

To demonstrate the impact that the pharmaceutical and biotech industry has on the construction labor market—and regional economies as a whole—this report will examine privately-funded construction on major research, development, and manufacturing projects (\$5+ million) for 11 states between 2012 and 2017 (CA, CT, IL, MA, MD, NJ, NY, OH, OR, PA and WA). The states included in this report were selected by the Pharmaceutical Industry Labor-Management Association (PILMA), a coalition of labor organizations and companies in the pharmaceutical industry with dual goals of fostering medical innovation and promoting high-quality construction jobs.² This report relies extensively on data from Industrial Information Resources (IIR), a well-respected global consulting firm specializing in market data on major power, energy, and industrial infrastructure projects in the United States. This report will first identify major private-sector projects in each state and present IIR estimates of total industry construction spending and labor demand. The second part of this study will integrate data from IIR and the U.S. Census Bureau to examine the economic impact of the partnership between the pharmaceutical and biotech industry and construction trades unions; the result is a series of conservative estimates that illustrates the importance of the industry in supporting middle-class families and regional economies across the country.

MAJOR CONSTRUCTION PROJECTS

In the 11 states selected for this study, Industrial Information Resources identified 249 major, privately-funded construction projects (\$5+ million valuations) in the pharmaceutical and biotech sector that were active at any point between 2012 and 2017. Combined, these projects represent \$14.3 billion in capital investment in these 11 states over a six-year period. As outlined in Table 1, the pharmaceutical and biotech industry has made significant infrastructure investments in every state included in this study. Between 2012 and 2017, eight of the 11 states analyzed in this study experienced over \$600 million in new construction on pharmaceutical and biotech production facilities. This was led by California (58 projects, \$4.8 billion valuation) and Massachusetts (54, \$3.8 billion) but even the state with the least amount—Oregon—experienced over \$190 million worth of private investment.

2. More information on Pharmaceutical Industry Labor Management Association can be found at its website, <http://www.pilma.org>.

Table 1. Number of Major Projects and Total Investment Value, by State, 2012-2017

STATE	# OF PROJECTS	TOTAL VALUATION
California	58	\$4,847,000,000
Massachusetts	54	\$3,776,600,000
New York	39	\$1,260,400,000
Pennsylvania	22	\$938,650,000
Maryland	13	\$769,000,000
Illinois	11	\$723,500,000
Connecticut	9	\$630,500,000
New Jersey	20	\$618,000,000
Ohio	11	\$317,000,000
Washington	8	\$208,000,000
Oregon	4	\$190,700,000
TOTAL	249	\$14,279,350,000

Source: Industrial Information Resources. Total investment value included for any major construction project (\$5+ million TIV) active between 2012 and 2017.

Table 2. Pharmaceutical and Biotech Construction Projects, \$250+ Million Construction Value, Active Between 2012 and 2017

OWNER	CITY	STATE	ACTIVE	VALUE
Vertex Pharmaceuticals Incorporated	Boston	MA	2011-2014	\$800,000,000
<i>Boston Grassroot Fan Pier Biotech R&D Center</i>				
Novartis Institutes for Biomedical Research	Cambridge	MA	2012-2015	\$600,000,000
<i>Cambridge Vaccine and Diagnostics R&D Center Expansion</i>				
Gilead Sciences Incorporated	La Verne	CA	2015-2017	\$500,000,000
<i>La Verne Grassroot Sterile Intravenous Therapeutics Plant</i>				
Scripps Research Institute	La Jolla	CA	2011-2014	\$456,000,000
<i>La Jolla Scripps Cardiovascular Institute Addition</i>				
Gilead Sciences Incorporated	Foster City	CA	2016-2020	\$300,000,000
The Jackson Laboratory	Farmington	CT	2013-2014	\$300,000,000
Merck and Company Incorporated	West Point	PA	2013-2016	\$300,000,000
Fresenius Kabi USA LLC	Melrose Park	IL	2017-2022	\$250,000,000
Bristol-Myers Squibb Company	Devens	MA	2014-2016	\$250,000,000
MedImmune LLC	Frederick	MD	2015-2017	\$250,000,000
GlaxoSmithKline Incorporated	Collegeville	PA	2015-2018	\$250,000,000

Source: Industrial Information Resources.

A similar pattern emerges in an examination of Table 2, which presents the 11 largest private-sector pharmaceutical and biotech construction projects active between 2012 and 2017. First, a construction project valued at \$250 million or more was located in six of the 11 states studied; three additional states had a project valued at \$125 million or more. The second trend apparent in Table 2 is the enormous amount of investment spending in California and Massachusetts. In addition to featuring the four largest pharmaceutical and biotech construction projects, these two states combined to represent 16 of the 22 projects valued at more than \$150 million. Many of these projects are clustered in major metropolitan areas. As an example, Figure 1 presents a map of projects in the Greater Boston area, which features 53 of the state's 54 projects; this includes the largest two projects in the data—Vertex Pharmaceuticals' Biotech R&D Center (\$800 million) and Novartis' Vaccine and Diagnostics R&D Center Expansion (\$600 million)—which are located less than five miles apart in Boston and Cambridge, Mass., respectively. Across the 11 states studies in this report, clusters of projects were also evident in Chicago, Columbus, Los Angeles, New York, Philadelphia, San Diego, San Francisco, and Seattle.³

ANNUAL CONSTRUCTION SPENDING

The preceding analysis of major projects active at any point between 2012 and 2017 offers an incomplete analysis of private-sector construction spending on research, development, and manufacturing infrastructure by the pharmaceutical and biotech industry during this six-year period. First, this ignores the scores of construction projects that fell below the \$5 million threshold. The pharmaceutical and biotech industry requires extensive construction work to annually maintain, repair and overhaul existing facilities; while some of these projects exceed \$5 million, many others do not. Second, some of the projects outlined in the above analysis featured construction that started before 2012 or finished after 2017. As a result, the section below addresses these concerns by offering IIR's "topline" construction spending estimates—which includes small projects and isolates spending on an annual basis—for the pharmaceutical and biotech industry for each of the 11 states included in this study.

Overall, the pharmaceutical and biotech industry is estimated to have spent \$22.4 billion on constructing and renovating private-sector production facilities in these 11 states between 2012 and 2017. As outlined in Figure 2, the last two years have featured substantial growth in this 11-state area, with spending peaking at \$4.4 billion in 2017. This trend does not look temporary, as Industrial Information Resources projects the total to approach \$4.6 billion in 2018 and remain above \$4.3 billion annually through 2020. Much of this growth is attributable to new capital expenditures (in blue), growing from \$1.8 billion in 2012 to \$3.0 billion in 2017. Regardless of whether the spending is on new construction or repair of existing work, Figure 2 offers clear evidence of the billions of dollars that the pharmaceutical and biotech industry annually invests into states' economies and industrial infrastructure.

Figure 1. Pharmaceutical and Biotech Construction Projects Active in Boston (\$5+M), 2012-2017

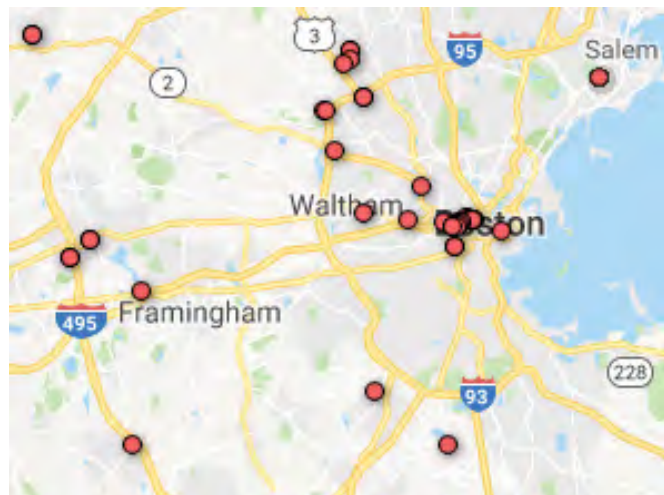
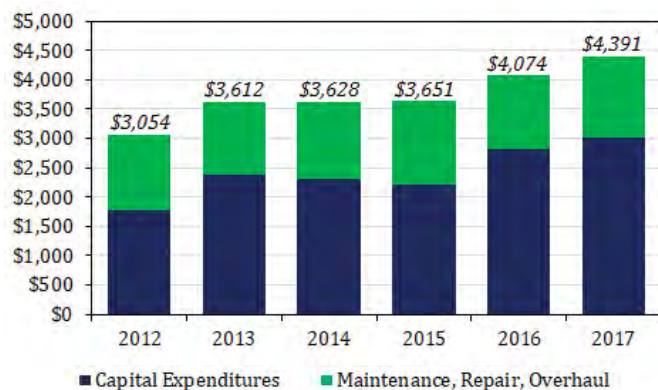


Figure 2. Annual Construction Spending (in \$ millions), Pharmaceutical and Biotech Industry, 11 States, 2012-2017.



Source: Industrial Information Resources.

3. A map providing location and details for all 249 major projects can be found at: goo.gl/mxuAM7. All projects identified in this study were designated by IIR as either having completed construction or featuring a high probability of future completion (since many projects are still ongoing).

Table 3. Annual Construction Spending (in \$ millions), Pharmaceutical and Biotech Industry, by State, 2012–2017

STATE	2012	2013	2014	2015	2016	2017	TOTAL
California	\$854.3	\$741.4	\$973.1	\$1,126.1	\$1,538.3	\$1,565.5	\$6,798.7
Massachusetts	\$743.9	\$916.0	\$838.2	\$684.9	\$594.7	\$753.9	\$4,531.6
Pennsylvania	\$303.2	\$397.4	\$423.5	\$430.2	\$530.2	\$416.0	\$2,500.6
New York	\$244.9	\$477.0	\$352.1	\$363.8	\$357.5	\$430.4	\$2,225.6
New Jersey	\$350.0	\$395.7	\$348.1	\$360.7	\$372.4	\$370.9	\$2,197.9
Maryland	\$111.6	\$87.8	\$75.3	\$189.2	\$250.8	\$346.6	\$1,061.4
Connecticut	\$125.8	\$263.6	\$262.4	\$128.1	\$62.9	\$52.7	\$895.5
Illinois	\$124.8	\$98.7	\$104.6	\$187.3	\$175.2	\$195.9	\$886.4
Ohio	\$109.4	\$148.0	\$148.6	\$114.2	\$72.9	\$109.9	\$703.0
Washington	\$78.4	\$76.8	\$83.4	\$48.7	\$52.8	\$60.7	\$400.8
Oregon	\$8.1	\$8.9	\$19.1	\$17.8	\$66.4	\$88.5	\$208.9
Total	\$3,054.2	\$3,611.5	\$3,628.5	\$3,651.1	\$4,074.2	\$4,391.0	\$22,410.5

Source: Industrial Information Resources.

To analyze these data on a state-by-state basis, Table 3 details the annual construction spending by the pharmaceutical and biotech industry on private-sector projects for the 11 states included in this study between 2012 and 2017. While generally consistent with state rankings of major project activity identified earlier, Table 3 demonstrates significant concentration of construction spending on production facilities in five states—California, Massachusetts, Pennsylvania, New York and New Jersey—which all exceeded \$2 billion in investment over the six years studied. Diving deeper into the underlying data, New Jersey (53 percent) and Pennsylvania (49 percent) reflected the highest rates of spending to repair or overhaul existing facilities. In contrast, more than 80 percent of investment in Massachusetts and Oregon were directed towards new facilities, additions, or expansions.⁴

The results from Table 3 also highlight enormous growth in construction spending in a number of states between 2012 and 2017, as private-sector investment tripled in Maryland and nearly doubled in California and New York. On a percentage basis, spending grew most rapidly in Oregon, jumping from \$8.1 million in 2012 to \$88.5 million in 2017 attributable in large part to a \$125 addition to Genetech's campus in Hillsboro in 2016 and 2017. Overall, the pharmaceutical and biotech industry spent \$22.4 billion on construction in these 11 states between 2012 and 2017, with even more on the horizon: six of these states (CT, IL, NJ, NY, OH, and PA) are projected to experience significant growth (25% or more) in construction spending between 2017 and 2020.

4. While the total construction spending between 2012 and 2017 (Table 3) exceeds the value of major projects active at any point between 2012 and 2017 (Table 1) for 10 states, this is not true for Connecticut. This is due to two reasons. Most importantly, a number of Connecticut projects started in 2011, meaning that a substantial portion of the value offered in Table 1 was not installed during the 2012 through 2017 window (Table 3). Second, IIR uses a statistical algorithm to estimate annual spending that considers the possibility that some projects may not be completed on time, thus potentially falling outside the time period studied in this analysis.

CONSTRUCTION EMPLOYMENT

The pharmaceutical and biotech industry invests billions of dollars annually to build and renovate the world-class production facilities necessary to research, develop, and manufacture life-saving and life-enhancing medical treatments. In addition to the public health benefits of such private-sector investment, this infrastructure has enormous economic benefits, as the industry employs hundreds of thousands of employees in good-paying jobs across the country. Investment by the pharmaceutical and biotech sector also benefits—and is reliant on—the highly-skilled workers of America’s building trades unions.

As described in the preceding section, the pharmaceutical and biotech industry spent \$22.4 billion on construction between 2012 and 2017 in the 11 states analyzed in this study. As estimated by Industrial Information Resources and presented in Table 4, this equates to 45.4 million construction labor hours across 14 trades, with electricians, instrumentation techs, and plumbers and pipefitters accounting for more than half of that total. In 2017 alone, the pharmaceutical and biotech industry required 8.9 million construction labor hours across these trades to build and renovate the sector’s infrastructure in the 11 states included in this study; assuming a 2,000-hour work year, that equates to an annual full-time employment of 4,447 construction workers.

For perspective on these 45.4 million labor hours, it is important to recall that the exacting specifications of cutting-edge science and medical facilities require the employment of the construction industry’s most skilled and experienced workers. As a result, the pharmaceutical and biotech industry often chooses union contractors and workers given the advantages wrought by the union sector’s long-established—and highly effective—training and apprenticeship programs. The decision to hire union labor only amplifies the economic benefit of infrastructure investment for a local community. Union construction work represents a “good” job featuring a respectable hourly wage, health and pension benefits, and a commitment to workplace safety. In sum, many of the 4,447 construction jobs created annually by the pharmaceutical and biotech industry are not just any jobs: these are the types of middle-class jobs that have long represented the backbone of American families and communities.

Table 4. Construction Labor Hours Demanded, Pharmaceutical and Biotech Industry, by Trade, 2012-2017.

TRADE	LABOR HOURS
Boilermaker	557,231
Carpenter	3,133,896
Electrician	14,367,209
HVAC Installers	998,565
Instrumentation Tech	7,387,100
Insulator	1,272,480
Ironworker	2,324,042
Laborer	2,309,099
Millwright	3,017,478
Operator	2,420,178
Painting	729,169
Plumber + Pipefitter	4,327,052
Scaffolding	961,202
Welder	1,638,035
Total	45,442,737

Source: Industrial Information Resources.

Table 5. Estimated Union Hours and Earnings, Pharmaceutical and Biotech Industry Construction, by State, 2012-2017.

STATE	TOTAL HOURS	STATE UNION %	ESTIMATED UNION HOURS	AVG. UNION WAGE	ESTIMATED UNION EARNINGS
California	13,784,599	34.8%	4,801,002	\$28.47	\$136,684,539
Massachusetts	9,137,897	27.5%	2,513,283	\$30.73	\$77,233,195
New York	4,512,813	53.6%	2,420,889	\$28.02	\$67,833,317
New Jersey	4,487,036	33.7%	1,512,525	\$31.39	\$47,478,162
Pennsylvania	5,095,122	32.6%	1,662,997	\$27.13	\$45,117,095
Illinois	1,803,866	57.5%	1,037,673	\$30.73	\$31,887,695
Maryland	2,148,231	21.2%	454,585	\$28.12	\$12,782,930
Ohio	1,429,888	33.1%	473,221	\$26.42	\$12,502,505
Washington	813,198	39.8%	323,250	\$30.79	\$9,952,857
Connecticut	1,809,525	17.8%	322,813	\$28.65	\$9,248,598
Oregon	420,562	23.2%	97,382	\$30.06	\$2,927,313
Total	45,442,737		15,619,621		\$453,648,206

Source: Industrial Information Resources.

The pharmaceutical and biotech industry's reliance on these highly-skilled union construction workers—earning decent wages and benefits—can substantially impact a local and regional economy. To project the economic impact by state, Table 5 offers conservative, lower-bound estimates of the amount of labor hours and earnings of union construction workers on major private-sector projects for the pharmaceutical and biotech industry across 14 trades in 11 states between 2012 and 2017. Union hours are estimated by multiplying the total number of labor hours demanded by each state's union density in non-residential construction; the results suggest that the pharmaceutical and biotech industry required, *at minimum*, 15.6 million hours of union construction workers to build and renovate manufacturing facilities between 2012 and 2017.^{5,6} Using the state-average hourly wage for union construction workers, this suggests that privately-funded projects in this industry resulted in *at least* \$453 million in earnings for union workers in these 11 states over a six-year span.

There are many reasons to believe that the estimates presented in Table 5 substantially underrepresent the economic impact of the partnership between the pharmaceutical and biotech industry and America's construction unions. First, while the use of non-residential union density by state is the best available measure, this approach ignores that union activity is significantly more concentrated in highly technical areas of construction—such as pharmaceutical and biotech facilities—than it is in other parts of the non-residential market (e.g., big-box retail stores, low-rise office buildings). Further, an emphasis on earnings ignores the millions of dollars in additional compensation extended to skilled tradespeople that includes, but is not limited to, union health insurance and pension benefits. In sum, the economic impact of the relationship between the pharmaceutical and biotech industry and construction unions is likely an unknown multiple of the values presented in Table 5.

5. This step is required given that Industrial Information Resources data do not offer insight on the union composition of the labor force employed on major pharmaceutical and biotech construction projects.

6. State-wide union densities in non-residential construction are developed in two steps. First, the reputable research site, unionstats.com, provides state-by-state estimates of union density in construction via an analysis of the Census Bureau's Current Population Survey. This number, however, reflects both residential and non-residential construction. Considering that the national unionization rate in residential construction is considered to be close to zero, this analysis assumes that the statewide union numbers are entirely drawn from the non-residential sector. As a result, non-residential union densities are calculated by dividing the industry-wide density estimates by the proportion of a state's construction workers employed in the non-residential sector as identified by the Quarterly Census of Employment and Wages (QCEW) from the Bureau of Labor Statistics.

A full analysis of the economic impact of the relationship between the pharmaceutical and biotech industry and construction unions would be incomplete without also identifying an important public policy outcome: the growth and sustainability of union apprenticeship programs. Union construction programs are among the most successful and long-standing apprenticeship systems in the United States. These programs allow enrollees to “earn while they learn”: apprentices develop skills while working on a job site during the day and supplement their training with classroom learning in the evening.

While union construction apprenticeship programs have been around for generations, their importance to America’s working families and the communities in which they live are at an all-time high. As economic opportunities for blue-collar workers in other industries continue to deteriorate, union construction apprenticeship programs are one of the few remaining pathways to the middle class for workers without a four-year college degree. From a public policy perspective, there is no downside to supporting these workforce development programs: union construction apprenticeships provide workers with important education and training opportunities without imposing a nickel of student debt or requiring a dime of taxpayer money. Instead, programs in this sector are funded by union workers diverting a portion of their hourly compensation to support union apprenticeship training and the next generation of skilled tradespeople.

To estimate the financial impact of the pharmaceutical and biotech industry on union construction apprenticeship programs via these per-hour contributions, the data in Table 5 suggests that the sector required *a minimum* of 15.6 million labor hours by union workers in an 11-state area between 2012 and 2017. While worker contributions to apprenticeship programs differ across trades and locals, a conservative estimate of \$0.30 per union labor hour would suggest that infrastructure investment by the pharmaceutical and biotech industry delivered *at least* \$4.7 million to union apprenticeship programs in these states in this six-year period. Beyond statistical concerns, this estimate undervalues the importance of the pharmaceutical and biotech companies to apprenticeships for another reason: the industry has been the training ground for generations of apprentices across the country, with a steady volume of employment opportunities for workers to earn a paycheck while developing their skills on the jobsite.

In essence, the partnership between the pharmaceutical and biotech industry and America’s construction unions has contributed to a financially self-sufficient pipeline of skilled tradespeople who are capable of building world-class research and manufacturing facilities that are critical engines of economic growth in this country. The opportunities offered by the pharmaceutical and biotech industry strengthen a region’s workforce development program by creating the construction jobs that represent the backbone of long-standing, well-regarded apprenticeship programs. In doing so, the industry is intrinsically supporting one of the few remaining pathways to the middle-class for millions of non-college educated men and women across the country: the skilled construction trades. In sum, the partnership between industry and labor has produced a virtuous cycle that simultaneously uplifts workers, regional economies, and public health around the world.



Conclusion

The pharmaceutical and biotech industry has advanced life-saving and life-enhancing health options for individuals and communities worldwide and, in doing so, has become an important economic engine in the United States. As outlined in this study, the sector has invested billions of dollars in industrial infrastructure between 2012 and 2017 across the 11 states identified by the Pharmaceutical Industry Labor-Management Association. This includes 249 major (\$5+ million), privately-funded construction projects active at any point in this six-year period, representing \$14.3 billion in investment in research, development, and manufacturing facilities according to data from Industrial Information Resources. Incorporating the amount spent on smaller projects, IIR further projects that the sector spent a total of \$22.4 billion on the construction and renovation of production facilities in these 11 states between 2012 and 2017.

The infrastructure investments by the pharmaceutical and biotech industry benefit—and are largely reliant on—the sector’s unique partnership with the

highly-skilled construction workers of North America’s Building Trades Unions. Building cutting-edge medical and science facilities require the most educated, skilled, and experienced construction labor force. Because of this, the pharmaceutical and biotech industry has come to rely on union workers and contractors to meet their high-tech construction standards. Reliable construction demand by the pharmaceutical and biotech industry helps keep union tradespeople employed and apprenticeship programs thriving. As outlined in this study, the sector required over 45 million labor-hours in the last six years, the equivalent of 4,447 full-time construction workers in 2017. Union workers comprised a significant portion of the labor force used to build these world-class facilities. Earning middle-class wages, health and pension benefits, and featuring the industry’s best safety record, these union construction jobs—as supported by private-sector spending by the pharmaceutical and biotech industry—represent the economic and social backbone of families and communities across the country.

