CENTER FOR BETTER GOVERNMENT

REGAINING MASSACHUSETTS' EDGE IN RESEARCH AND DEVELOPMENT

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Pioneer's Mission

Pioneer Institute is an independent, non-partisan, privately funded research organization that seeks to improve the quality of life in Massachusetts through civic discourse and intellectually rigorous, data-driven public policy solutions based on free market principles, individual liberty and responsibility, and the ideal of effective, limited and accountable government.

This paper is a publication of the Center for Better Government, which seeks limited, accountable government by promoting competitive delivery of public services, elimination of unnecessary regulation, and a focus on core government functions. Current initiatives promote reform of how the state builds, manages, repairs and finances its transportation assets as well as public employee benefit reform.

The Center for School Reform seeks to increase the education options available to parents and students, drive system-wide reform, and ensure accountability in public education. The Center's work builds on Pioneer's legacy as a recognized leader in the charter public school movement, and as a champion of greater academic rigor in Massachusetts' elementary and secondary schools. Current initiatives promote choice and competition, school-based management, and enhanced academic performance in public schools.

The Center for Economic Opportunity seeks to keep Massachusetts competitive by promoting a healthy business climate, transparent regulation, small business creation in urban areas and sound environmental and development policy. Current initiatives promote market reforms to increase the supply of affordable housing, reduce the cost of doing business, and revitalize urban areas.

The Center for Health Care Solutions seeks to refocus the Massachusetts conversation about health care costs away from government-imposed interventions, toward market-based reforms. Current initiatives include driving public discourse on Medicaid; presenting a strong consumer perspective as the state considers a dramatic overhaul of the health care payment process; and supporting thoughtful tort reforms.

Pioneer Institute is a tax-exempt 501(c)3 organization funded through the donations of individuals, foundations and businesses committed to the principles Pioneer espouses. To ensure its independence, Pioneer does not accept government grants.

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Executive Summary

Massachusetts' ranking among the states in overall R&D spending by industry rose from fifth to second between 1991 and 2006, but although it's ranking improved, Massachusetts – and every other state – lost market share over that period to California, which had enacted much stronger tax incentives. In fact, the commonwealth's market share of national R&D spending by industry actually declined between 1991 and 2011. Over that same period California increased its industrial R&D spending by more than its top seven competitor states combined, including Massachusetts.

In 2008, Massachusetts passed a 10-year, $1 billion initiative targeted at businesses engaged in life science research, development, manufacturing and commercialization in the commonwealth. Yet of the more than $11 billion in company-funded R&D spending in Massachusetts in 2010, nearly $7 billion is in non-life science sectors. These businesses were left behind by the initiative.

When Gov. Deval Patrick proposed the life sciences initiative in the midst of the 2008 recession, he said it would create 250,000 Massachusetts jobs over a decade.[1] But using the same definitions of life sciences industry clusters the Massachusetts Life Sciences Center used in the "Superclusters" report it used to advocate for the initiative, this report finds that the commonwealth has created just 571 life sciences job since the initiative's tax incentives were implemented at the beginning of 2009.

Since then, the state Legislature has appropriated $525 million for the initiative, which translates to over $900,000 per job created. During that time, total employment in Massachusetts has risen 6.2 percent, but life sciences employment is up by less than 1 percent. Between the first quarter of 2009 and the third quarter of 2013, Massachusetts ranked 13th among the states in life sciences job growth and 14th in life sciences job growth as a percentage of overall job growth.

Two reports have found slightly better life sciences job growth performance since the initiative was implemented, but both use different definitions of life sciences industry sectors than the ones used in "Superclusters." A 2013 study by Northeastern University economists Barry Bluestone and Alan Clayton-Mathews for the Boston Foundation entitled "Life Science Innovation as a Catalyst for Economic Development – The Role of the Massachusetts Life Sciences Center" used a revised and broader definition of life science industry sectors. Pioneer Institute calculates that if measured by the Bluestone/Clayton-Mathews redefinition, the life science initiative has generated 1,438 net additional life science jobs.

The Massachusetts Biotechnology Council's "2013 Industry Snapshot" used a revised and downsized definition of life sciences sectors, dropping 11 previously included sectors that had incurred net losses of 2,267 jobs since 2009 and adding one that gained 181 jobs. Pioneer Institute calculates that if measured by the "2013 Industry Snapshot" *ex post facto* redefinition, the life science initiative has generated 3,024 net additional life science jobs. Measured by any of the three definitions, Massachusetts has fallen far short of generating anything close to the 250,000 new life science jobs projected by the legislative sponsors of the $1 billion life sciences initiative.

Between 2007 and 2011, Massachusetts was the only one of the four states that lead the nation in overall industrial R&D spending, including not only life sciences but all other commercial R&D spending, that saw such spending drop. Among businesses, the commonwealth's R&D spending fell by almost 20 percent.

Massachusetts experienced an entirely different result when it gave broad-based incentives.

In 1991, Massachusetts enacted a set of research and development tax incentives that were among the most advantageous in the nation. Over the next five years, R&D spending in the commonwealth increased by more than 50 percent, which outstripped rival states.

Recommendations

State leaders should address the competitive disadvantages affecting the broader Massachusetts R&D industry by adopting the following two R&D tax credits.

1) Adopt a Massachusetts Super R&D Tax Credit for increased research and development conducted in the commonwealth. Maine is the only state that currently offers the credit for qualified research expenses greater than 150 percent of average expenses over the previous three years. Ten nations, though not the United States, currently offer the credit.

2) Adopt a Massachusetts Alternative Simplified R&D Credit (ASC), similar to the one allowed under the Internal Revenue Code. Presently, only Iowa offers a state-version of the ASC. This tax credit equals 12 percent of the excess of current-year qualified research expenses over 50 percent of the taxpayer's average qualified research expenses for the prior three years. For start-ups, the credit would equal 6 percent of current-year qualified research expenses.

3) Empirical research has shown that R&D tax credits are effective in stimulating expansion of research activities and attracting and retaining companies involved in R&D. Massachusetts is in a strong position to attract these businesses due to its academic resources and broad cluster of existing R&D firms.

Introduction

Hard work and execution, marketing and business instinct all play important roles in fostering economic growth. New product ideas can drive disruption, which in the long term creates more efficiencies in the marketplace, new demand for new products, and waves of related new goods and services. The results are a better quality of life, greater productivity, more prosperity, more jobs and opportunity.

That's the theory underlying a focus on innovation and the so-called innovation economy. So how do we think about the role of research and development (R&D) spending? Is it an investment or an expense? Generally in the marketplace, it is treated as an expense. But if such expenditures drive significant growth, should it be considered an investment? Most economists would agree that business investments in R&D can have a huge multiplier effect on economic growth and living standards; that is why many states—those with existing higher education, healthcare and scientific institutions and those without—want to attract more of these targeted investments.

As a state with world-renowned "knowledge" infrastructure and strong innovation clusters, Massachusetts considers itself an R&D powerhouse. Frequently in the press we see trumpeted the advances and growth of our biotechnology; information, communication and technology (ICT) industries; clean technology; and other industries. It is not uncommon to read headlines about "The new golden age of biotech in Massachusetts" or stories about how Massachusetts is a world leader and even attractive enough to lure the CEO or an international biotech powerhouse to move here. Such considerations are what can lead to assertions by political leaders in 2008 that a new set of public investments and tax incentives for one innovation sector (biotech) might "create up to 250,000 jobs and help protect the state's unrivaled standing in life sciences."[2]

A History of Massachusetts Legislative R&D Initiatives

In 1991, then Massachusetts Ways and Means Committee chairman Thomas Finneran, Governor William Weld, and Lieutenant Governor Paul Cellucci invited Harvard Business School Professor Michael Porter to Beacon Hill to discuss his then-recently published book, *The Competitive Advantage of Nations*. Porter advised them to adopt a strategy of expanding and strengthening Massachusetts' existing cluster of research and development companies that compete in national and international markets. In response, the Massachusetts High Technology Council and the Massachusetts Biotechnology Council worked with industry leaders, legislative leaders, and Professor Porter to enact the nation's most advantageous set of R&D tax incentives, applicable to a broad range of industries. During the five years following implementation of

the tax credits, Massachusetts' R&D expenditures by industry grew by 52.5 percent, far outstripping the R&D growth of its rivals over the same period: California (34 percent), New Jersey (27.6 percent), Michigan (27.4 percent), and New York (26.7 percent).

In 2008, the legislature and Governor Deval Patrick enacted a 10-year $1 billion life sciences initiative to create innovation infrastructure for researchers and science-based businesses through capital grants, tax incentives, and business loans. The initiative was targeted specifically at business entities engaged in life sciences research, development, manufacturing or commercialization in the commonwealth.

The initiative included a number of tax credits, including:

- an investment tax credit for 10 percent of qualified purchases of property related to a life science project made by certified life sciences companies, with a 10-year allowable carry-forward of 90 percent of unused credits
- an FDA user fee credit for 100 percent of qualified payments made to the U.S. Food and Drug Administration upon submission of an application user fee
- a research and development tax credit for 10 percent of the incremental increase in current year Massachusetts qualified research expenses over a calculated base period of prior year Massachusetts qualified research expenses
- an enhancement of net operating loss (NOL) carryover from 5 to 15 years for certified life sciences companies
- a dispensation from the sales throwback provision for sales attributed to out-of-state companies for certified life sciences companies
- elimination of sales tax for qualified property purchases by certified Massachusetts R&D and life sciences corporations
- a refundable job creation tax credit
- a life sciences research credit for out-of-state costs
- a construction sales tax exemption
- a refundable 10 percent investment tax credit

As had happened with the 1991 R&D initiative, Professor Porter's recommendations played a key role in the life sciences initiative. He presented an analysis entitled "Massachusetts' Competitive Position in Life Sciences:

Where Do We Stand?" at a 2003 conference of 100 Massachusetts life sciences leaders in business, medicine, government, and academia that was sponsored by Harvard University and M.I.T and held at Harvard Business School.

At that conference, business and academic leaders pointed out that competition among states for R&D business is fierce. For example, California, our biggest R&D competitor, offers a 15-24 percent R&D tax credit with a 100 percent net-operating loss carry-forward for eight years. Massachusetts, by comparison, offers a 10 percent R&D tax credit and a carry-forward period of just three years. The conferees identified Massachusetts' major competitive advantages and disadvantages. The key advantage they identified is the existing cluster of businesses, academic institutions, and hospitals conducting research and product development. Key disadvantages included high labor costs and price for space, relatively poor transportation infrastructure including air transportation at Logan Airport, high cost of doing business, slow government permitting processes, and inadequate tax incentives compared with other states.

Professor Porter's presentation at the 2003 conference included many recommendations specifically directed at enhancing the competitiveness of Massachusetts' life science industry but also included calls to address a broader range of issues affecting all industries. His report identified a host of challenges, including addressing weaknesses in Massachusetts' physical and telecommunications infrastructure, increasing the supply of housing to lower the cost of living in the state, increasing the overall responsiveness of state government to business needs, securing the state's medium skilled workforce, capturing more downstream manufacturing, making the process of site regulation more consistent and predictable especially at the local level, improving incentives and processes for innovation and investment

in R&D initiatives, addressing the high cost of doing business, and many other issues.

The Life Science Initiative legislation that ultimately passed into law four years later focused narrowly on the life sciences component of Professor Porter's recommendations, leaving the broader range of competiveness issues unaddressed, resulting in legislation targeted almost exclusively for the benefit of the life sciences industry.

At the time the life sciences legislation was being considered, Pioneer Institute raised the concern that it was too narrowly focused on the life sciences industry and that it ignored other important Massachusetts industry clusters that face strong competition from other states, including the financial services and technology sectors. Pioneer argued that state leaders should commit themselves to addressing Massachusetts' systemic competitive disadvantages, not pick winners and losers.

Massachusetts' R&D Spending by Industry: A Loss of Market Share

When it comes to research and development spending by industries across all sectors, Massachusetts' rank among the states has improved in the most recent two decades. But during that time the commonwealth and every other leading state have lost market share to California, the unquestioned leader in industry R&D spending.

Quarterly data published by the National Center for Science and Engineering Statistics (NCSES) shows that Massachusetts ranked fifth in the nation in total commercial research and development expenditures in 1991, trailing California, New Jersey, New York, and Michigan. By 2006, Massachusetts had risen to second. This rise might indicate that Massachusetts is doing exceedingly well in the national R&D competition, except for one thing: As the following graphs and charts indicate, while Massachusetts, New Jersey, New York, and Michigan were jostling for 2nd place in the R&D race in the two decades between 1991 and 2011, they were all falling farther behind California, which was surging ahead to capture more of the national R&D market from its rival states. The broader research and development sector in Massachusetts, which faces harsh competitive disadvantages such as high costs and burdensome regulations just as the Life Science industry sector does, was overlooked by the life sciences initiative. The following charts and graphs demonstrate that Massachusetts, like other states, has lost market share to California over the past two decades.

As Figure 1 demonstrates, total R&D expenditures by industry in California grew enormously, from $21 billion in 1991 to $75 billion in 2011. Over this period, California achieved a dominance unseen in the past. In 1991, the Golden State's businesses spent just under three times more than its closest competitor (at the time New Jersey); today it spends five times more than its closest competitors (Massachusetts and Texas). It achieved this dominance by adding a total of $54 billion in annual R&D expenditures.

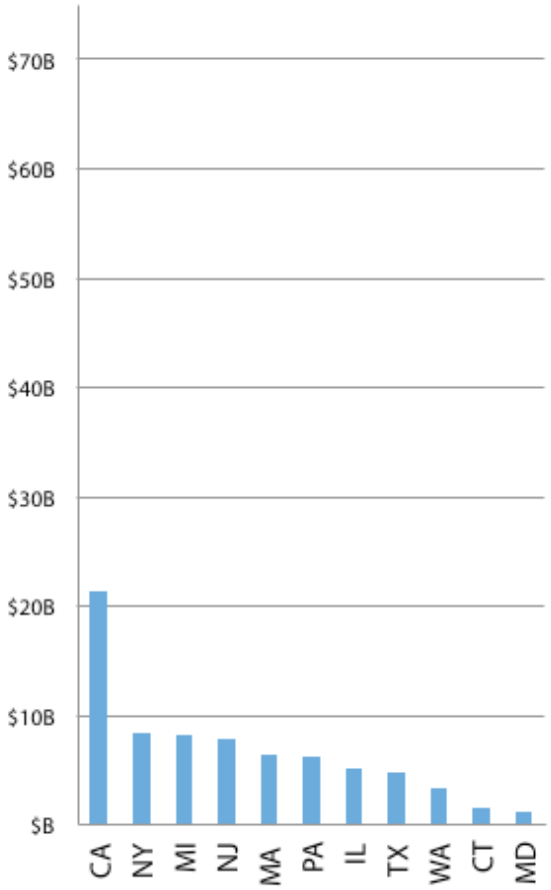
Figure 1. R&D Expenditures by Industry by State, 1991-2011

State	1991[3]	2011[4]	1991-2011
California	21,279	75,035	53,756
Washington	3,215	14,558	11,343
Texas	4,755	15,309	10,554
Massachusetts	6,335	15,722	9,387
Illinois	5,027	12,038	7,011
New Jersey	7,810	13,930	6,120
Connecticut	1,535	7,504	5,969
Michigan	8,116	13,660	5,544
Maryland	1,203	5,101	3,898
New York	8,268	12,072	3,804
Pennsylvania	6,262	9,718	3,456
Other states	21,617	82,596	60,979
Total	95,422	277,243	181,821

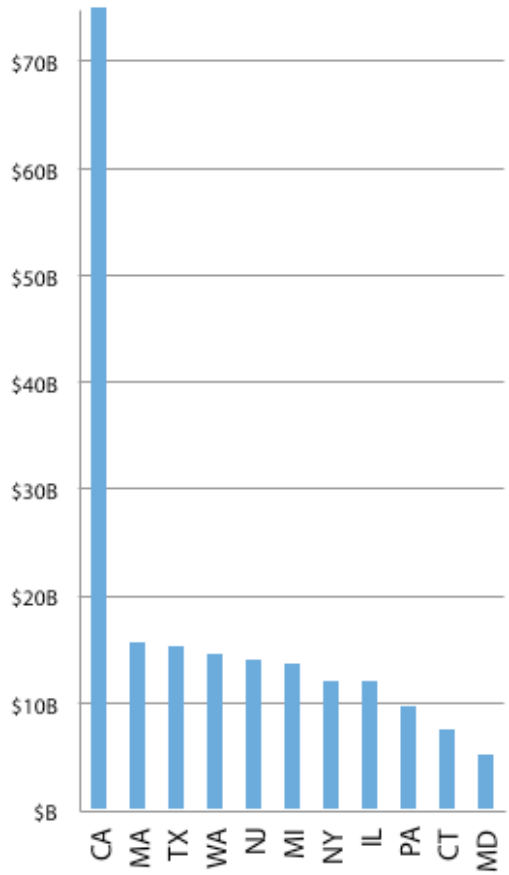
Figures 2 and 3 further show that while Massachusetts went from 5th to 2nd among the states in total R&D expenditures by companies between 1991 and 2011, California's market share has made the state something of a category killer, when looked at nationally.

FIGURES 2 AND 3. R&D EXPENDITURES BY INDUSTRY, TOP TWELVE STATES, 1991 AND 2011, SHOWING CALIFORNIA'S DRAMATIC GAINS IN COMPARISON TO COMPETING STATES

1991



2011



To make the point even more sharply, it is helpful to consider Massachusetts' share of national R&D market on an expenditures basis. Figure 4 shows that over the 20-year period beginning in 1991, Massachusetts' share of national R&D expenditures actually declined by nearly 1 percent.

Figure 5 depicts California's R&D expenditure growth of $53.76 billion between 1991 and 2011 in comparison to the growth in the expenditures of the Golden state's top seven competitor states combined. California's growth outpaced the growth in its seven competitor states combined.

Figure 4. State Winners and Losers of National R&D Market Share
R&D Expenditures by Industry 1991-2011

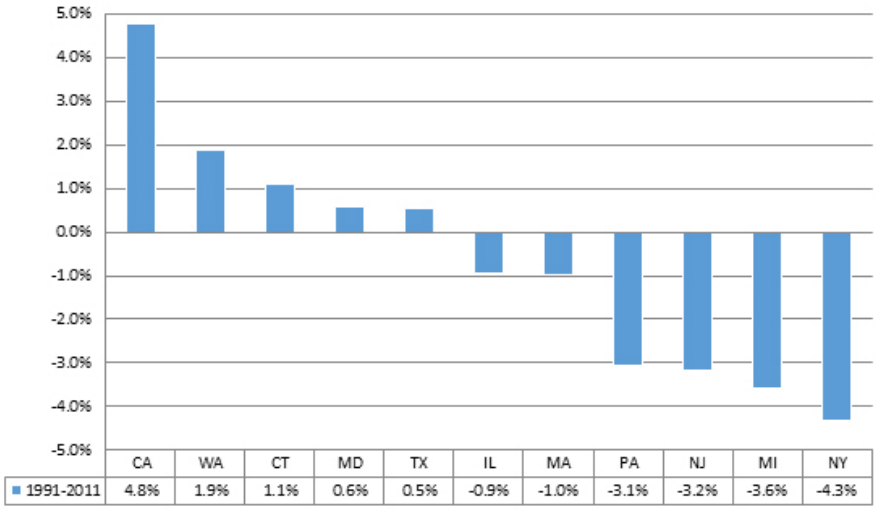
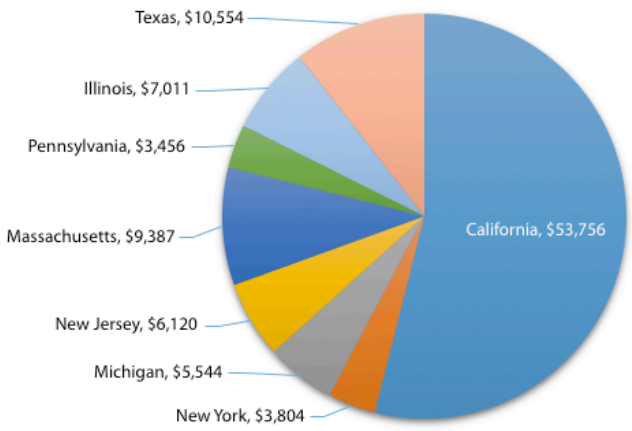


Figure 5. California's R&D Expenditure Growth from 1991 to 2011 Exceeded its Top 7 Competitor States' Combined
($Millions)



State	1991	2011	1991-2011 $ Increase
California	$21,279	$75,035	$53,756
Total Other 7 states	$46,573	$92,449	$45,876
New York	$8,268	$12,072	$3,804
Michigan	$8,116	$13,660	$5,544
New Jersey	$7,810	$13,930	$6,120
Massachusetts	$6,335	$15,722	$9,387
Pennsylvania	$6,262	$9,718	$3,456
Illinois	$3,027	$12,038	$7,011
Texas	$4,755	$15,309	$10,554

Massachusetts' 2008 Life Sciences Initiative

Massachusetts' research and development-driven sectors face harsh competitive disadvantages such as high costs and burdensome regulations. Yet California has many of these same negative business climate features as well. One important reason why Massachusetts has lost market share may be because state government has focused its attention so narrowly on the life science sector. While biotechnology certainly has an R&D component, nearly two-thirds of Massachusetts' R&D spending is not life sciences-related, meaning that the majority of R&D industries have been unaffected by the initiative and were essential left behind by the Life Science Initiative.

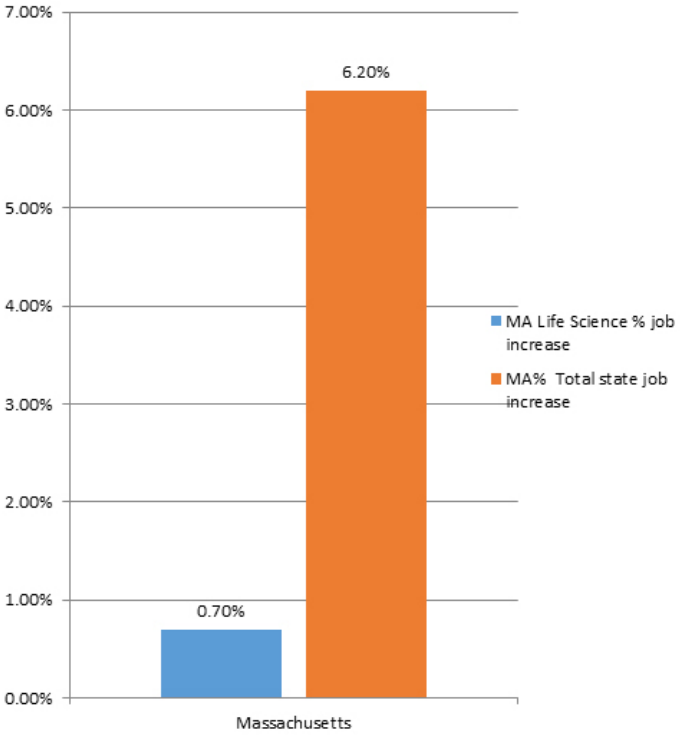
Adopted in 2008, the life science initiative relied on future legislatures to provide $1 billion over the following decade in tax expenditures, grants, and economic incentives to promote Massachusetts' super-cluster of bioscience and related businesses. After five years, or half the life of the initiative, the legislature is on schedule, having provided about half of that amount.

This policy paper presents data from the Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages (QCEW) QCEW North American Industry Classification System (NAICS)-Based Data Files (1975-2013) using the same definitional methodology proponents utilized to support creation of the initiative when the legislation was proposed in 2007. Governor Patrick claimed the life sciences initiative would create 250,000 jobs, but thus far the results are disappointing. Pioneer Institute calculates that since the life science tax incentives took effect in the first quarter of 2009, Massachusetts has added a net 571 jobs and ranked 13th among the states in life science industry job growth between the first quarter of 2009 and the third quarter of 2013, 20th in life science industry job growth measured by percentage increase, and 14th in life sciences job growth as a percentage of total job growth. At a cost to date of approximately $525 million, the creation of 571 net new jobs translates to more than $900,000 per net new job.

- **Growth in life science jobs - Massachusetts ranked 13th** among the states in life science job growth between 2009Q1 and 2013Q3; i.e. Massachusetts had 87,048 life science jobs in 2009Q1 and 87,619 in 2013Q3; a net gain of 571 jobs. Twelve other states added more jobs than MA did over this period.
- **Percentage growth in life science jobs – Massachusetts ranked 20th** among the states in percentage life science job growth between 2009Q1 and 2013Q3. Massachusetts had 87,048 life science jobs in 2009Q1 and 87,619 in 2013Q3; a 0.7% increase (87619/87048 = 0.7% increase). Nineteen states had a higher percentage increase in life science jobs over this period.
- **Life science job growth as a percentage of total state job growth- Massachusetts ranked 14th** among the states in life science job growth as a percentage of total job growth between 2009Q1 and 2013Q3. Massachusetts' total employment grew from 3,124,780 in 2009Q1 to 3,318,316 in 2013Q3, an increase of 193,536 jobs with a percentage increase of 6.2%. During the same period Massachusetts added 571 life science jobs. Therefore, life science job growth constituted 571 out of 193,536 added jobs, or 0.29% of total job growth (571/193536 = 0.29%). Thirteen other states had a higher percentage of life science job growth as a percentage of total job growth. This statistic is consistent with the fact that MA overall job growth was substantial during this period (6.2%) but that LS job growth was weak by comparison (0.7%).

When it comes to picking winners and losers in technology and scientific industries, state governments like Massachusetts are at a decided disadvantage in comparison to venture capital and other investment experts who comb the nation to identify and invest in emerging companies. Massachusetts' expensive economic development strategy relies upon state officials successfully picking winners from among applicant companies that seek targeted incentives from the Life Sciences Initiative. If the first 4¾ years of the ten year Life Science Initiative is a legitimate measurement of

FIGURE 6. PERCENTAGE EMPLOYMENT GROWTH, MASSACHUSETTS TOTAL VS. LIFE SCIENCE, 2009Q1 TO 2013Q3[5]

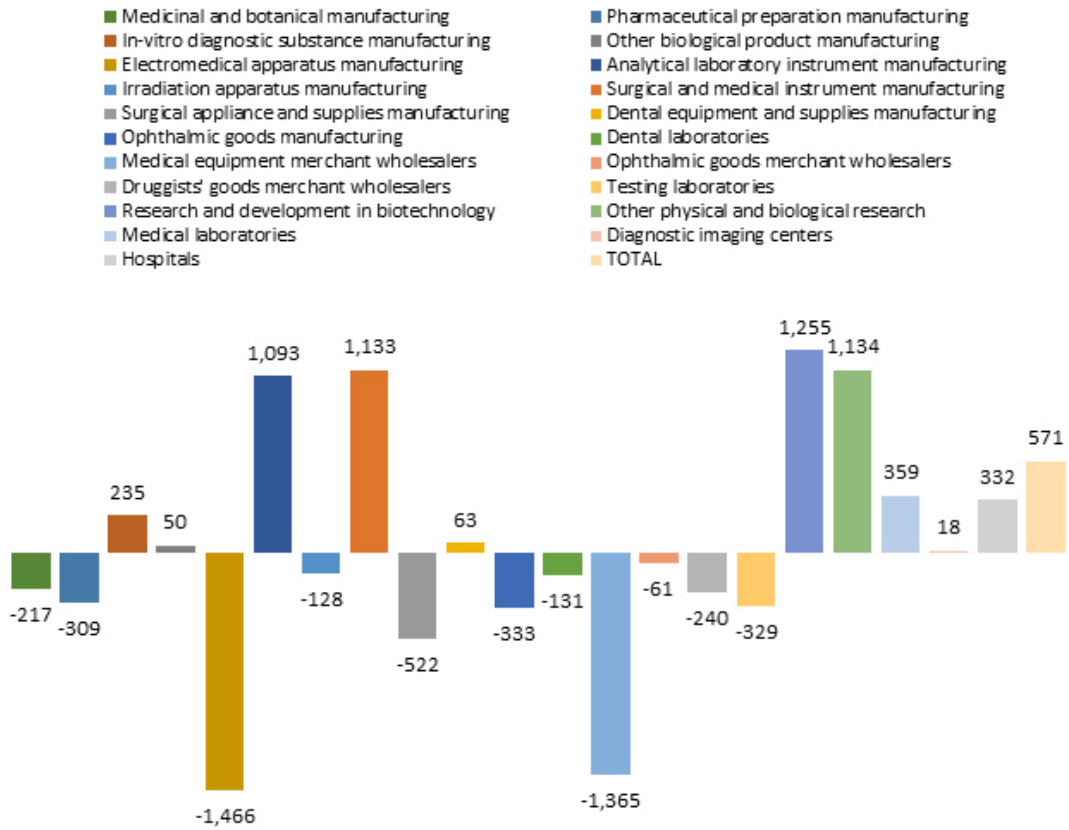


success, Massachusetts has not fared well in comparison to its competitor states.

Figure 6 demonstrates that the growth of life science jobs in Massachusetts between 2009Q1 and 2013Q3 badly trailed the overall growth of jobs in Massachusetts, notwithstanding the expenditure of hundreds of millions of dollars in public incentives. During that four-and-three-quarter year period, Massachusetts total employment grew by 6.2 percent, from 3.12 million to 3.32 million. Meanwhile, Massachusetts life science employment grew by only 0.7%, from 87,048 to 87,619, over the same period.

Figures 7 and 8 present job growth data showing how each of Massachusetts life science sectors performed between 2009Q1 and 2013Q3. The data below are based upon the definition of life science industrial sectors included in materials presented to the legislature by the Mass Life Science Collaborative (MLSC) in its 2007 PricewaterhouseCoopers "Superclusters" report advocating for passage of the life science legislation. Using the MLSC definitional base, Massachusetts had

FIGURE 7. JOB GROWTH, 2009Q1 TO 2013Q3, MLSC DEFINITION (GRAPHIC REPRESENTATION)



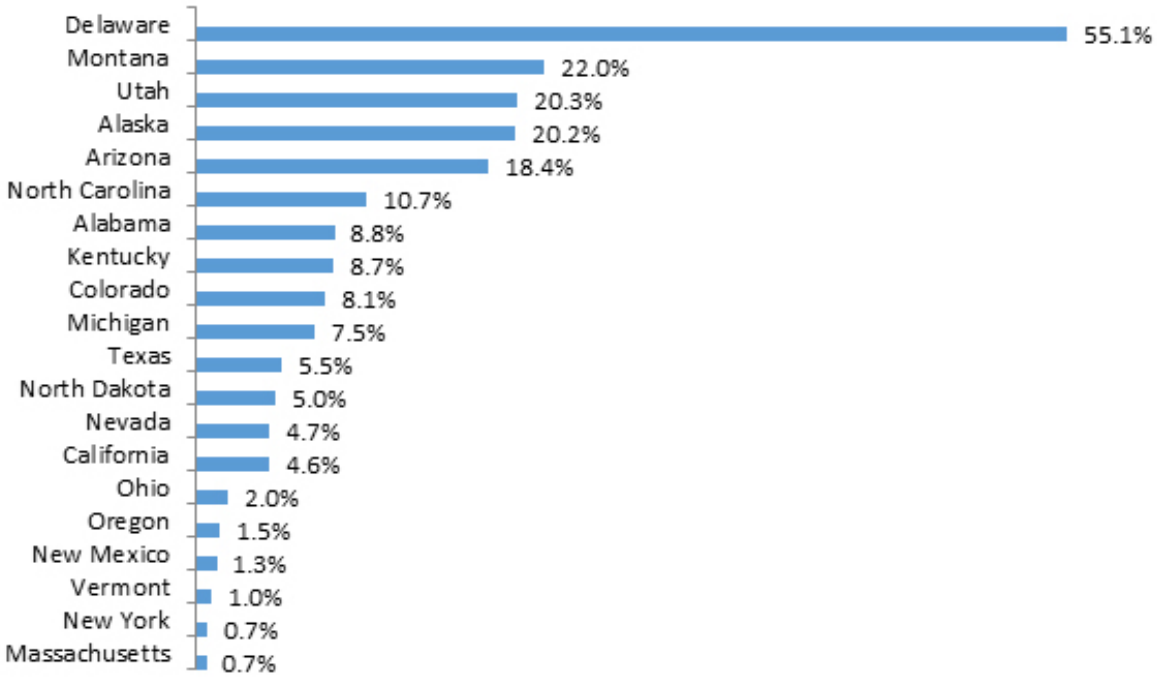
a net job growth gain of only 571 jobs between 2009Q1 and 2013Q3.

Figure 8 provides the raw data supporting Figure 7 in order of NAICS codes for the listed biotechnology sectors, the number of jobs in each subsector in 2009 Q1 and in 2013 Q3, the percentage of total employment attributable to life sciences within each sector and the job data. The NAICS codes and percentages are based upon the definition of life sciences used in the 2007 Mass Life Science Collaborative PricewaterhouseCoopers "Superclusters" report. This analysis shows how Massachusetts life science employment has fared since implementation of the life sciences initiative in the first quarter of 2009, measuring by the definitional standard employed by advocates of the legislation when the legislation was proposed.

FIGURE 8. JOB GROWTH, 2009Q1 TO 2013Q3, MLSC DEFINITION (RAW DATA)

NAICS Code	NAICS Industry Description	2009Q1	2013Q3	MLSC original method	2009Q1	2013Q3	Jobs +/-
325411	Medicinal and botanical manufacturing	433	216	100%	433	216	-217
325412	Pharmaceutical preparation manufacturing	7,182	6,873	100%	7,182	6,873	-309
325413	In-vitro diagnostic substance manufacturing	1,379	1,614	100%	1,379	1,614	235
325414	Other biological product manufacturing	638	688	100%	638	688	50
334510	Electromedical apparatus manufacturing	5,221	3,755	100%	5,221	3,755	-1,466
334516	Analytical laboratory instrument manufacturing	5,358	6,451	100%	5,358	6,451	1,093
334517	Irradiation apparatus manufacturing	1,048	920	100%	1,048	920	-128
339112	Surgical and medical instrument manufacturing	5,834	6,967	100%	5,834	6,967	1,133
339113	Surgical appliance and supplies manufacturing	2,575	2,053	100%	2,575	2,053	-522
339114	Dental equipment and supplies manufacturing	337	400	100%	337	400	63
339115	Ophthalmic goods manufacturing	1,104	771	100%	1,104	771	-333
339116	Dental laboratories	870	739	100%	870	739	-131
423450	Medical equipment merchant wholesalers	6,437	5,072	100%	6,437	5,072	-1,365
423460	Ophthalmic goods merchant wholesalers	359	298	100%	359	298	-61
424210	Druggists' goods merchant wholesalers	4,429	4,189	100%	4,429	4,189	-240
541380	Testing laboratories	7,072	3,415	9%	636	307	-329
541711	Research and development in biotechnology	26,682	27,937	100%	26,682	27,937	1,255
541712	Other physical and biological research	13,946	19,100	22%	3,068	4,202	1,134
621511	Medical laboratories	3,455	3,814	100%	3,455	3,814	359
621512	Diagnostic imaging centers	1,486	1,504	100%	1,486	1,504	18
622	Hospitals	189,254	196,634	4.5%	8,516	8,849	332
	TOTAL				87,048	87,619	571

FIGURE 9. LIFE SCIENCE JOB GROWTH 2009Q1 TO 2013Q3 IN MASSACHUSETTS AND COMPETITOR STATES, BY PERCENTAGE



State	Life Science employment 2009 Q1	Life Science employment 2013 Q3	Life Science +/-	
Massachusetts	87,048	87,619	571	0.7%
New York	111,036	111,839	803	0.7%
Vermont	2,448	2,473	25	1.0%
New Mexico	11,383	11,533	150	1.3%
Oregon	14,422	14,633	211	1.5%
Ohio	57,420	58,595	1,175	2.0%
California	260,320	272,387	12,067	4.6%
Nevada	7,656	8,016	360	4.7%
North Dakota	1,725	1,812	87	5.0%
Texas	101,343	106,866	5,524	5.5%
Michigan	51,847	55,752	3,904	7.5%
Colorado	30,911	33,427	2,516	8.1%
Kentucky	12,965	14,091	1,126	8.7%
Alabama	14,355	15,613	1,258	8.8%
North Carolina	66,828	74,009	7,180	10.7%
Arizona	25,200	29,846	4,647	18.4%
Alaska	1,268	1,524	256	20.2%
Utah	24,002	28,872	4,871	20.3%
Montana	2,286	2,788	503	22.0%
Delaware	5,574	8,647	3,073	55.1%

Figure 9 further suggests the very limited success of the life science initiative. The figure depicts life science job growth in Massachusetts and its leading competitor states since the start of the Commonwealth's $1 billion initiative, measured by percentage increase in life science employment. Between 2009Q1 and 2011Q3, Massachusetts life science employment increased by only 0.7%. Massachusetts ranked 20th among the states in life science job growth during this period.

Figure 10 reveals that Massachusetts ranked 13th among the states in life science job growth between 2009Q1 and 2013Q3, trailing its major competitors.

Figures 11 and 12 look at life sciences job growth in a different manner, as a percentage of overall state job growth. The figures once again focus on 2009Q1 and 2013Q3, the period subsequent to the passage of the Commonwealth's life sciences initiative. Figure 11 demonstrates that on this basis Massachusetts ranked 14th among the states by this measurement.

Figure 12 presents the raw data for the chart above. Between 2009Q1 and 2013Q3, Massachusetts' total employment grew fairly substantially, from 3,124,780 to 3,318,316, an increase of 193,536 jobs with a percentage

increase of 6.2%. During the same period Massachusetts added just 571 LS jobs. Therefore, LS job growth constituted 571 out of 193,536 added jobs, or 0.29% of total job growth (571/193536 = 0.29%). Thirteen other states had a higher percentage of LS job growth as a percentage of overall job growth over this period.

FIGURE 10. RANKING MASSACHUSETTS AND COMPETITOR STATES BY LIFE SCIENCE JOB CREATION, 2009Q1 TO 2013Q3[6]

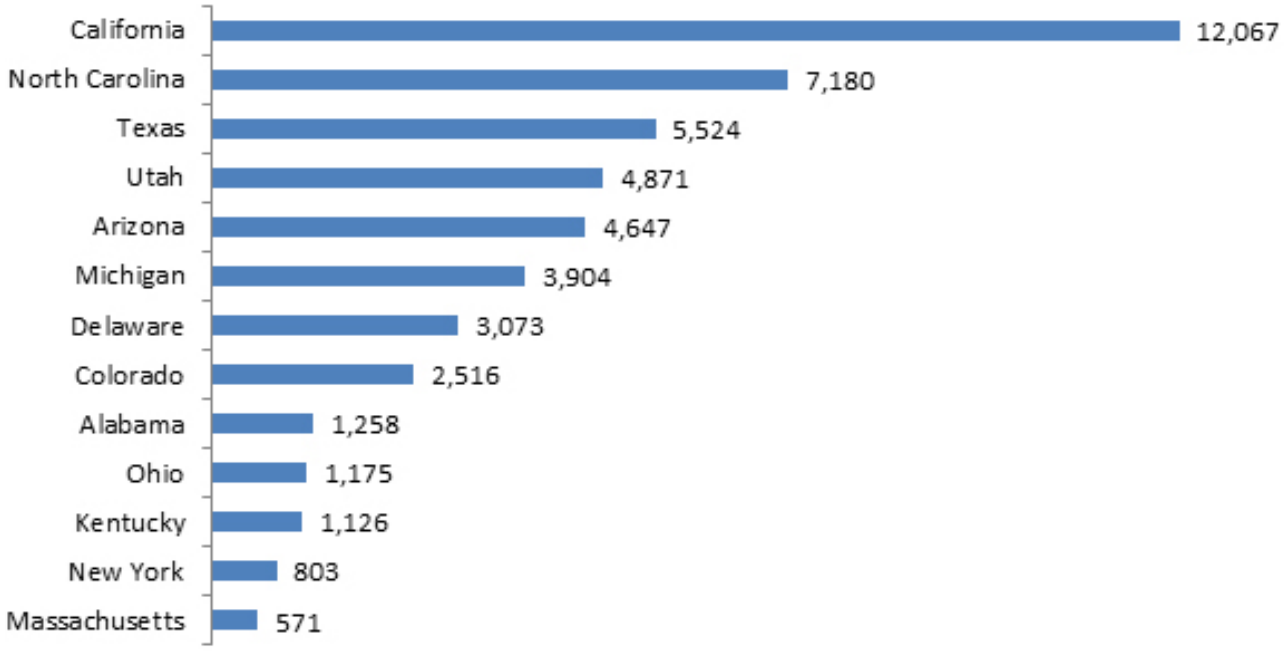


FIGURE 11. RANKING MASSACHUSETTS AND COMPETITOR STATES, LIFE SCIENCE GROWTH AS A % OF TOTAL STATE JOB GROWTH, 2009Q1 TO 2013Q3 (GRAPHIC REPRESENTATION)

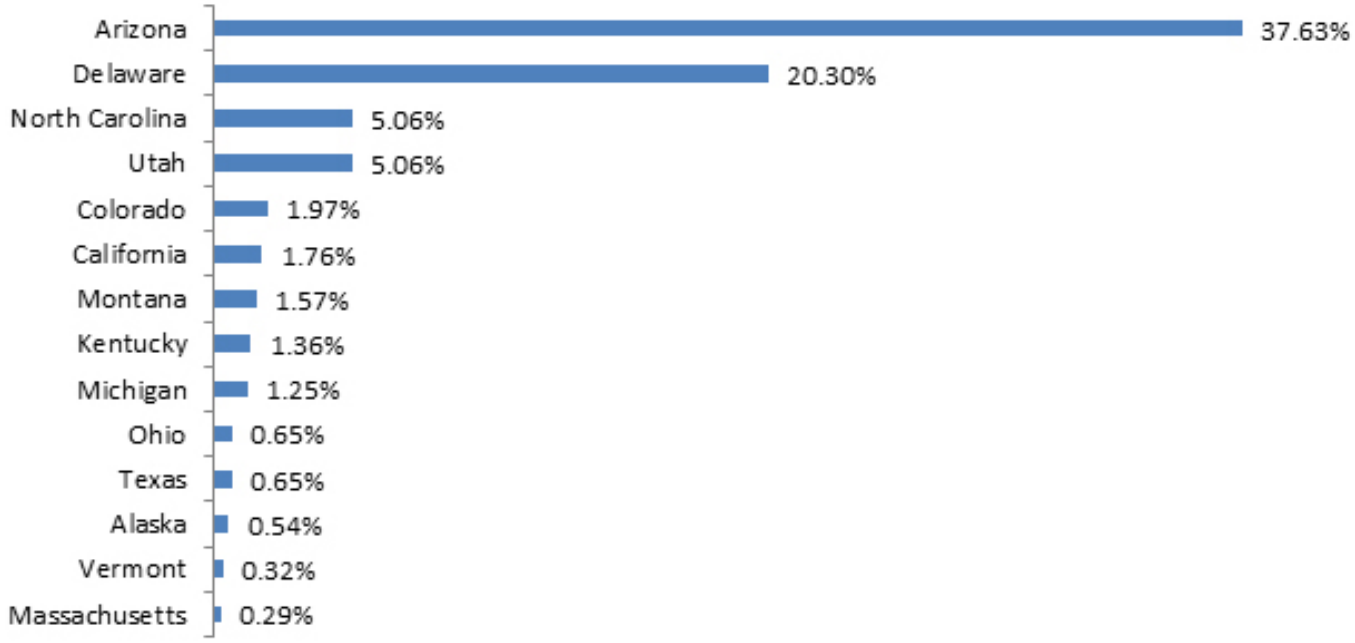


Figure 12. Ranking Massachusetts and Competitor States, Life Science (LS) Growth as a % of Total State Job Growth, 2009Q1 to 2013Q3 (raw data)

State	LS 2009Q1	LS 2013Q3	LS +/-	LS % increase	Total employ 2009Q1	Total employ 2013Q3	Total employ +/-	Total employ % increase	% new jobs due to LS
Arizona	25,200	29,846	4,647	18.4%	2,478,546	2,490,893	12,347	0.5%	37.63%
Delaware	5,574	8,647	3,073	55.1%	401,618	416,755	15,137	3.8%	20.30%
North Carolina	66,828	74,009	7,180	10.7%	3,864,469	4,006,389	141,920	3.7%	5.06%
Utah	24,002	28,872	4,871	20.3%	1,169,117	1,265,454	96,337	8.2%	5.06%
Colorado	30,911	33,427	2,516	8.1%	2,228,235	2,355,654	127,419	5.7%	1.97%
California	260,320	272,387	12,067	4.6%	14,841,772	15,526,446	684,674	4.6%	1.76%
Montana	2,286	2,788	503	22.0%	414,702	446,686	31,984	7.7%	1.57%
Kentucky	12,965	14,091	1,126	8.7%	1,711,499	1,794,481	82,982	4.8%	1.36%
Michigan	51,847	55,752	3,904	7.5%	3,756,866	4,069,658	312,792	8.3%	1.25%
Ohio	57,420	58,595	1,175	2.0%	4,966,678	5,147,505	180,827	3.6%	0.65%
Texas	101,343	106,866	5,524	5.5%	10,240,195	11,091,882	851,687	8.3%	0.65%
Alaska	1,268	1,524	256	20.2%	297,791	344,976	47,185	15.8%	0.54%
Vermont	2,448	2,473	25	1.0%	294,616	302,464	7,848	2.7%	0.32%
Massachusetts	87,048	87,619	571	0.7%	3,124,780	3,318,316	193,536	6.2%	0.29%

Thus far our analysis shows the results of the Commonwealth's life sciences initiative to be meager at best.

There are data that suggest some positive outcomes resulting from the life sciences initiative, especially as regards some sub-elements of the overall life sciences sector. In two of 21 life science sectors, "Research and development in biotechnology" (NAICS code 541711) and "Other physical and biological research" (NAICS code 541712), Massachusetts' job growth outperformed that of all other states with the exception of California. As figure 13 shows, California and Massachusetts added 4,237 and 2,389 life science research and development jobs respectively in the "Research and development in Biotechnology" and "Other physical and biological research" industry sectors between 2009Q1 and 2013Q3. In these two subsectors, Massachusetts' and California's job growth exceeded the total job growth of the other 48 states combined, suggesting that the Life Science Initiative has potentially had a positive impact in these industry sectors. In fact, it may have staved off job losses in as much as the other 48 states lost 2,004 jobs in these two subsectors over the period examined.

Figure 13. Between 2009Q1 and 2013Q3, Massachusetts and California Added Jobs in NAICS Sectors 541711 and 541712, While the Other 48 States Combined to Lose Jobs in These Sectors.

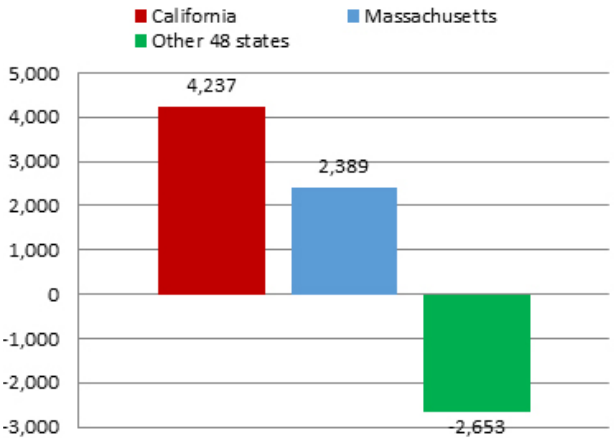


FIGURE 14. CALIFORNIA AND MASSACHUSETTS OUTPERFORMED THE OTHER 48 STATES IN THE INDUSTRY SECTORS ENTITLED "RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY" (NAICS CODE 541711) AND OTHER PHYSICAL AND BIOLOGIC RESEARCH (NAICS 541712) BETWEEN 2009Q1 AND 2013Q3.

State	NAICS 541711/541712	NAICS 541711/541712	NAICS 541711/541712
	Total 2009Q1	Total 2013Q3	+/-
California	41,177	45,414	4,237
Massachusetts	29,750	32,139	2,389
Other 48 states	159,616	156,963	-2,653

FIGURE 15. JOBS CREATED IN MASSACHUSETTS IN R&D IN BIOTECHNOLOGY (NAICS 541711) AND OTHER PHYSICAL & BIOLOGICAL RESEARCH (NAICS 541712) VS. JOBS LOST IN MASSACHUSETTS IN ITS OTHER 19 LIFE SCIENCES INDUSTRY SECTORS, 2009Q1 TO 2013Q3 (GRAPHIC REPRESENTATION)

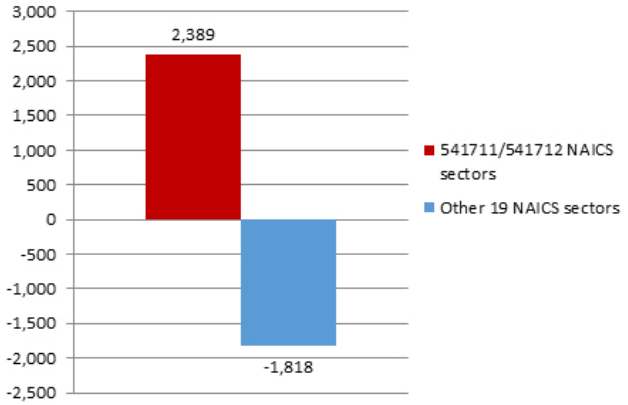


Figure 14 provides the raw data for the previous graph.

As Figure 15 shows, the drag on job creation in the life sciences comes from the job creation data in the other 19 industry elements of the life science sector. Massachusetts' gain of 2,318 jobs in the Research and Development in Biotechnology sector (NAICS code 541711) and Other Physical and Biological Research (NAICS code 541712) was offset by a net loss of 1,818 jobs in the 19 other life science sectors between 2009Q1 and 2013Q3, resulting in a net gain of only 571 jobs.

Figure 16 provides the raw data for the above graphic.

Figure 17 shows that Massachusetts led the nation in the Research and Development in Biotechnology industry sector (NAICS code 541711) prior to passage of the life science initiative. Between 2009Q1 and 2013Q3, Massachusetts retained its status as leader among the states in this sector. During this period, California narrowed Massachusetts' lead.

FIGURE 16. JOBS CREATED IN R&D IN BIOTECHNOLOGY (NAICS 541711) AND OTHER PHYSICAL & BIOLOGICAL RESEARCH (NAICS 541712) VS. IN THE OTHER 19 LIFE SCIENCES INDUSTRY CATEGORIES, 2009Q1 TO 2013Q3 (RAW DATA)

Massachusetts	2009Q1 jobs	2013Q3 jobs	+/-
541711/541712 NAICS sectors	29,750	32,139	2,389
Other 19 NAICS sectors	57,298	55,480	-1,818
TOTAL job gain	87,048	87,619	571

Figure 18 (next page) provides raw data for the Figure 17.

Figure 17. R&D in Biotechnology Jobs (NAICS 541711), by State, 2009Q1 to 2013Q3. Massachusetts Retained Number One Ranking in this Sector Over this Period.

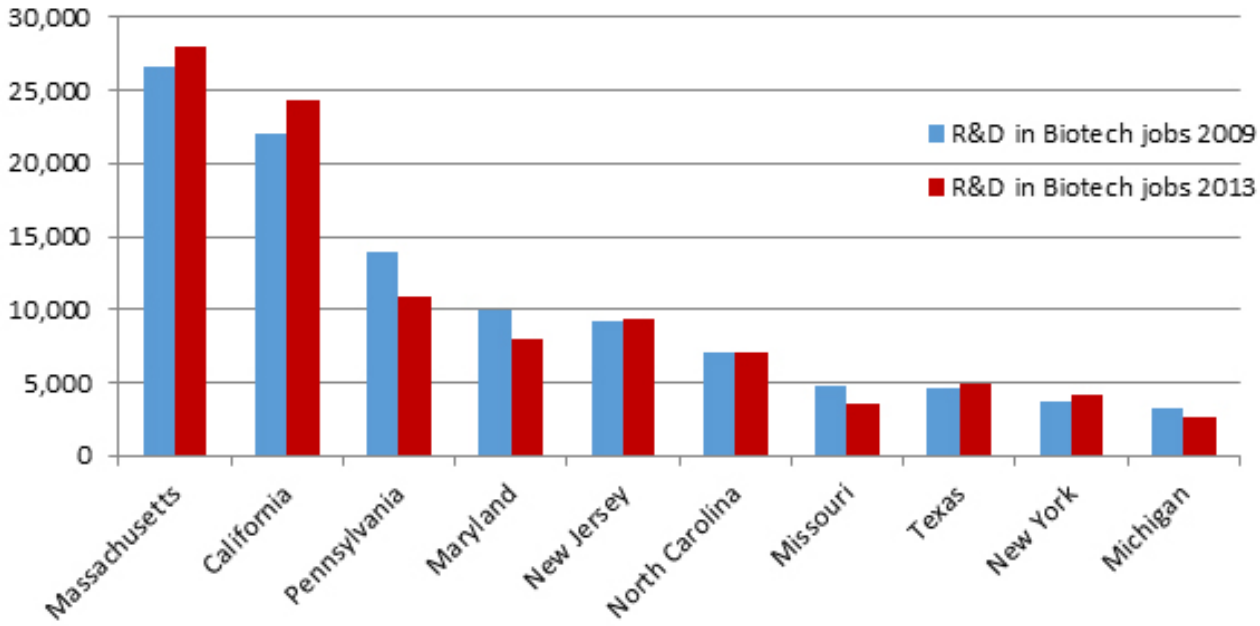


Figure 18.
R&D in Biotechnology Jobs (NAICS 541711), by State, 2009Q1 to 2013Q3 (raw data)

State	2009	2013	+/-
Massachusetts	26,682	27,937	1,255
California	22,042	24,290	2,248
Pennsylvania	14,000	10,818	-3,182
Maryland	9,976	7,900	-2,076
New Jersey	9,182	9,296	114
North Carolina	7,005	7,087	82
Missouri	4,685	3,453	-1,232
Texas	4,534	4,908	374
New York	3,709	4,185	476
Michigan	3,157	2,639	-518

Revisiting Two Reports on the Life Sciences Initiative

The 2013 MassBiotechnology Council Report

The MassBiotechnology Council issued a report in 2013 entitled "2013 Industry Snapshot" in which it reported on the recent performance of the life science initiative. This report used a revised definition of the Massachusetts life sciences sector than that which had been used in Mass Life Science Collaborative's (MLSC) report in 2007, dropping 11 NAICS industrial sectors that had incurred a net loss of 2,267 jobs between 2009Q1 and 2013Q3 and adding a new sector that had gained 186 jobs. This ex post facto redefinition had the effect of making the life science initiative look more effective than it would have looked had the earlier, pre-legislation, definition been used. By this revised definition, the size of all Massachusetts life science sectors totaled only 55,600 in 2009Q1, as compared to 87,048 by the earlier definition. By this scoped-down redefinition of life science industry sectors, Massachusetts gained 3,024 jobs, as compared to only 571 jobs by the earlier definition. By either definition, Massachusetts has fallen far short of the pre-legislation projection that the life science initiative would add 250,000 jobs in Massachusetts over a decade.

Figure 20. Biotechnology Jobs Created, Using MBC Revised Sector Definition, 2009Q1 to 2013Q3 (Graphic Representation)

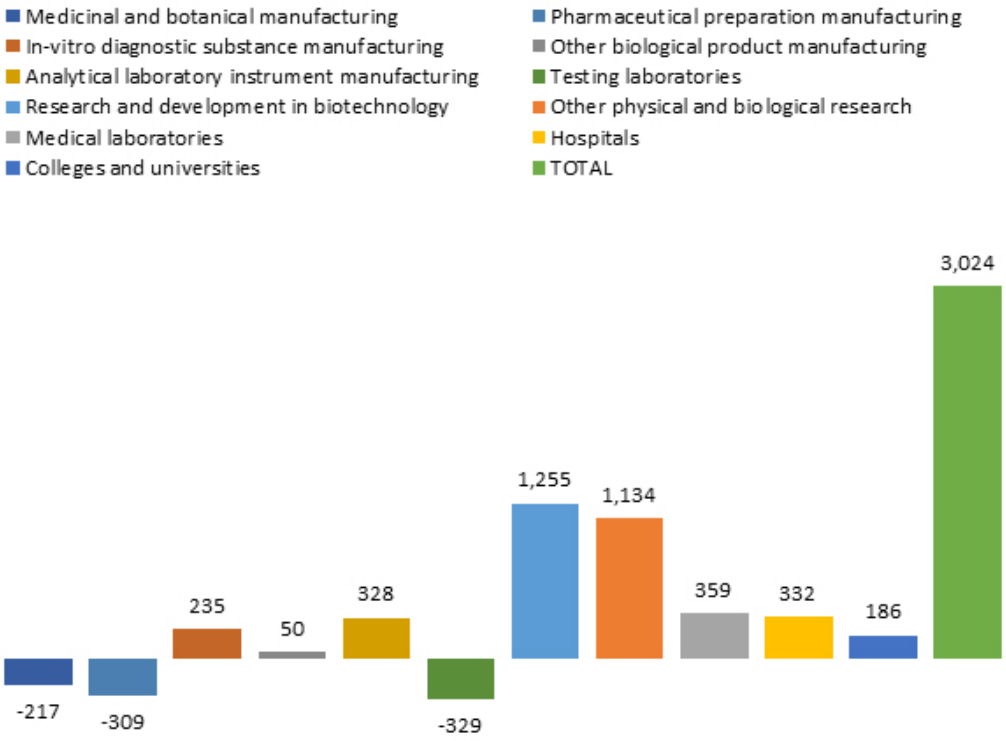


Figure 21. Biotech Jobs Created, Using MBC Revised Sector Definition, 2009Q1 to 2013Q3 (Raw Data)

Sector Code	Sector Description	2009Q1	2013Q3	MBC revised definition	MBC revised 2009Q1	MBC revised 2013Q3	MBC revised 2013-2009
325411	Medicinal and botanical manufacturing	433	216	100%	433	216	-217
325412	Pharmaceutical preparation manufacturing	7,182	6,873	100%	7,182	6,873	-309
325413	In-vitro diagnostic substance manufacturing	1,379	1,614	100%	1,379	1,614	235
325414	Other biological product manufacturing	638	688	100%	638	688	50
334516	Analytical laboratory instrument manufacturing	5,358	6,451	30%	1,607	1,935	328
541380	Testing laboratories	7,072	3,415	9%	636	307	-329
541711	Research and development in biotechnology	26,682	27,937	100%	26,682	27,937	1,255
541712	Other physical and biological research	13,946	19,100	22%	3,068	4,202	1,134
621511	Medical laboratories	3,455	3,814	100%	3,455	3,814	359
622	Hospitals	189,254	196,634	4.5%	8,516	8,849	332
61131	Colleges and universities	105,418	115,217	1.90%	2,003	2,189	186
	TOTAL				55,600	58,624	3,024

Figures 20 and 21 present data about Massachusetts life science job growth as measured by MassBiotechnology Council's revised 2013 definition of Massachusetts life science sectors.

Figure 21 provides raw data for the graphic above, starting with the NAICS codes for associated biotechnology sectors, followed by the number of jobs in the sector in 2009 Q1 and in 2013 Q3, the percentage of each NAICS code used in the MassBiotechnology Council revised definition of the life sciences sectors, and the job data based on those revised definitions.

The 2013 Boston Foundation–Northeastern University Report

In March 2013, the Boston Foundation (TBF) published a report written by Northeastern University professors/economists Barry Bluestone and Alan Clayton-Matthews entitled "Life Science Innovation as a Catalyst for Economic Development – The Role of Massachusetts Life Science Sector." The authors used a different set of NAICS codes to define the Life Sciences sector. As Figure 22 shows, by this TBF definition, Massachusetts gained 1,438 net jobs between FY2009Q1 and FY2013Q3.

Figure 23 (next page) presents the raw data for Figure 22.

Life Sciences Initiative: Winners and Losers

The life sciences initiative pertained to companies engaged in life science research, development, manufacturing, and commercialization and did not apply to the nearly two-thirds of commercial R&D activity currently performed by Massachusetts companies that is outside the life science sector.

The scope of the life sciences initiative legislation is largely determined by the following definitions:

> "Life sciences", advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including,

Figure 22. Biotechnology Jobs Created, Using TBF Revised Definition of the Sector, 2009Q1 to 2013Q3 (graphic representation)

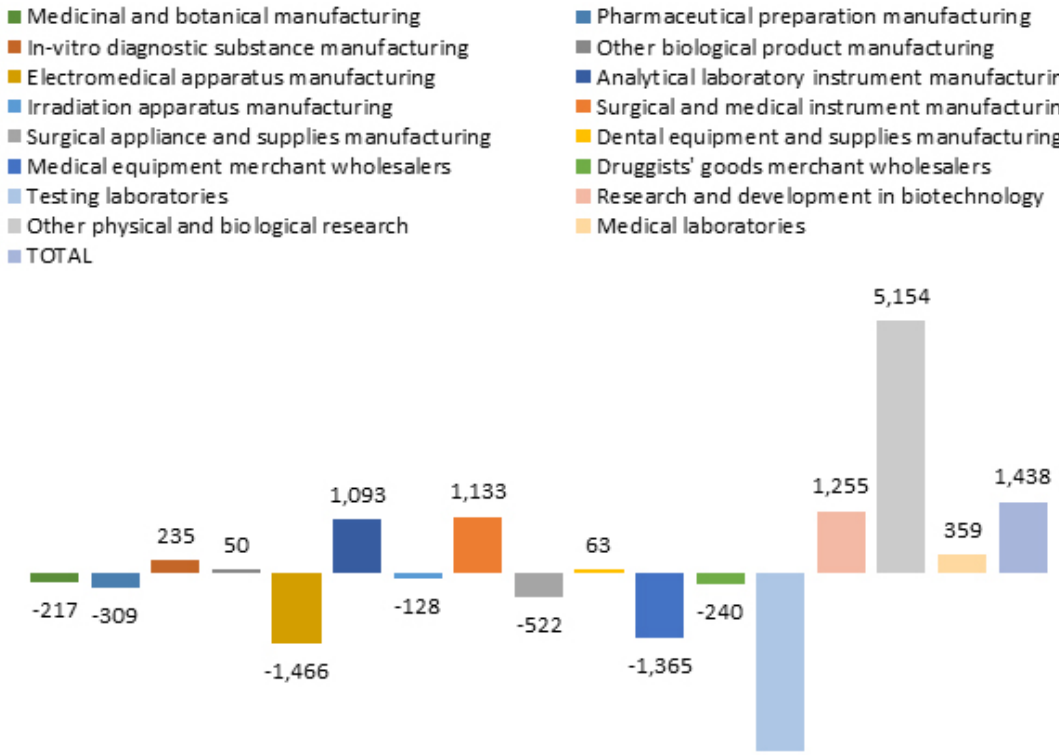


FIGURE 23. BIOTECHNOLOGY JOBS CREATED, USING TBF REVISED SECTOR DEFINITION, 2009Q1 TO 2013Q3 (RAW DATA)

Sector Code	Sector Description	MA 2009Q1	MA 2013Q3	TBF method	TBF 2009Q1	TBF 2013Q3	TBF 2013-2009
325411	Medicinal and botanical manufacturing	433	216	100%	433	216	-217
325412	Pharmaceutical preparation manufacturing	7,182	6,873	100%	7,182	6,873	-309
325413	In-vitro diagnostic substance manufacturing	1,379	1,614	100%	1,379	1,614	235
325414	Other biological product manufacturing	638	688	100%	638	688	50
334510	Electromedical apparatus manufacturing	5,221	3,755	100%	5,221	3,755	-1,466
334516	Analytical laboratory instrument manufacturing	5,358	6,451	100%	5,358	6,451	1,093
334517	Irradiation apparatus manufacturing	1,048	920	100%	1,048	920	-128
339112	Surgical and medical instrument manufacturing	5,834	6,967	100%	5,834	6,967	1,133
339113	Surgical appliance and supplies manufacturing	2,575	2,053	100%	2,575	2,053	-522
339114	Dental equipment and supplies manufacturing	337	400	100%	337	400	63
423450	Medical equipment merchant wholesalers	6,437	5,072	100%	6,437	5,072	-1,365
424210	Druggists' goods merchant wholesalers	4,429	4,189	100%	4,429	4,189	-240
541380	Testing laboratories	7,072	3,415	100%	7,072	3,415	-3,657
541711	Research and development in biotechnology	26,682	27,937	100%	26,682	27,937	1,255
541712	Other physical and biological research	13,946	19,100	100%	13,946	19,100	5,154
621511	Medical laboratories	3,455	3,814	100%	3,455	3,814	359
	TOTAL				92,026	93,464	1,438

but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.

"Life sciences company", a business corporation, partnership, firm, unincorporated association or other entity engaged in life sciences research, development, manufacturing or commercialization in the commonwealth, and any affiliate thereof, which is, or the members of which are, subject to taxation under chapter 62, 63, 64H or 64I.

Source: https://malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter130

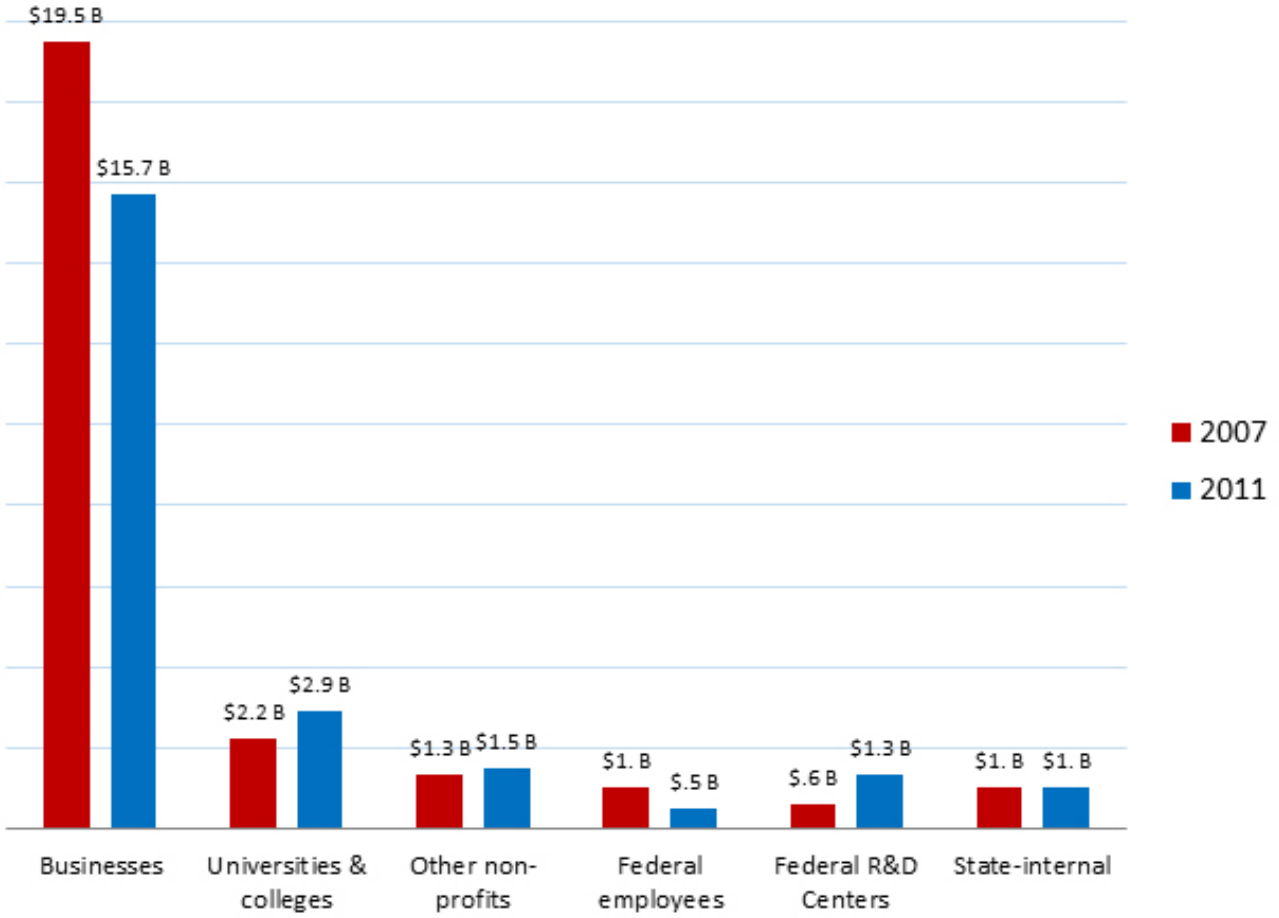
The NCSES reported that in 2010 Massachusetts companies performed $11.14 billion in company-funded R&D. Of that, approximately $6.9 billion was performed in R&D classifications not involving the life sciences. Other current Massachusetts R&D industry sectors include computer systems design, communications equipment, computer and electronic products, semiconductor and other electronic components, software design, data processing and hosting, architectural, engineering and related services, aerospace products and parts, plastics, rubber and industrial products, electrical equipment, appliances and components, and more than 30 other industry classifications.

While Massachusetts' life sciences legislation established the most advantageous incentives in the U.S. and broadened access to capital for the life science industry, it left other Massachusetts R&D industry clusters in the same disadvantageous position that the life sciences cluster had faced before passage of the law.

It is important to put the life sciences initiative into a broader perspective by examining how all segments of the Massachusetts R&D industry have fared since the law was passed in 2008. Figure 24 underscores that total R&D spending by Massachusetts entities declined from 2007, the year prior to passage of the life sciences initiative, and 2011, the most recent year for which national R&D data is published by the NCSES.

Notable in this graph is the 19.3 percent decline of total R&D spending by Massachusetts businesses from $19.5 billion in 2007 to $15.7 billion in 2011. Conversely, R&D spending at state universities and colleges increased from $2.2 billion to $2.9 billion over the same period, an increase of 35.8 percent. R&D expenditures at other non-profits, including medical research institutions, increased by 17 percent from $1.3 billion to $1.5 billion. The largest percentage increase occurred at Massachusetts' two federally funded research and development centers (FFRDCs), Lincoln Laboratory in Lexington and the National Security Engineering Center in Bedford, both sponsored by the U.S. Department of Defense. R&D expenditures in this sector rose from $0.6 billion in 2007 to $1.3 billion in 2011, a 109.2 percent increase. Another sector is the so-called federal intramural R&D, conducted by federal personnel at agencies of the U.S. government. R&D spending in this sector declined by half from $1 billion to $0.5 billion over the period. The final category,

FIGURE 24. TOTAL MASSACHUSETTS R&D EXPENDITURES, BY PERFORMING SECTOR, CYS 2007 & 2011



internal state government R&D, remained approximately constant at $1 billion.

These six categories account for all reported Massachusetts R&D spending, which declined from $24.6 billion in 2007 to $22.0 in 2011, a net decrease of 10.3 percent.

It might come as a surprise to many that Massachusetts R&D spending declined overall during the four years following passage of the life sciences initiative. Given that this period overlaps with the national recession, one might expect that Massachusetts' competitor states and the country as a whole experienced a similar decline, but that is not what the data shows, as Figures 25 and 26 demonstrate.

FIGURE 25. INCREASE (DECREASE) IN ANNUAL R&D SPENDING, 4 TOP R&D STATES, CYS 2007-11

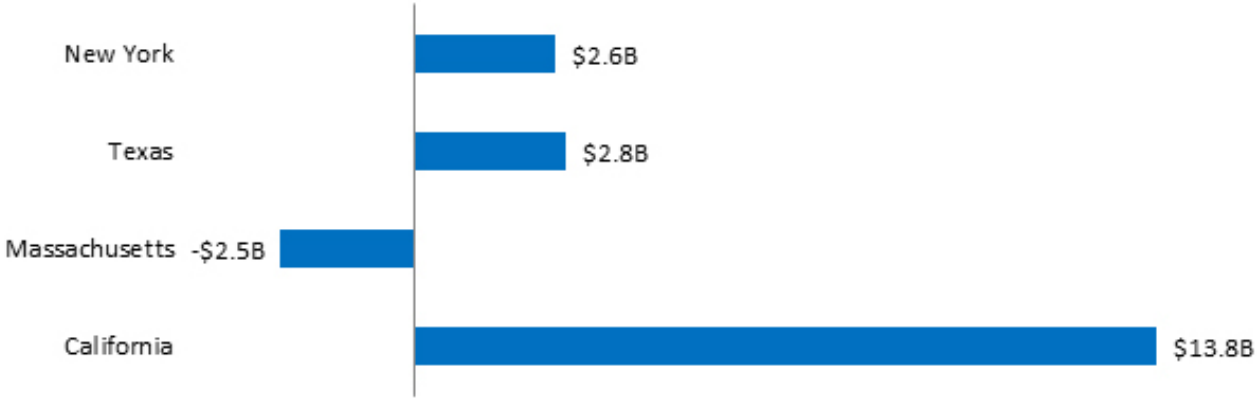
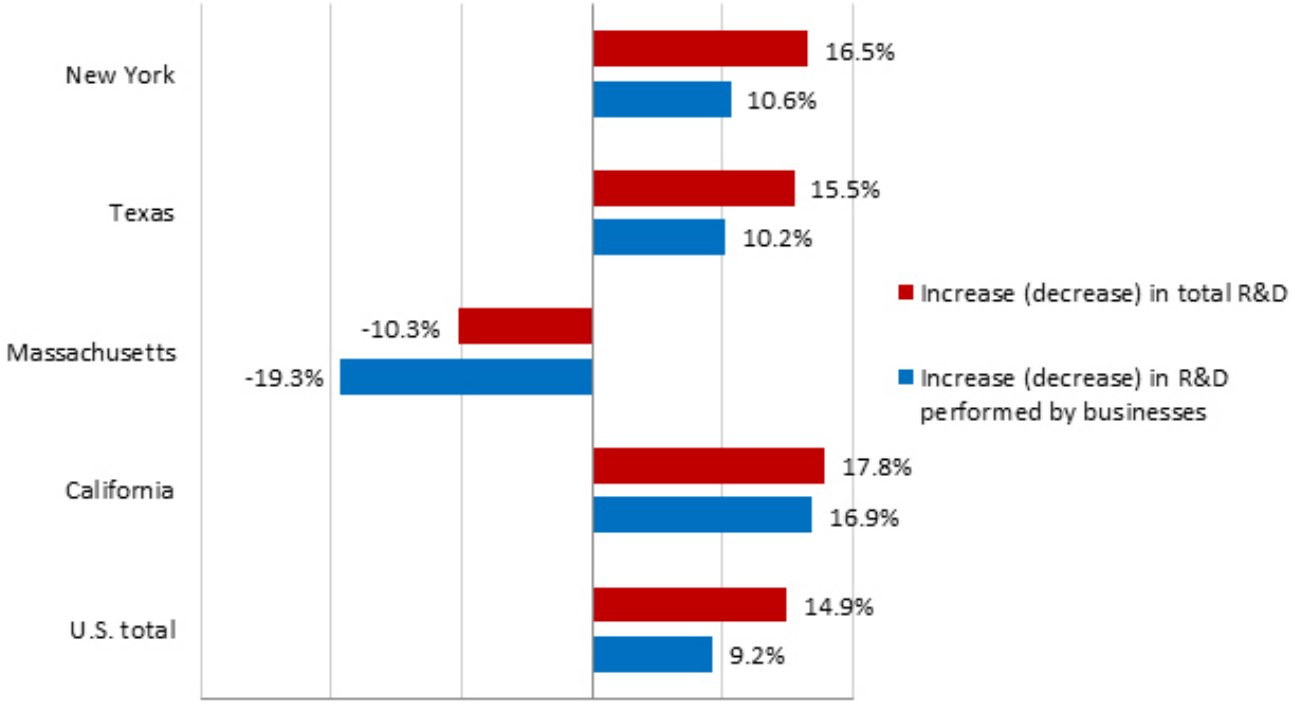


FIGURE 26. INCREASE (DECREASE) IN ANNUAL R&D SPENDING, 4 TOP R&D STATES & US, %, CY2007-11



These figures show that while Massachusetts' R&D spending fell more than 10 percent from 2007 to 2011, its four top competitor states and the United States as a whole experienced strong R&D spending growth, ranging from 14.9 percent to 17.8 percent. Likewise, R&D spending by businesses grew in competitor states and the U.S. at rates ranging from 9.2percent to 16.9 percent, while Massachusetts' declined by 19.3 percent.

These statistics are both surprising and troubling. They show that during the same period that R&D expenditures grew at Massachusetts universities by 35.8 percent, at non-profit entities by 17 percent, and more than doubled at federally funded research and development centers, Massachusetts was losing overall ground to its major competitor states at an alarming rate. Massachusetts' gains in non-profit R&D helped offset a 19.3 percent decline in business R&D, resulting in a net overall R&D decline of 10.3 percent. Because business is by far the largest sector when it comes to R&D spending in Massachusetts, large gains in its smaller sectors cannot compensate for a steep decline in business R&D. This is evidence of a larger problem.

The Competitive Strategy of Enhancing Traded Industry Clusters

According to Professor Porter's research, the key to regional economic prosperity is promoting the expansion of clusters of interconnected companies, suppliers, and service providers in industries that trade not only locally but across the country and the world. Well-known examples are the financial services cluster in New York City, Boston's medical devices cluster, the entertainment cluster in Hollywood, and the information technology cluster in Silicon Valley. Unlike local industries that provide goods and services to local customers and must be located in the sales and service area, traded industry companies are free to locate wherever they can get the best competitive advantage. Professor Porter's research shows that traded industry companies can gain a significant advantage by locating within existing regional clusters. He recommends that regions with existing traded industry clusters adopt a new economic development model aimed at increasing the economic competitiveness of traded industry clusters and thereby attract companies from around the country to take advantage by joining in.

Recommendations to Grow Massachusetts' R&D-Related Sectors

Massachusetts should focus on all its R&D industries, not just a relatively narrow swath of life sciences companies. Pioneer's review of current state R&D incentives (presented in Addendum A) identifies two steps Massachusetts could take to reestablish itself as having the nation's most favorable climate for R&D.

1) Adopt a Massachusetts Super R&D Tax Credit for substantially increased research and development conducted with state borders. Presently, 10 nations -not including the United States- and one state, Maine, offer a Super R&D tax credit for qualified research expenses greater than 150 percent of the prior three-year average expenses.

2) Adopt a Massachusetts Alternative Simplified R&D Credit (ASC), similar to the ASC allowed by the Internal Revenue Code. Presently, only Iowa offers a state-version of the ACS. This tax credit equals 12 percent of the excess of current-year qualified research expenses over 50 percent of the taxpayer's average qualified research expenses

Appendix A presents an overview of Massachusetts research and development tax incentives. Appendix B presents a summary of R&D Tax Credits of the 50 states and the District of Columbia from The Legislative Budget Board of Texas, as updated by Pioneer Institute. Appendix C presents a graph showing 12 nations that offer Super R&D tax credits. A super credit consists of an extra tax saving that can be claimed by companies with levels of research activity and/or a numbers of new employees over a set base amount. Appendix D presents data showing that Massachusetts ranked 13th among the states in life science job growth between 2009Q1 and 2013Q3, trailing its major competitors.

for the prior three years. For start-ups, the credit would equal 6 percent of current-year qualified research expenses. Empirical research has shown that R&D tax credits are effective in stimulating expansion of research activities and attracting and retaining companies involved in R&D. Massachusetts is in a strong position to attract R&D businesses due to its academic resources and its broad cluster of existing R&D firms.

Recommendation 1: A Super R&D Tax Credit

The Super R&D Tax Credit proposed by Pioneer Institute is modeled on the super credit for substantially increased research and development offered by the state of Maine.[7]

Explanation of Alternative Simplified Research and Development Credit proposal

- The super credit would be allowed for substantial expansions of research and development. A taxpayer qualifying for a research expense tax credit would be allowed an additional credit against the tax due equal to the excess, if any, of the qualified research expenses for the taxable year over the super credit base amount. "Super credit base amount" means the average amount spent on qualified research expenses by the taxpayer in the three taxable years immediately preceding the effective date of this act, increased by 50%. The super credit would apply only to the expenditures for research conducted in Massachusetts. The term "qualified research expenses" has the same meaning as currently defined in 830 CMR 63.38M.1: Massachusetts Research Credit.
- The credit would be limited to 50% of the taxpayer's tax due after the allowance of any other credits taken.
- A taxpayer entitled to a credit for any taxable year would be able to carry over and apply to the tax due for any one or more of the next succeeding five taxable years the portion, as reduced from year to year, of any unused credit, but in no event may the credit applied in any single year exceed 50% of the taxpayer's tax due after the allowance of any other credits taken pursuant to MGL Chapter 63, Section 38M.
- The credit would not be able to be used to reduce the taxpayer's tax liability to less than the amount of the taxpayer's tax due in the preceding taxable year after the allowance of any credits taken pursuant.
- In the case of corporations filing a combined return, a credit generated by an individual member corporation under the provisions of this section would have to be applied first against the tax due attributable to that company. A member corporation with an excess research and development credit would be able to apply its excess credit against the tax due of another group member to the extent that that other member corporation can use additional credits. Unused, unexpired credits generated by a member corporation would be able to be carried over from year to year by the individual corporation that generated the credit.

According to the Stanford Institute for Economic Policy Research study, Do R&D tax credits work? (2007); "We find evidence that tax incentives are effective in increasing R&D intensity. This is true even after allowing for permanent country-specific characteristics, world macro shocks and other policy influences. We estimate that a 10% fall in the cost of R&D stimulates just over a 1% rise in the level of R&D in the short-run, and just under a 10% rise in R&D in the long-run."

Recommendation 2: An Alternative Simplified Research and Development Credit

This proposal is modeled on Iowa Code § 422.10: Alternative Simplified research and development tax credit.[8]

The Information Technology and Innovation Foundation said about the ACS: "Increasing the rate of the Alternative Simplified Credit (ASC) from 14 to 20 percent would increase annual GDP growth by $66 billion and create at least 162,000 jobs." Source: The Information Technology and Innovation Foundation, 2012.[9]

Explanation of Alternative Simplified Research and Development Credit proposal

- In lieu of the credit amount computed in under MGL Chapter 63, Section 38M, a taxpayer could elect to compute the credit amount for qualified research expenses incurred in this state in a manner consistent with the alternative simplified credit described in section 41(c)(5) of the Internal Revenue Code. The taxpayer would be allowed to make this election regardless of the method used for the taxpayer s federal income tax. The election made under this paragraph is for the tax year and the taxpayer may use another or the same method for any subsequent year.
- For purposes of the alternate credit computation method, the credit percentages applicable to qualified research expenses described in section 41(c)(5)(A) and clause (ii) of section 41(c)(5)(B) of the Internal Revenue Code are four and fifty-five hundredths percent and one and ninety-five hundredths percent, respectively.
- For purposes of this proposal, an individual would be allowed to claim a research credit incurred by a partnership, S corporation, limited liability company, estate, or trust electing to have the income taxed directly to the individual. The amount claimed by the individual would be based upon the pro rata share of the individual s earnings of a partnership, S corporation, limited liability company, estate, or trust.
  - o For purposes of this section, base amount, basic research payment, and qualified research expense mean the same as defined for the federal credit for increasing research activities under section 41 of the Internal Revenue Code, except that for the alternative simplified credit such amounts are for research conducted within this state.
  - o For purposes of this section, Internal Revenue Code means the Internal Revenue Code in effect on January 1, 2012.
- Any credit in excess of the tax liability imposed less the amounts of nonrefundable credits allowed under this division for the taxable year would be refunded with interest computed. In lieu of claiming a refund, a taxpayer may elect to have the overpayment shown on the taxpayer s final, completed return credited to the tax liability for the following taxable year.
- An individual would be allowed to claim an additional research activities credit if the eligible business is a partnership, S corporation, limited liability company, or estate or trust which elects to have the income taxed directly to the individual.
- The department of revenue would be required by February 15 of each year to issue an annual report to the general court containing the total amount of all claims made by employers under this section and the portion of the claims issued as refunds, for all claims processed during the previous calendar year. The report would be required to contain the name of each claimant for whom a tax credit in excess of five hundred thousand dollars was issued and the amount of the credit received.

Conclusions

Massachusetts is in the enviable position of having the higher education, cluster and venture capital pieces to make the Bay State a true international powerhouse—and one that could add so much to the quality of life and prosperity of its people. We have in fact a comparative advantage given these built-in advantages. These were the considerations that drove policymakers in the 1990s to draft the start-of-the-art tax credit system for R&D investments, as well as the 2008 life sciences initiative. Massachusetts still possesses these core built-in advantages. But as this report demonstrates, the Bay State's spending trends on R&D suggest that we have not used policy and tax treatment of R&D investments to leverage real and sustained job growth or market share of R&D investment from around the country. We believe that part of this is related to taking our eyes off the ball, even as California put into place much more favorable policies toward the tax treatment of R&D investments; the other part of this is the political rather than economic approach to expanding R&D tax incentives. Our "picking of winners and losers"—

our selection of the life sciences and to some degree clean technology as favored industries leaves out of the equation two-thirds of those industries nationwide that attract R&D investments.

We find that California has taken the right path on tax treatment of R&D expenditures, and that there are two paths for Massachusetts to choose to compete and win greater market share and jobs in R&D-related sectors.

After measuring analysis up against recent analyses from the MassBiotechnology Council and The Boston Foundation/Northeastern University partnership, we find that the beneficial outcomes of the Life Sciences Initiative are disturbingly small. Job growth of 571 jobs across the entire life science industry is certainly an almost insignificant harvest from the hundreds of millions of dollars of the total Life Sciences package already spent.

While the life sciences sector has benefited to a limited extent, the remainder of Massachusetts R&D industries –representing the vast majority of R&D commercial enterprise here- has been left behind, even while California has surged dramatically ahead in the competition to attract and retain R&D enterprises and jobs. But the policies of the Commonwealth of Massachusetts are meant to benefit all of Massachusetts and all sectors of the economy. Given the upside of thinking big, thinking broad, and thinking about leveraging the power of Massachusetts' financial resources, institutions of higher education, and scientific clusters that cut across all industries, we can settle for the status quo. We can and should lead the world.

Appendix A. Overview of Research and Development Tax Incentives. Memorandum from Legislative Budget Board. Boston. Retrieved on 11/6/2013 at: http://www.lbb.state.tx.us/Other_Pubs/Overview%20of%20Research%20and%20Development%20Tax%20Incentives.pdf

Figure A1. Summary of the Massachusetts R&D Program

Tax Expenditure	Description of Tax	Tax Expenditure (in millions)		
		FY2011	FY2012	FY2013
Expensing of Research and Development Expenditures in One Year Income Tax for Economic competitiveness, targeted policy priorities	Individuals or investors in a trade or business may take an immediate deduction for research and development expenditures. For a more detailed description of this tax expenditure, see corporate excise item 2.308. Origin: IRC § 174	$1.2	$1.2	$1.2
Investment Tax Credit Corp&Bus Tax for Economic competitiveness, targeted policy priorities / R&D companies and Manufacturing	Manufacturing corporations and corporations engaged primarily in research and development, agriculture or commercial fishing are allowed a credit of 3% of the cost of depreciable real and tangible property. Such property must have a useful life of four years or more. The property must be used and located in Massachusetts on the last day of the taxable year. A corporation cannot take the credit on property which it leases to another. A corporation can take the credit on property which it leases from another (for property leased and placed in service on or after July 1, 1994). Generally, eligible corporate lessees making qualifying leasehold improvements may claim the credit. A corporation may carry over to the next succeeding 3 years any unused portion of its Investment Tax Credit (ITC). Origin: M.G.L. c. 63, § 31A (i), (j)	$57.2	$57.9	$56.5
Expensing of Research and Development Expenditures in One Year Corp&BusTax for Economic competitiveness, targeted policy priorities / R&D companies	Taxpayers may elect to treat research or experimental expenditures incurred in connection with a trade or business as immediately deductible expenses. Under generally accepted accounting principles, at least some of these costs would otherwise be treated as capital expenditures and depreciated or amortized over a period of years. Their immediate deduction results in a deferral of tax or an interest-free loan. Involves Corporations which made basic research payments and/or incurred qualified research expenses conducted in Massachusetts Origin: IRC, § 174	$47.6	$47.3	$61.1
Life Sciences Tax Incentive Program Corp&Bus Tax for Economic Competitiveness/ Life Sciences/Job Creation	On June 16, 2008, "An Act Providing for the Investment in and Expansion of the Life Sciences Industry in the Commonwealth" was passed. The Act establishes the Life Sciences Investment Program as well as the Life Sciences Tax Incentive Program. It provides for a $1B dollar investment in the life sciences sector, including $25 million each year for 10 years for the Massachusetts Life Sciences Investment Fund (subject to required authorizations by the Massachusetts Life Sciences Center and to approval by the Secretary of Administration and Finance). These incentives are effective from January 1, 2009 through December 31, 2018. Since the tax expenditures in this item will be subject to approval and their composition will differ from year-to-year, it is not known what proportion will be in the form of corporate tax credits as opposed to other tax expenditures. However, the Department of Revenue believes that the largest portion of the tax expenditure will be in the form of corporate tax credits, and therefore has placed it in this section of the tax expenditure budget. Since July 1, 2010, the Life Sciences Refundable Jobs Credit has been added to this program. The credit is applicable to insurance companies as well. Origin: M.G.L. c. 63, § 31M; 38CC; 38W; 38U Includes the Life Sciences Investment Tax Credit, the Life Sciences User Fee Credit and the Life Sciences Research Credit	$20.0	$20.0	$25.0

Tax Expenditure	Description of Tax	Tax Expenditure (in millions)		
		FY2011	FY2012	FY2013
Research Credit Corp&Bus Tax for Economic competitiveness, targeted policy priorities / R&D companies	A credit is allowed for corporations which made basic research payments and/or incurred qualified research expenses conducted in Massachusetts during the taxable year. A corporation taking the research credit is limited in the amount that can be taken against the excise in any year. The credit cannot reduce the tax to less than $456. The amount of credit is equal to: 100% of the first $25,000 of excise; and 75% of any amount of excise remaining after the first $25,000. The deduction allowed to a corporation for any research expenses generating a Massachusetts Research Credit must be reduced by the amount of the credit generated. This amount is added back to income on Schedule E, line 13. Any corporation which is a member of a combined group may share excess research credits with other members of the combined group. Corporations which are members of a controlled group or which are under common control with any trade or business (whether or not incorporated) are treated as a single taxpayer for purposes of determining the allowable Research Credit. The credit may be carried-forward for up to 15 years with certain restrictions. Origin: M.G.L. c. 63, § 38M	$ 116.3	$ 113.5	$110.9
Exemption for Materials, Tools, Fuels and Machinery Used in Research and Development Sales Tax for Economic competitiveness, Structural (Avoid Tax Pyramiding)	Materials, tools, fuels and machinery, including spare parts, used in research and development by certified manufacturing or research and development corporations are exempt from sales tax. Origin: M.G.L. c. 64H, § 6(r) and (s)	$ 76.2	$ 80.2	$ 86.3

APPENDIX B.

The Legislative Budget Board of Texas (LBB), on January 2013, published a report which presented the main features as well as the costs and benefits of the federal and state R&D tax incentives. Attached is a summary table taken from this report which compares the tax incentive programs offered by each state. Changes made to state-level R&D tax incentive programs after the LBB published this report were added in italics by Pioneer Institute.

State	Business Tax Incentive	Sales Tax Incentive	Notes
Alabama	None.	None.	No specific R&D credit. A business that falls in certain research related NAICS industries is eligible for a capital investment tax credit of up to 5% of initial capital costs for qualifying projects and is eligible for an abatement of all state and local non-educational portion of the construction related sales tax associated with equipping and constructing a qualified project.
Alaska	Alaska adopts the federal credit by reference. Taxpayers are eligible to claim 18% of the amount of federal credit attributable to Alaska. Credits may be carried forward for 15 years.	Alaska does not levy a sales tax.	In early 2012, the Alaska House passed a bill implementing a R&D credit similar to the federal credit, but the bill failed to advance in the Senate.
Arizona	Beginning in 2011, a business may claim the Credit for Increased Research Activities equal to 24% of the first $2.5 million of qualifying expenses (follows the federal definition) plus 15% of the qualifying expenses in excess of $2.5 million. The credit is capped at $2.5 million and unused credits may be carried forward for 15 years. Previously the credit was non-refundable, however beginning in 2011 a small business (< 150 employees) may apply for a partial refund of up to 75% of the unused credit. Beginning in 2011 a business may claim an additional credit of 10% of basic research payments to an Arizona state university.	Machinery or equipment used in R&D is exempt from the Transaction Privilege Tax	In 2018, the percentage credit amounts will revert to 20% and 11% for amounts below and in excess of $2.5 million, respectively.
Arkansas	A business may claim a credit of 20% of its excess qualified research expenditures (same as the federal credit). The credit is nonrefundable, non- capped, and unused credits may be carried forward for 9 years. Arkansas has a larger business tax R&D credit for 3 types of research: A business that (1) contracts with a state university in performing research, (2) is in one of 6 sectors deemed a "targeted business" (generally start-up tech companies), or (3) a business performing research in an "area of strategic value" to the state may claim a credit of 33% instead of the normal 20% offered to all businesses.	None	Arkansas businesses must apply to the Economic Development Commission to receive a R&D tax credit. The business must re-apply every 5 years to continue to claim the credit.
California	The state has a credit for both the personal and corporate income tax for qualified research expenditures above a computed base amount. The credit is 15% and is non- refundable, but unused credits may be carried forward to future years. In addition, corporations may claim a credit of 24% of payments to qualified organizations for basic research.	*See update.*	California generally follows the federal definition of "qualified research expenditure" with some modifications, such as the definition of a "qualified organization" and the definition of gross receipts. *Update: In 2013, California enacted an exemption from sales tax for manufacturing and research development limited to the first $200 million of purchases made during the calendar year. Not applicable to local sales and use taxes.*
Colorado	Non-refundable income tax credit equal to 3% of expenditures on research and experimental activity above the average of those expenditures in the prior two years. The research and expenditure definition is based on the federal definition, but is not as strict. 25% of the earned credit may be claimed in the year it is earned and in each of the 3 following years.	None. *Update: In 2013, Colorado enacted a 2.9% refund on sales and use taxes for firms in the biotechnology, clean technology and/or medical devices industries.*	Research activity must be performed in an enterprise zone. The credit must be pre-certified by the zone administrator prior to the research expenditures being made. Prior to 2010, taxpayers were eligible for a refund of sales and use tax paid for property used in R&D if state revenue collections exceeded a certain level (TABOR), however this provision was repealed in 2010.
Connecticut	Includes 3 different business tax credits. (1) 20% of the research and experimentation expenditures (those that may be deducted under Section 174 of the Internal Revenue Code) that exceed the prior year. Credit is non-refundable but may be carried forward 15 years. (2) 25% of the amount spent on grants to Connecticut institutions of higher	50% exemption for machinery and equipment used in R&D In furtherance of manufacturing	If a company claims credit (3) and either (1) or (2), they must the amount of allowable expenditure claimed for credit (3), by the amount of excess expenditures they claimed for either (1) or (2).

	education for performing R&D activities. (3) A credit may be taken for the total R&D expenses made in a year, with the definition of expenditures including those deductible under Section 174 of the Internal Revenue Code and those defined under Section 41 of the Internal Revenue Code. The amount of the credit increases ratably with the amount of expenses made, starting at 1% for less than $50 million of expenses and increasing up to 6% for expenses exceeding $200 million. Qualified small businesses are eligible for the 6% credit regardless of total expenditures. No more than 1/3 of the amount of credit earned may be claimed in a year and the amount of credit claimed may not exceed 50% of tax liability, but unused credits may be carried forward to future years.	tangible personal property.	
Delaware	Taxpayers are eligible to claim a credit equal to either (1) 10% of their qualified R&D expenditures over a base amount, or (2) 50% of the amount of their federal R&D tax credit apportioned to	Delaware does not levy a sales tax.	Taxpayers must apply to the Director of the Department of Revenue to claim the credit. The tax credit currently sunsets on December 31, 2013.
Florida	Credit equals 10% of qualified research expenses over the average of qualified research expenses made in the preceding 4 years. The definition of qualified research expenses follows the federal definition in Section 41 of the Internal Revenue Code. Credits may not exceed 50% of tax liability in a year, and unused credits may be carried forward for 5 years. Total credits taken by all taxpayers may not exceed $9 million in any one year.	Tangible personal property for use directly and solely in R&D is exempt for the state sales tax. Machinery and equipment used predominately for R&D are exempt from the state sales tax.	The credit was enacted in 2011 and will be first available for tax year 2012, making it the newest state R&D tax credit.
Georgia	If a taxpayer claims a federal R&D tax credit, they are eligible for a state credit of 10 percent of qualifying research expenses above a base amount. Qualifying research expenses follow the federal definition in Chapter 41 of the Internal Revenue Code, except that all wages paid and services and supplies purchased must be made in Georgia. The base amount is the current year Georgia gross receipts multiplied by the average ratio of state research expenses to state gross receipts for the prior 3 years, or 0.3, whichever is less. Credits may not exceed 50% of tax liability in a year, and unused credits may be carried forward for 10 years.	None.	New business enterprises in their first 5 years can use unused credits against state payroll withholding. *Update: On May 3, 2012, Georgia signed into law the "Income tax credits" bill, which extended the "credits against payroll withholding" feature of the incentive to all qualified companies with an emphasis on the alternative energy, biomedical, biotechnology and telecommunications industries.*
Hawaii	None. *Update: on July 9, 2013, Hawaii introduced a 20% credit on qualified research expenses through the bill "Relating to economic development". The bill also included a High Technology Business Investment Tax Credit, which offered an 80% income tax credit to investors in high technology businesses of Hawaii. The investment credit is capped at $2 million per qualified business year. The new business and investment tax incentives are scheduled to sunset in 2019.*	None.	Hawaii previously provided a 20% refundable credit for qualified research activities, which expired on December 31, 2010.
Idaho	Non-refundable credit of 5% of qualified research expenses for research conducted in Idaho over the base amount and 5% of basic research payments. Qualified research expenses, base amount, and basic research payment definitions follow section 41 of the Internal Revenue Code. Credits may be carried forward for 14 years.	Tangible personal Property primarily used in R&D activities is exempt from the state sales tax.	
Illinois	Non-refundable credit of 6.5% of qualifying research expenditures above the average of the previous three years qualifying research expenditures. Qualifying research expenditures follow the definition in Section 41 of the Internal Revenue Code. Unused credits may be carried forward for 5 years.	None.	Illinois recently extended the sunset date of its research tax credit from 2011 until 2016. In the past, Illinois provided an exemption from the sales tax for tangible personal property used in R&D from July 1, 2007 to June 30, 2008.
Indiana	Research expense credit is equal to 15% of the first $1 million of qualified research expenses over a base amount and 10% of excess qualified research expenses above $1 million. Qualified research expense follows the definition in section 41 of the Internal Revenue Code; however, the base amount is a modification of the federal definition by including only Indiana qualified research expenses and gross receipts in the calculation of the taxpayers fixed base percentage and average annual gross receipts. The credit is non-refundable and may be carried forward for 10 years.	Beginning June 30, 2007 tangible personal property used for R&D equipment is exempt from the sales tax.	Indiana allows taxpayers engaged in aerospace manufacturing to use the alternative computation allowed under the federal credit definition.

Iowa	Research Activities Credit equal to 6.5% of qualified research expenditures in the state above a base amount. Qualified expenditures and base amount definitions follow section 41 of the Internal Revenue Code. The credit is refundable. Certain taxpayers can apply to the Economic Development Authority to receive a Supplemental RAC that can be as high as 10% depending on the size of the business.	The sale of computers, machinery, and equipment directly and primarily used in R&D of new products or processes of processing is exempt from the state sales tax.	Taxpayers can elect to calculate the credit using the Alternative Simplified Credit calculation, similar to the federal version of the ASC. No prior approval for the credit is required unless the taxpayer wishes to claim the supplemental credit.
Kansas	Credit for qualified R&D expenditures equal to 6.5% of expenditures over the average of the current year and prior 2 years expenditures. Qualified expenditures definition follows the federal definition in section 41 of the Internal Revenue, with some exceptions. Credit is non- refundable and 25% of the total amount of credit may be used in a single year. Unused credits may be carried forward until all of the credit is used.	None.	*Update: Beginning 2013, the credit will only be available to C corporations (corporations subject to Kansas corporate income tax)*
Kentucky	Non-refundable income tax credit equal to 5% of the qualified costs of constructing, remodeling, or equipping, or expanding facilities conducting qualified research. Unused credits may be carried forward for 10 years. The definition of qualified research follows section 41 on the Internal Revenue Code.	Companies can apply for a refund of sales tax on R&D equipment for certain economic development projects with a minimum $500 thousand investment.	Total sales tax refunds for all projects may not exceed $5 million in a single year.
Louisiana	Refundable tax credit based on the number of employees of the taxpayers. Qualified research expenses follow the federal definition in section 41 of the Internal Revenue Code. The base amount equals 70% of the annual average of qualified research expenses made in the preceding 3 years. If a company employees: (1) over 100 employees the credit is 8% of the qualified research expenses in the state in excess of the base amount, (2) between 50 and 99 employees the credit is 20% of the qualified research expenses in the state in excess of the base amount, or (3) less than 50 employees the credit is 40% of the qualified research expenses in the state.	None.	The credit is scheduled to sunset in 2019. All taxpayers must apply to the Department of Economic Development to receive the credit.
Maine	Non-refundable Research expense credit equals to 5% of qualified research expenses in the state over a base amount plus 7.5% of basic research payments in the state. Qualified research expenses and basic research payments follow the definition in section 41 of the Internal Revenue Code. Base amount is the average of qualified research expenditures for the prior 3 years. If tax liability exceeds $25,000, the credit cannot reduce tax liability below 75% of the amount of tax liability above 25,000, and unused credits may be carried forward for 15 years. Taxpayers can also receive a "super credit" equal to the qualified research expenditures in excess of 1.5 times the base amount. Super credits are limited to 50% of the taxpayer's tax liability and may be carried forward for 5 years.	Sale of machinery and equipment for use in a statutorily defined list of R&D purposes is exempt from the state sales tax.	Individual entities of a combined group can give unused credits to other entities within the group.
Maryland	Taxpayers are eligible a non-refundable credit equal to 3% of total qualified research and expenditure expenses in the state that are less than the base amount plus 10% of qualified research and expenditure expenses in the state in excess of a base amount. Qualified research and expenditure expenses and the base amount follow the federal definition in section 41 of the Internal Revenue Code, adjusted for expenses in Maryland. Unused credits may be carried forward for seven years.	The sale of tangible personal property for use in statutorily defined R&D activities is exempt from the state sales tax.	Taxpayers must file an application with the Department of Business and Economic Development to receive the credit. The total credit amount awarded to all taxpayers cannot exceed $6 million in a given year. The credits are scheduled to sunset in 2020. *Update: Starting December 15, 2013, some small business will be able to receive a refund instead of the credit. Maryland also increased the total amount awarded to taxpayers from $6 million to $ 8 million. The Maryland biotechnology investment tax credit was extended to companies that have been active for more than 10 years.*

Massachusetts	Business corporations are eligible for a credit of 10% of qualified research expenses over a base amount, and 15% of basic research payments made to research organizations in the state. Qualified research expenses, base amount, and basic research payments all follow the federal definition in Section 41 of the Internal Revenue Code, except only apply to instate expenses. The credit may not reduce a taxpayer's liability below $456 and a taxpayer cannot earn a credit greater than the first $25,000 of tax liability and 75% of any liability over $25,000. Unused credits may be carried forward for an unlimited amount of time.	Sales of materials, tools, fuels, and machinery used directly and exclusively by a R&D corporation are exempt from the state sales tax.	Beginning in 2009, a company certified as a "life science company" is eligible for a refund of 90% of any unused research and expense credits in a given year. Life science companies include areas such as biomedical engineering, medical devices, pharmaceuticals, and stem cell research.
Michigan	None.	Tangible personal property used for industrial processing is exempt from the state sales tax. The statutory definition of industrial processing includes research and experimental activities.	Michigan previously allowed a 1.9% R&D credit under the Michigan Business Tax. The MBT was replaced in 2012 with a 6% corporate income tax that does not include a R&D credit.
Minnesota	A refundable credit equal to 10% of first $2 million of qualified research expenses over the base amount plus 2.5% of the qualified research expenses in excess of $2 million over the base amount. Qualified research expenses and base amount follow the definition if Section 41 of the Internal Revenue Code, with adjustments made to include only expenses made in the state.	Machinery and equipment used for R&D is exempt from the sales tax.	Minnesota made its credit refundable in 2010 and added more entities to the list that was eligible to receive the credit.
Mississippi	Business or corporation may claim a tax credit of $1,000 for each full time employee requiring R&D skills for a 5 year period. There is no limit on the number of employees, but the total amount of credit may not exceed 50% of tax liability. Unused credits may be carried forward for 5 years.	None.	Taxpayers must apply to the Department of Revenue to be eligible for the Research and Development Skills Tax Credit.
Missouri	None.	Tangible personal property and utilities purchased for use or consumption directly or exclusively in the R&D of agricultural, biotechnology, plant genomics products, or prescription pharmaceuticals consumed by humans or animals are exempt from the state sales tax.	Missouri previously had a 6.5% incremental credit that expired on January 1, 2005.
Montana	A R&D company is not subject to corporate income taxes for the first 5 years of activity in the state.	Montana does not levy a sales tax.	Montana previously had a 5% incremental, non-refundable tax credit that expired on December 31, 2010.
Nebraska	Two credits are available. (1) A refundable credit equal to 15% of the incremental qualified expenditures federal credit as defined by Section 41 of the Internal Revenue Code and (2) A refundable credit equal to 35% of the basic research payment federal credit as defined by Section 41 of the Internal Revenue Code made to a college or university in Nebraska. Only qualified research expenses made in Nebraska qualify for the credit. The amount of credit may also be used to claim a refund of sales and use tax paid by the taxpayer	None.	Beginning in 2009, all taxpayers claiming the credit must use the E- verify system to verify the work eligibility status of all employees hired in the year the credit is claimed.
Nevada	Nevada does not levy a business tax.	None.	
New Hampshire	Non-refundable credit equal to 10% of the qualified manufacturing R&D expenses. Total credit for a single taxpayer may not exceed $50,000 and unused credits may be carried forward for 5 years. Qualified manufacturing R&D expenses and the base amount definitions follow Section 41 of the Internal Revenue Code, except that statutory	New Hampshire does not levy a sales tax.	Taxpayers must apply to the Commissioner of Revenue Administration to be eligible to claim the credit. Total amount of credits awarded to all taxpayers may not exceed $1 million in any one year. The credit

	adjustments are made to include only the manufacturing industry.		was scheduled to expire on July 1, 2013, however the sunset date was recently extended until 2015. *Update: In August 2013, New Hampshire made its business tax credit permanent and increased the total amount of credits available to all taxpayers from $1 million to $2 million.*
New Jersey	Non-refundable credit equal to 10% of the qualified research expenses in the state over the base amount and 10% of the basic research payments made in the state. Qualified research expenses, base amount, and basic research payment definitions follow Section 41 of the Internal Revenue Code. Unused credits may be carried forward for 7 years.	Sales of tangible personal property, except energy, and digital property purchased for use or consumption directly and exclusively in R&D in the experimental or laboratory sense are exempt from the state sales tax.	Prior to 2012, the amount of credit claimed in a year could not exceed 50% of tax liability. Beginning in 2012, the amount of credit can reduce tax liability by greater than 50%, as long as tax liability does not fall below the statutory minimum amount of tax due in the state.
New Mexico	A credit for a qualified R&D small businesses equal to sum of all gross receipts taxes or 50% of withholding taxes paid on behalf of employees during a reporting period. To be a small business a business must employ less than 25 employees and have total revenue of no more than $5 million.	None.	The tax credit expired on June 30, 2009 and was inactive for 2 years. The credit was reenacted on July 1, 2011 and will sunset on June 30, 2015.
New York	Taxpayers must apply to Empire State Development to participate in the Excelsior Jobs Program. If approved, taxpayers may claim a credit for R&D expenses made in New York equal to 50% of their federal research and experimentation credit claimed under Section 41 of the Internal Revenue Code. The credit is capped at 3% of total research and expenditure expenses made in New York. Unused credits may be carried forward for 10 years.	Fuel oil, gas, electricity, refrigeration, and steam; and gas, electric, refrigeration, and steam service used directly and exclusively in R&D is exempt from the state sales tax. Tangible personal property used or consumed directly in R&D is exempt from the sales tax.	The state previously had a 9% credit for qualified research expenses made by qualified emerging technology companies that met certain conditions. The credit expired on December 31, 2011.
North Carolina	Credit for qualified North Carolina research expenses of (1) 1.25% of expenses less than $50 million, (2) 2.25% of expenses between $50 million and $200 million, and (3) 3.25% of expenses above $200 million. Taxpayers may claim a credit of 20% for any North Carolina University research expense. Beginning in 2011, research performed in an Eco- Industrial Park is eligible for a credit of 35% of eligible expenses. Amount of credit may not exceed 50% of tax liability and unused credits may be carried forward for 15 years.	A R&D company in the physical, engineering, and life sciences is eligible to purchase tangible personal property used for R&D at a reduced sales tax rate of 1%. The statutory sales tax rate is 4.75%	The tax credit is scheduled to sunset on December 31, 2014. *Update: On July 17, 2013, the business tax incentive was extended through 2015*
North Dakota	A non-refundable credit equal to 25% of the first $100,000 of qualified research expenses over the base amount and 8% of all qualified research expenses more than $100,000 in excess of the base amount. Qualified research expenses and base amount definitions follow Section 41 of the Internal Revenue Code, with adjustments to only include expenses in North Dakota. Unused credits may be carried back for 3 years or carried forward for 15 years.	None.	Prior to 2010, the credit percentage was larger for expenses over $100,000, but the total credit was capped at $2 million
Ohio	A non-refundable credit equal to 7% of the qualified research expenses in excess of the average qualified research expenses made in the prior 3 years. Qualified research expense follows the definition under Section 41 of the Internal Revenue Code.	Capitalized tangible personal property used primarily to perform R&D is	

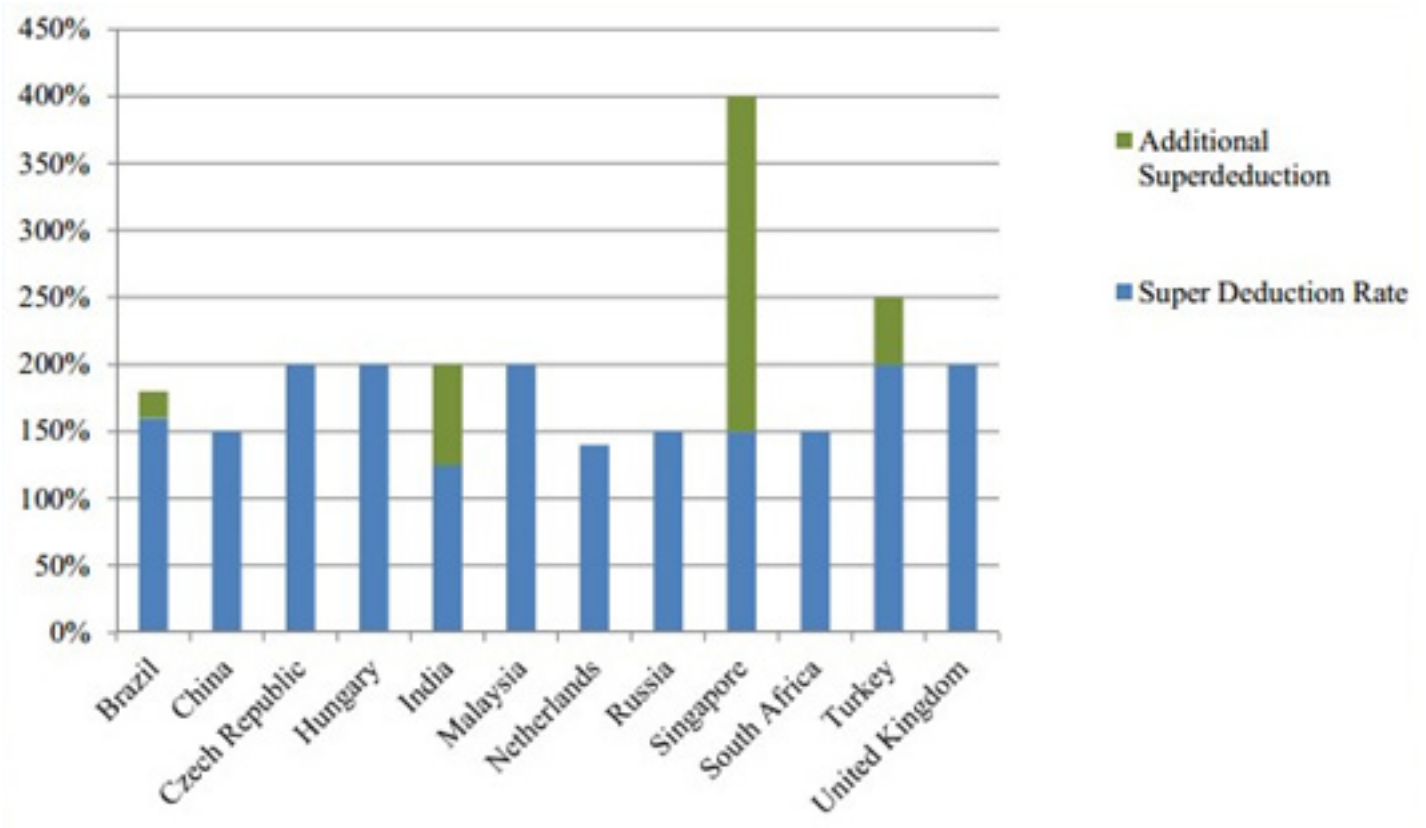
	Unused credits may be carried forward for 7 years. In addition, taxpayers who have borrowed money through the state's R&D loan fund are eligible for a credit equal to the qualified R&D loan payments made during the previous year. This credit may not exceed $150,000 in single tax year.	exempt from the sales tax.	
Oklahoma	Taxpayers may claim a non- refundable credit of $500 per employee for each new employee added in a year engaged in R&D, capped at 50 employees per year. Unused credits in a year may carry forward for 4 years.	Taxpayers in a R&D NAICS industry sector are eligible for a sales tax refund on the purchase of computers, data processing equipment, related peripherals, telegraph or telecommunication services, and equipment.	The jobs credit expired July 1, 2010,but was renewed on July 1, 2012.
Oregon	Taxpayers can elect to take one of two credits (but not both): A non-refundable credit of 5% of qualified research expenses and basic research payments over a base amount, or a non-refundable credit of qualified research expenses that exceed 10% of Oregon sales. If the second credit is used, the amount of credit is capped at $10,000 times the percentage amount that qualifying research expenses exceed 10% of Oregon sales. Both credits are capped at $1 million per taxpayer. Qualified research expenses, basic research payments, and base amount follow the definitions in Section 41 of the Internal Revenue Code, with adjustments made to apply only to Oregon expenses. Unused credits may be carried forward for 5 years.	Oregon does not levy a sales tax.	Oregon recently extended the sunset date of the credit from 2012 to 2018 and reduced the maximum credit per taxpayer from $2 million to $1 million.
Pennsylvania	Non-refundable credit equal to 10% (20% for a "small" business, whose total business assets are less than $5 million) of qualified research expenses over the product of the fixed- base percentage and the average annualized gross receipts of the taxpayer for the previous 4 years. Qualified research expenses follow the definition in Section 41 of the Internal Revenue Code. Unused credits may be carried forward for 15 years or sold to another taxpayer. If sold, the credit cannot exceed 75% of the purchaser's tax liability.	Tangible personal property and services used directly in research having as its objective the production of a new or improved product or utility service or method of producing a product or utility service is exempt from the state sales tax.	Taxpayers must submit an application to the Department of Revenue to receive the credit. The amount of credit to all taxpayers is capped at $55 million in a year. The credit is currently set to sunset in 2016.
Rhode Island	A non-refundable credit equal to 22.5% for the first $111,111 of qualified research expenses over the base period, and 16.9 percent for the qualified research expenses in excess of $111,111 over the base period. Qualified research expenses and base period follow the same definition as Section 41 of the Internal Revenue Code. The credit may not reduce tax liability by more than 50% and unused credits may be carried forward for 7 years. Taxpayers are also eligible for a credit equal to 10% of the cost of tangible personal property, including buildings and components of buildings that are used principally for purposes of R&D.	Scientific equipment, computers, software, and related items used for R&D purposed are exempt from the sales tax.	
South Carolina	A credit equal to 5% of qualified research expenses made in South Carolina. Qualified research expense follows the definition in Section 41 of the Internal Revenue Code. A credit may not reduce a taxpayer's liability by more than 50% in a year and unused credits may be carried forward for 10 years.	Machines used in R&D are exempt from the sales tax.	Taxpayers operating a R&D facility may qualify for a jobs credit depending on the county they are located in.
South Dakota	South Dakota does not levy a business tax.	None.	
Tennessee	None.	None.	R&D enterprises can qualify for a jobs credit based on the number of jobs created and the size of their capital investment.
Texas	None. *Update: On June 14, 2013, Texas reinstated the "Texas Franchise Tax Credit" for qualified research activities, which will be effective beginning in*	None. *Update: Taxpayers may elect*	Texas previously had an incremental nonrefundable credit that was repealed,

	2014. The credit is equal to 5% of excess research expenses over 50% of the prior 3 year average, which is about equivalent to the federal method of calculating the credit). The credit is increased to 25% if taxpayers contract a public institution of higher education. The credit may be carried forward 20 years. The credit is limited to 50% of a taxpayer's Texas Franchise Tax liability.	*sales tax exemption instead of the credit.*	effective January 1, 2008.
Utah	Non-refundable credit equal to 5% of a taxpayer's qualified research expenses that exceed the base amount and a nonrefundable credit equal to 7.5% of basic research payments to a qualified organization. Qualified research expenses, base amount, and basic research payments all follow the definition from Section 41 of the Internal Revenue Code, with an adjustment made to apply to expenses and payments in Utah. The unused portion of the 5% credit may be carried forward for 14 years, but the 7.5% credit may not be carried forward	Construction materials used in the construction of a new or expanding life science R&D facility and machinery and equipment that are used in performing qualified research are exempt from the state sales tax.	Utah's qualified research expenses credit expired in 2011, but was renewed in 2012. The sales tax exemption was enacted in 2012.
Vermont	None.	Tangible personal property used directly or exclusively in R&D is exempt from the state sales tax.	Beginning in 2011, Vermont has a credit equal to 30% of the federal credit for qualified research expenses performed in Vermont. Since the credit is tied to federal version, it also expired in 2012, but will be reinstated if and when the federal credit is reinstated.
Virginia	A credit equal to 15% of the first $167,000 of qualified research expenses in excess of the base amount or 20% of the first $175,000 of qualified research expenses in excess of the base amount if the research is conducted in conjunction with a Virginia college or university. Qualified research expenses and base amount follow the definition in Section 41 of the Internal Revenue Code, with an adjustment made to apply only to expenses incurred in the state. Tax credits in excess of a taxpayer's liability are refundable.	Tangible personal property used directly and exclusively in basic research or R&D in the experimental or laboratory sense is exempt from the state sales tax.	A previous version of the credit expired at the end of 2010. The current version was implemented in 2011 and will sunset at the end of 2015. There is a statewide cap of total credits awarded of $5 million.
Washington	A credit against the state Business and Operations (gross receipts) tax is given if taxpayers qualified R&D spending exceeds 0.92 percent of their taxable income during the year. The credit is equal to 1.5% of the difference of these two amounts. The credit is capped at $2 million per taxpayer, is nonrefundable, and may not be carried forward to future years. Washington has its own definition of qualified R&D expenditures and must be performed in one of 5 specific fields.	Sales to a public research institution of machinery and equipment used primarily in R&D operations are exempt from the state sales tax.	Its credit is scheduled to expire on January 1, 2015. Taxpayers claiming the credit must complete an annual survey with information on the jobs created by the research and the output of the research, such as new products, patents, or trademarks.
West Virginia	A credit equal to the greater of 3% of annual qualified R&D expenditures or 10% of annual qualified R&D expenditures over the base amount. West Virginia has statutory definitions of qualified research and expenditures and base amount that are broader in scope than the federal definition. The credit is refundable for businesses with revenues less than $20 million and payroll less than $2.5 million. For other businesses, unused credits may be carried forward for 10 years. Credits are capped at $2 million per year.	Sales of tangible personal property and services directly used or consumed in the activity of R&D are exempt from the state sales tax.	Taxpayers must apply to the tax commissioner to be eligible to receive the credit.
Wisconsin	A non-refundable credit equal to 5% of the qualified research expenses over the base amount and 5% of the amount paid to construct and equip new facilities or expand existing facilities for qualified research. Qualified research expenses and base amount follow the definition in Section 41 of the Internal Revenue Code with an adjustment made to apply only to expenses in Wisconsin. Unused credits may be carried forward for 15 years. The amount of credit increases to 10% if the research is related to designing internal combustion engines or the design and manufacturing of energy efficient lighting systems, building automation and control systems, or automotive batteries for use in hybrid-electric vehicles. In addition, taxpayers are eligible for a "super" credit equal to 100% of the qualified research expenses over 1.25 times the average of qualified research expenses made in the prior 3 years. The super credit is non-refundable and may be carried forward for 5 years.	Machinery and equipment, including attachments, parts, and accessories, and tangible personal property that are sold to entities engaged primarily in manufacturing or biotechnology in this state and are used exclusively and directly in qualified research.	The super R&D credit was recently enacted in tax year 2011. The sales tax exemption was enacted beginning in 2012. The Super R&D tax credit was superseded by a broader set of economic incentives beginning in tax year 2014. *Update: Wisconsin extended its business tax incentive to individuals, S-companies, partnerships and some limited liability corporations. The Super R&D tax credit was superseded by a broader set of economic incentives beginning in tax year 2014.*
Wyoming	Wyoming does not levy a business tax.	None.	

Appendix C.

The "super R&D credit" or "super deduction" has become increasingly popular internationally, with twelve countries offering such incentives as of 2012. Following is a summary of countries offering super deductions. (Source: Deloitte Global R&D Survey, 2012). http://www.investinamericasfuture.org/PDFs/Global_RD_Survey_September_2012_FINAL.pdf

Jurisdictions Offering Super Deductions:



Note: For the United Kingdom, the super deduction is currently 200% for SMEs and 130% for non-SMEs

The United Kingdom is a country of particular interest in this list. Indeed, the UK is the country to attract the most R&D investment from the US. Deloitte found that US-affiliated investments on UK-based R&D amounted to $4 billion in 2003. The R&D industry is fast growing in China. Today it can claim the largest number of science graduate students. Recently, the country has also drawn major global firms such as Dow Chemical, Philips, Nestle, Bosch and Shell to establish their R&D centers. http://chinaipsummit.com/2012/press_1123/30.html. The US' generosity in subsidies offered to encourage R&D activities has steadily declined so that the US currently ranks 27th in the world, while it was 23rd in 2007. This might indicate that the United States' R&D is not currently as competitive as it could be and that the country is not creating as many jobs as it could with an improved tax credit (Stewart, L. A., Warda, J. & Atkinson, R. D., 2012). http://www2.itif.org/2012-were-27-b-index-tax.pdf

Appendix D.
Massachusetts ranked 13th among the states in life science job growth between 2009Q1 and 2013Q3, trailing its major competitors. See Figure 10.

State	Life Science employment 2009 Q1	Life Science employment 2013 Q3	Life Science +/-
California	260,320	272,387	12,067
North Carolina	66,828	74,009	7,180
Texas	101,343	106,866	5,524
Utah	24,002	28,872	4,871
Arizona	25,200	29,846	4,647
Michigan	51,847	55,752	3,904
Delaware	5,574	8,647	3,073
Colorado	30,911	33,427	2,516
Alabama	14,355	15,613	1,258
Ohio	57,420	58,595	1,175
Kentucky	12,965	14,091	1,126
New York	111,036	111,839	803
Massachusetts	87,048	87,619	571

About the Author

Gregory W. Sullivan is Pioneer's Research Director, and oversees the Centers for Better Government and Economic Opportunity. Prior to joining Pioneer, Sullivan served two five-year terms as Inspector General of the Commonwealth of Massachusetts, where he directed many significant cases, including a forensic audit that uncovered substantial health care over-billing, a study that identified irregularities in the charter school program approval process, and a review that identified systemic inefficiencies in the state public construction bidding system. Prior to serving as Inspector General, Greg held several positions within the state Office of Inspector General, and was a 17-year member of the Massachusetts House of Representatives. Greg is a Certified Fraud Investigator, and holds degrees from Harvard College, The Kennedy School of Public Administration, and the Sloan School at MIT.

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Pioneer Institute is an independent, non-partisan, privately funded research organization that seeks to change the intellectual climate in the Commonwealth by supporting scholarship that challenges the "conventional wisdom" on Massachusetts public policy issues.

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Endnotes

1. Source: http://www.bostonglobe.com/business/2014/05/09/windham-bannister-resigns-head-life-sciences-center/UtYRGqi4S4WkvSxj4TmhhM/story.html

2. Source: http://www.masslive.com/news/index.ssf/2007/10/governor_urges_ok_of_1_billion.html

3. National Science Foundation, Division of Science Resources Studies (NSF/SRS), National Patterns of R&D Resources: 2000 Data Update, NSF 01-309 (Arlington, VA, March 2001). Available at: http://www.nsf.gov/sbe/srs/nsf01309/start.htm

4. National Science Foundation, National Center for Science and Engineering Statistics (NSF/NCSES), National Patterns of R&D Resources (annual series), Business Research and Development and Innovation Survey, Survey of Research and Development Expenditures at Universities and Colleges, Survey of Federal Funds for Research and Development, Survey of State Government R&D. State GDP data are from the U.S. Bureau of Economic Analysis. Available at: http://www.nsf.gov/statistics/nsf14304/pdf/tab13.pdf

5. Data in this and the following graphs and charts are derived from the Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages (QCEW) QCEW North American Industry Classification System NAICS-Based Data Files (1975-2013). Analysis by Pioneer Institute.

6. See data in appendix.

7. Source: http://www.mainelegislature.org/ros/LOM/lom118th/LOM525to557-40.htm

8. Source: http://law.justia.com/codes/iowa/2013/titlex/subtitle1/chapter422/422-10

9. http://www2.itif.org/2012-were-27-b-index-tax.pdf Note: this quote is about the federal Alternative Simplified Credit.

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