



Massachusetts Life Sciences Employment Outlook, 2023

Prepared by TEconomy Partners, LLC for Massachusetts Biotechnology Education Foundation

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Introduction to the 2023 Massachusetts Life Sciences Employment Outlook

The Massachusetts Biotechnology Education Foundation (MassBioEd) is committed to understanding the needs of the state's life sciences workforce. Building on previous employment outlook reports, this annual series seeks to highlight the ongoing dynamics impacting the state's life sciences workers as well as the impact of the state's educational institutions supplying talent for this critical workforce.

- For over 20 years, **MassBioEd** has delivered **high quality educational programming** to build the Life Science workforce. We build bridges convening industry and education.
- We also place adults in life science careers through the nation's **first Life Sciences Registered Apprenticeship Program** and support students in diverse communities to enter life science careers through the **BioTeach program** in underserved middle and high schools and through **College to Career** in public 2- and 4-year colleges.



Executive Summary & Key Findings

Massachusetts has seen strong, steady life sciences industry growth in recent years—outpacing national growth with double-digit employment gains over the last 3 years and with a strong outlook for continued workforce expansion over the coming decade.

- The state has outpaced the nation in life sciences job growth since 2019, adding 14.6% to its employment base vs. 9.4% growth for the U.S.
- With more than 132,000 total life sciences jobs, the state maintains its identity as a leading global life sciences hub for highly-skilled, highly specialized scientific and business roles that drive life sciences innovation and support multinational operations.
- The state's industry base is differentiated and anchored by a cohort of more than 24,000 highly skilled life scientist occupations that continue to advance scientific breakthroughs and new life-saving and quality of life enhancing biomedical innovations.
- Looking forward, Massachusetts is projected to grow life sciences jobs by 32% or nearly 42,000 net new jobs by 2032.

Rapid growth of new workforce segments and high demand for hybrid skill sets highlight ongoing changes to the nature of life sciences work in Massachusetts, all of which require responsive workforce and talent development, recruitment and retention approaches, as well as enhanced career awareness in strategic “secondary” or non-life sciences fields.

- Computing and IT roles within the MA life sciences industry have increased by 52% since 2019 to nearly 11,000 jobs in 2022, reflecting the accelerated integration of digital solutions within the industry.
- Life sciences companies in the state are seeking talent with “hybrid” skill sets to build their future workforce, with executives reporting the need for multidisciplinary workers with life sciences, computational, and business operations knowledge.
- Production and manufacturing roles in MA have grown nearly 37% since 2019, reversing years of job declines for these occupational groups within the life sciences in the mid 2010s and highlighting the increasing importance of this middle skills labor force to the state's industry.

Executive Summary & Key Findings (continued)

While the state is home to world-class educational institutions anchoring the talent pipeline, the level of demand for key life sciences workers continues to outstrip available supply in a highly competitive labor market.

- Massachusetts institutions are 1.4 times more concentrated in life sciences degree production than the U.S., producing an average of 7,400 life sciences degree graduates annually from 2019 through 2022.
- Despite this pipeline and relatively strong in-state retention, life sciences talent “leakage” to other industries and competition with other STEM-intensive sectors for skilled labor is a key limiting factor to meeting demand with new graduates.
- Projections indicate more than 6,600 average annual job openings in key life sciences occupations over next decade—Life Scientists, Biotechnicians, and Medical Lab Technicians—but an average annual supply from the state’s education institutions of only half of this amount from new graduates in degree field most aligned with these openings.

Despite some return to normalcy for the industry in the wake of the pandemic, several trends continue to create disruptive impacts in life sciences workforce dynamics.

- Hybrid work arrangements are here to stay but are not optimal for all types of roles and teams in the life sciences and require skilled management to navigate shifting workplace dynamics.
- Several emerging technologies are poised to further disrupt the life sciences, led by a general shift towards large scale digitization of records and data, increasing automation and use of AI in drug development and other applications, and the emergence of new types of precision manufacturing.

Recommendations to Consider

Higher Education

Advance multidisciplinary “hybrid” programs and credentials to meet evolving life sciences talent demands.

Industry leaders, both in MA and nationally, regularly emphasize the need for workers with hybrid expertise and skill sets such as:

- science + technology/analytics, including roles such as bioinformatics scientists, biostatisticians, and computational biologists
- strong business/project management expertise + foundational scientific background, including roles such as process development specialists, regulatory affairs managers, and clinical research specialists.

Industry & Higher Education

Invest in postsecondary early-career connections and consider incentives targeted at retaining top talent within the state to mitigate “leakage” of graduates to other states, industries, and to prioritize employee retention.

Data on post-graduation retention of life sciences graduates from MA public institutions show that while the state retains relatively high shares, there is still significant “leakage” of graduates moving out of state particularly at the master’s and doctoral levels. However, graduates who do remain in-state are being hired in non-life sciences industries. As a result of these factors constraining supply and a competitive labor market, employers cite retention of their incumbent workforce to be a major priority.

Industry, Higher Education, & Workforce Programs

Expand awareness of life sciences industry career opportunities amongst a broader set of academic programs to meet robust needs for talent in key non-life sciences fields.

The life sciences industry has significant needs for talent in “secondary” or non-life sciences fields or expertise such as IT/tech, sales, financial analysis, data sciences, industrial engineering, marketing, etc. To continue to meet the need for individuals in these roles, the life sciences industry must raise awareness about its exciting career opportunities across a broader set of degree programs and educational settings.

Recommendations to Consider (continued)

Government & Higher Education

Invest in expanding specialized life sciences education and training programs to more public institutions and underserved communities to advance diversity, equity, and inclusion in the life sciences.

Despite efforts, underrepresentation in the state's life sciences degree programs and the industry persists. For example, black or African American students make up just 7% of MA life sciences graduates, but more than 9% of the state's population. The state needs to invest resources in initiatives such as Massachusetts Life Sciences Center's partnerships with HBCUs for internships that increase the diversity of graduates of public institutions entering the life science sector.

Industry, Workforce Programs, & Government

Invest in skills-based and experiential learning workforce development programs to address areas of high demand and to engage non-traditional workers.

Life sciences companies place a strong premium on demonstrated competencies and skills, for example:

- entry-level lab technicians and their ability to operate equipment
- quality control professionals in documentation
- biomanufacturing technicians operating in cleanrooms and/or highly sensitive production environments.

At the same time, there is a preference for experience with 65% of industry job postings in MA preferring 2+ years of experience.

Industry, Higher Education, & Government

Work together to track postsecondary outcomes for life sciences students and career outcomes for life sciences workers to scale long term investments in industry-relevant education and training.

The state must build partnerships to better track long term career paths for its life sciences graduates from state institutions. These data can then inform input and investment into postsecondary academic programming to better align with industry demand and address gaps in workforce development strategy. In a fast-moving industry such as life sciences, identifying the most effective interventions through data-driven insights can help drive larger impacts and make the case for further investment. Best practices from other states can inform how best to structure partnerships and track outcomes.

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Defining the Scope of the Life Sciences Industry in Massachusetts

The primary focus of the Outlook remains on the biopharmaceutical and medical labs segment of the industry (72% of total life sciences employment in 2022) that includes:

- Drug and pharmaceutical manufacturing
- Biotechnology and other commercial life sciences research, development, and testing
- Medical labs

Additional sectors where the life sciences workforce is actively deployed including Medical Devices (18% of employment), Hospitals (6% of employment) and Universities (3% of employment) are highlighted in select analyses (as shown in figure)

North American Industry Classification System (NAICS) Codes and Industry Sectors Associated with Life Sciences

Biopharmaceuticals & Medical Labs

325411, 325412, 325413, 325414

Pharmaceutical & Medicine
Manufacturing

541380*

Testing Laboratories

541713*, 541714, 541715*

Commercial Life Sciences/Biotech
R&D

621511

Medical Labs

Medical Devices & Equipment

334510

Electromedical
manufacturing

334516

Analytical lab
instruments

334517

Irradiation apparatus

339112

Surgical, medical
instruments

339113

Surgical supplies

339114

Dental equipment & supplies

Hospitals/ Research Hospitals

622110*

General medical &
surgical hospitals

622210*

Psychiatric &
substance abuse
hospitals

622310*

Other specialty
hospitals

Colleges & Universities**

611310*

Colleges, universities
& professional schools

*Includes only the portion of these engaged in relevant life sciences activities, and in the case of Hospitals and Colleges/Universities is focused on clinical and life sciences scientific and R&D related personnel (i.e., non-clinical and excluding core teaching faculty).

**Note: Includes both public and private institutions.

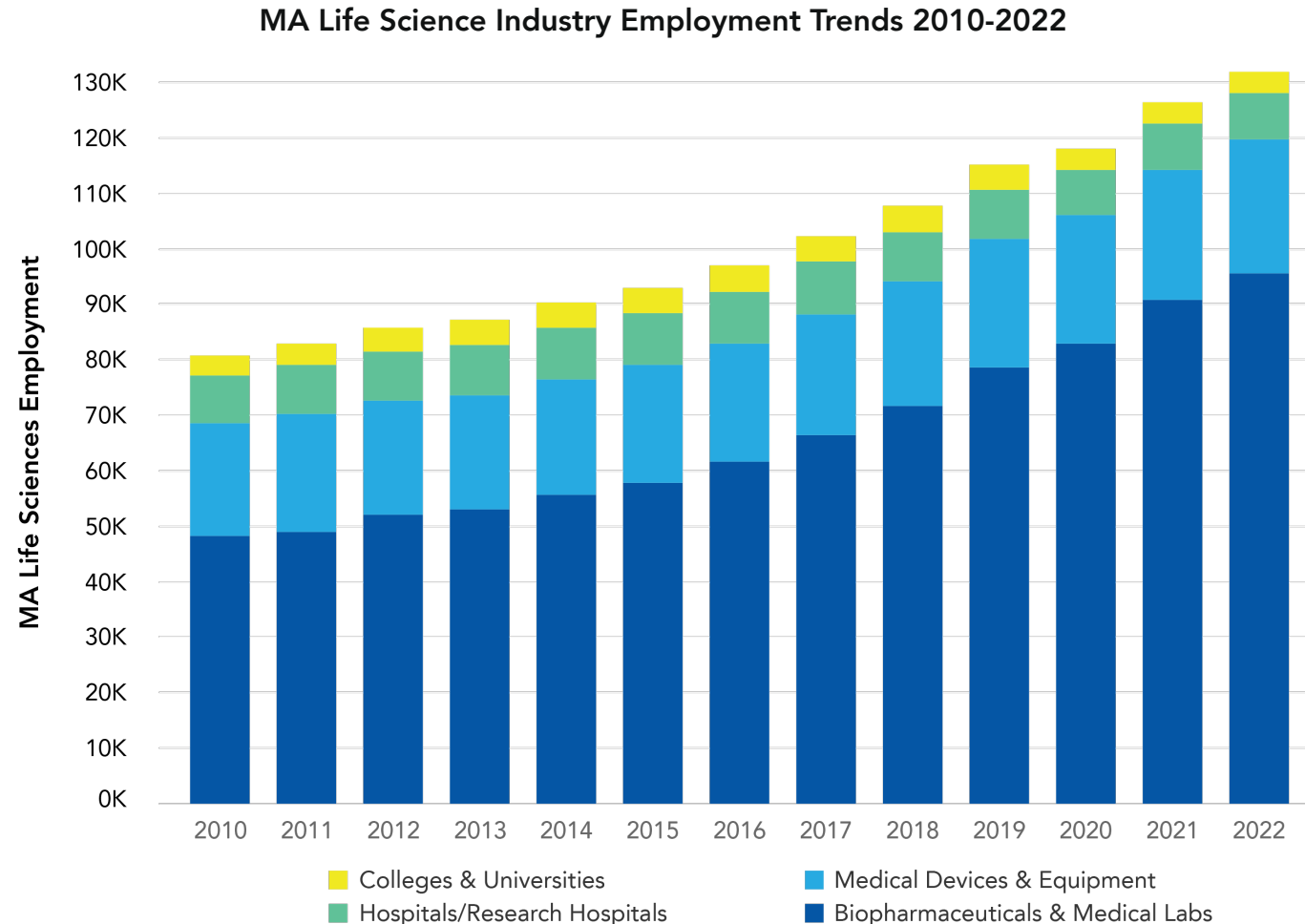


Massachusetts' Life Sciences Talent Demand Dynamics

Steady Life Sciences Growth for MA Over the Past Decade



- In 2022, there were just over 132k total life sciences jobs in the state across all industry segments, a growth of over 5.6k from 2021
- Over 72% of all life sciences jobs in 2022 located in biopharmaceuticals and medical labs



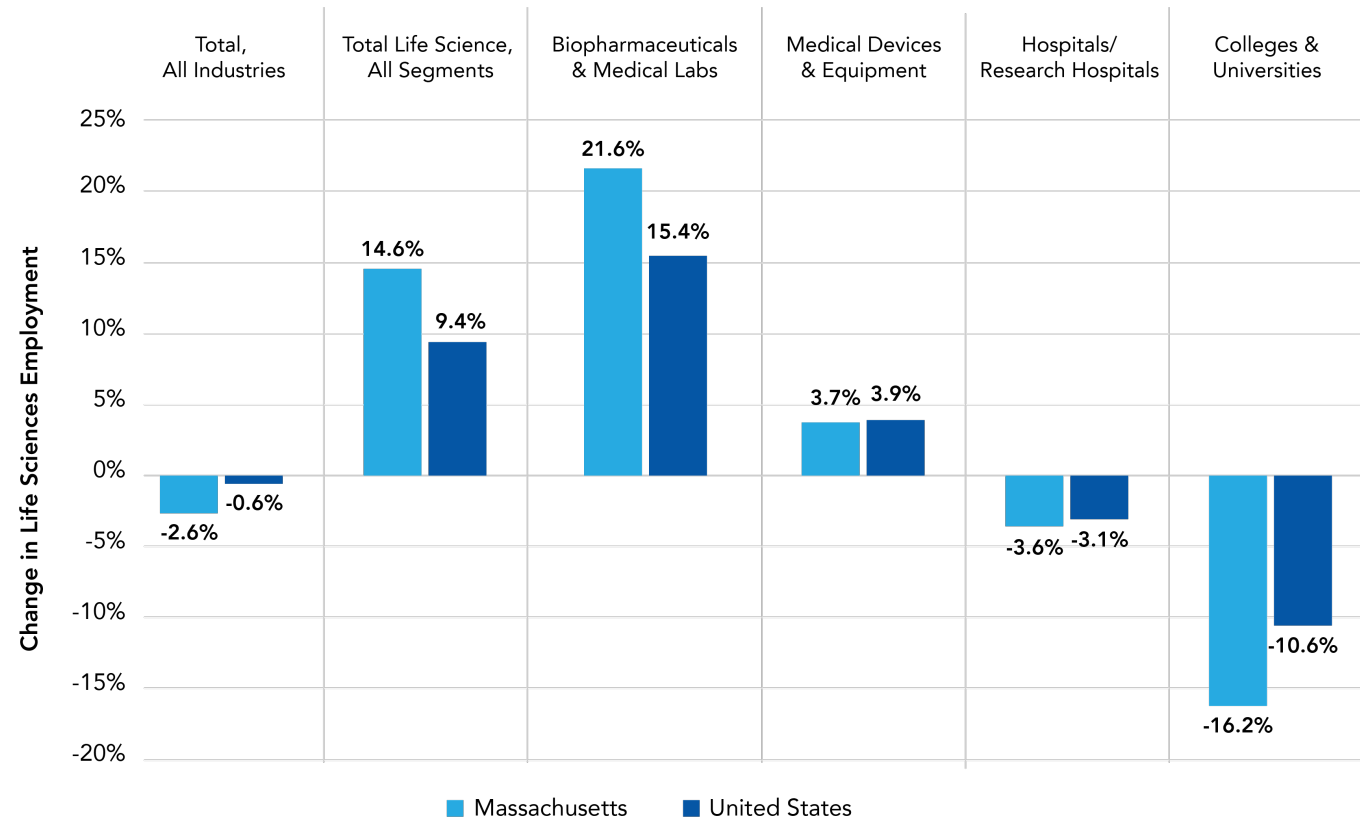
Note: Industry employment totals for 2022 are based on preliminary estimates of annual totals by Lightcast through Q2.
Source: TEconomy Partners' analysis of Lightcast Industry Employment Data, 2023.1

The Life Sciences Industry is an Economic Growth Engine for MA



- Life Sciences in MA has grown by 14.6% since 2019 while the state's overall economy is still recovering from a 2.6% decline
- MA outpacing US life sciences sector job growth by over 5 percentage points

MA and U.S. Life Science Industry Employment Trends, by Major Subsector, 2019-2022

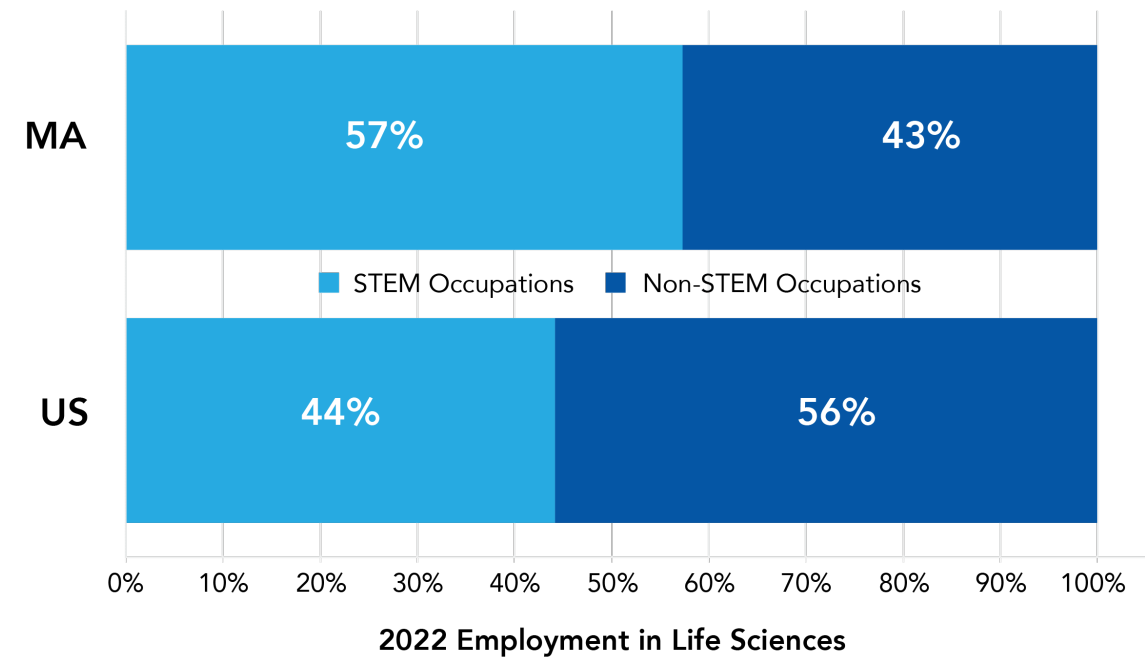
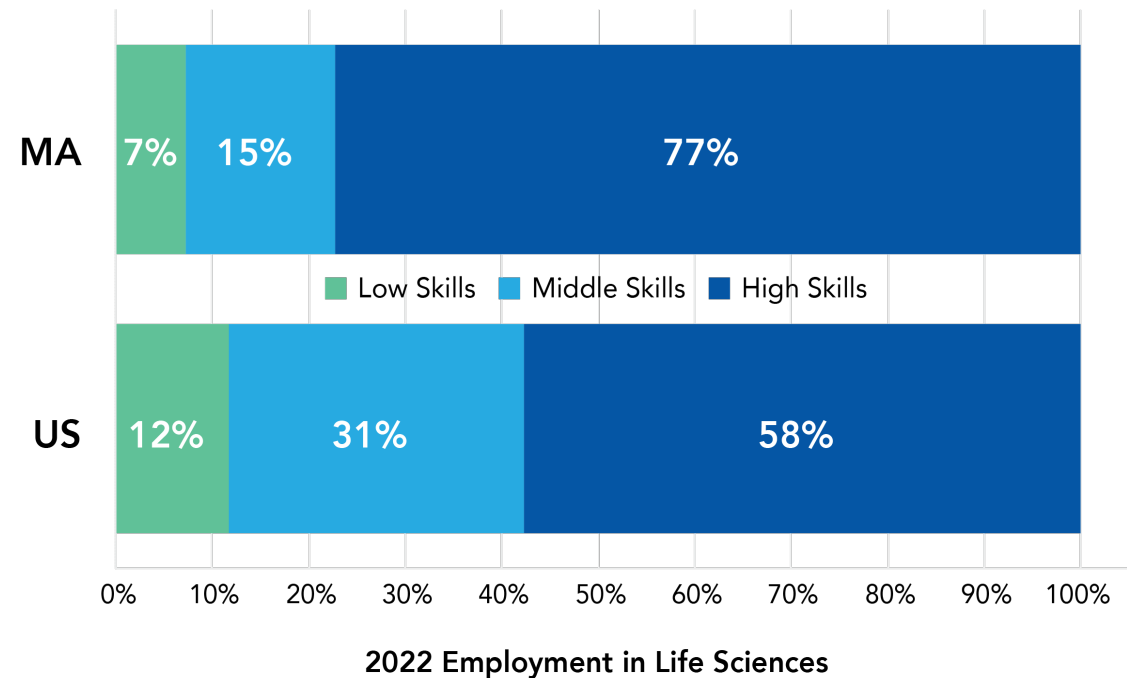


Note: Industry employment totals for 2022 are based on preliminary estimates of annual totals by Lightcast through Q2.
Source: TEconomy Partners' analysis of Lightcast Industry Employment Data, 2023.1

Massachusetts Remains a Hub for a Highly Specialized, STEM-Intensive Life Sciences Workforce



Occupational Employment by Skills Levels & STEM Job Classifications Within MA Biopharmaceuticals & Medical Labs Industries, 2022



Note: Skills level determined from typical federal classifications of required education, training, and experience. "High skills" occupations typically require a bachelor's degree or higher, "middle skills" jobs typically require more education and/or experience than a high school education but less than a bachelor's degree, and "low skills" jobs typically require a high school education or less.
Source: TEconomy Partners' analysis of Lightcast Staffing Patterns Data, 2023.1

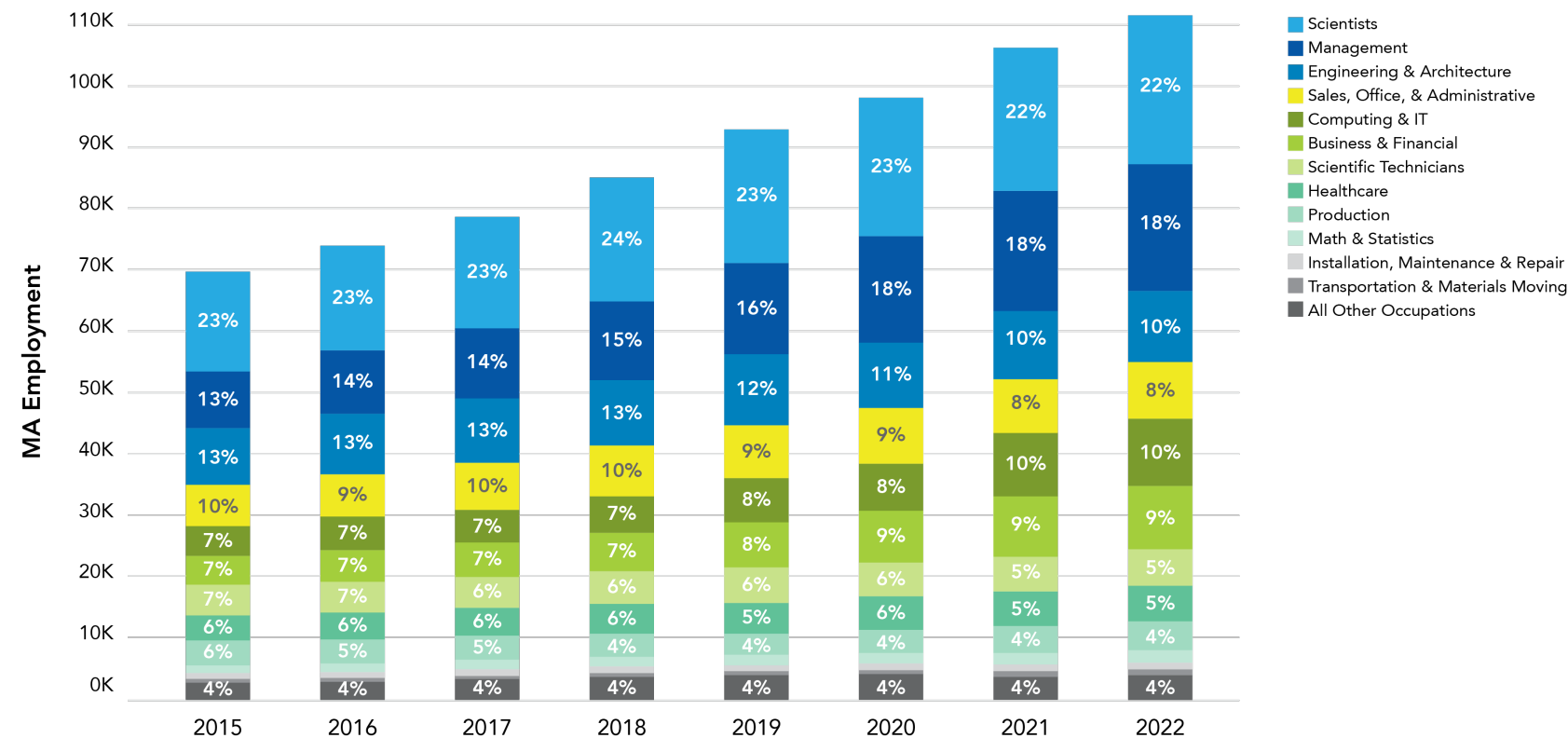
MA Life Sciences Industry Has Continued to Grow its High Skills Labor Segments



Job growth in key occupational segments since 2019:

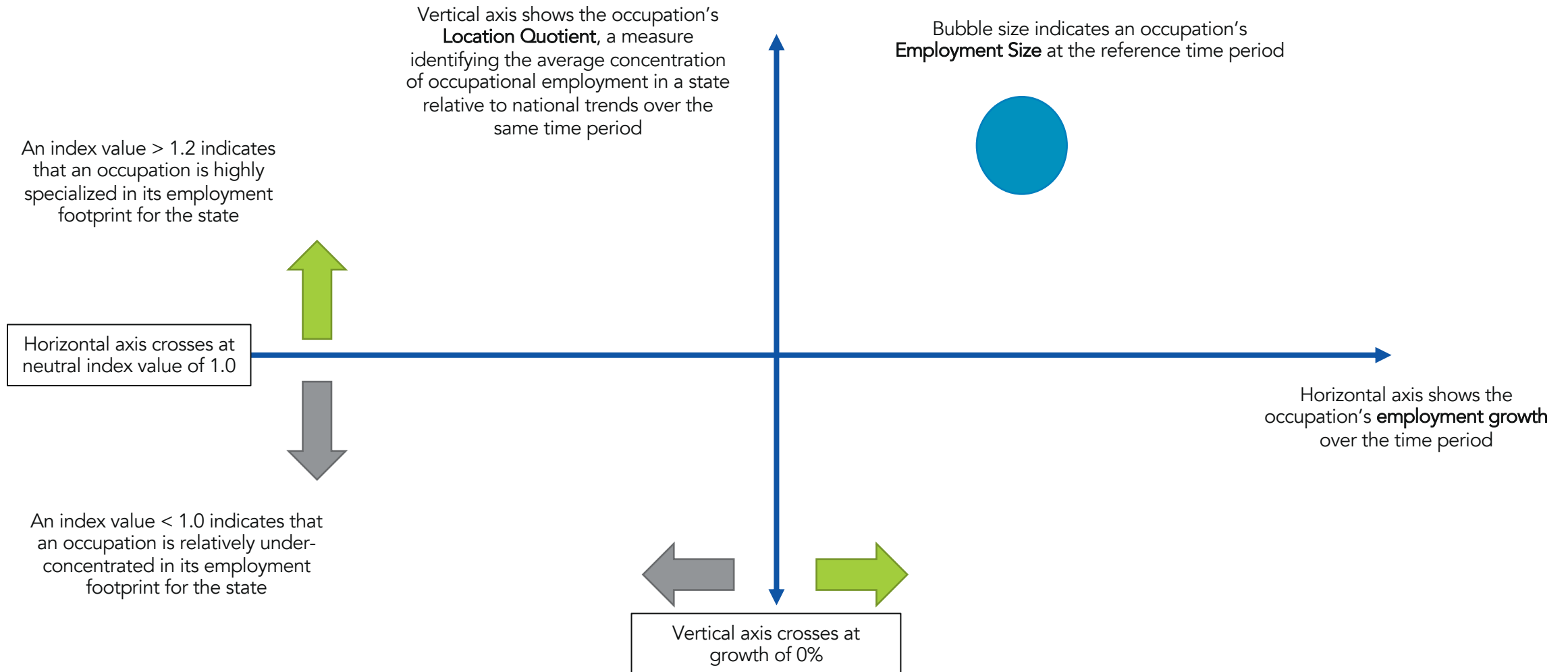
| | |
|----------------------|-------------------------|
| Life Scientists | 2.7k jobs 13% growth |
| Management | 5.6k jobs 38% growth |
| Computing/IT | 3.8k jobs 52% growth |
| Business & Financial | 3k jobs 40% growth |

Occupational Employment Trend Within
MA Biopharmaceuticals & Medical Labs Industries, 2015-2022



Source: TEconomy Partners' analysis of Lightcast Staffing Patterns Data, 2023.1

How to Read Detailed Life Sciences Occupational Employment Profiles Shown on Subsequent Slide

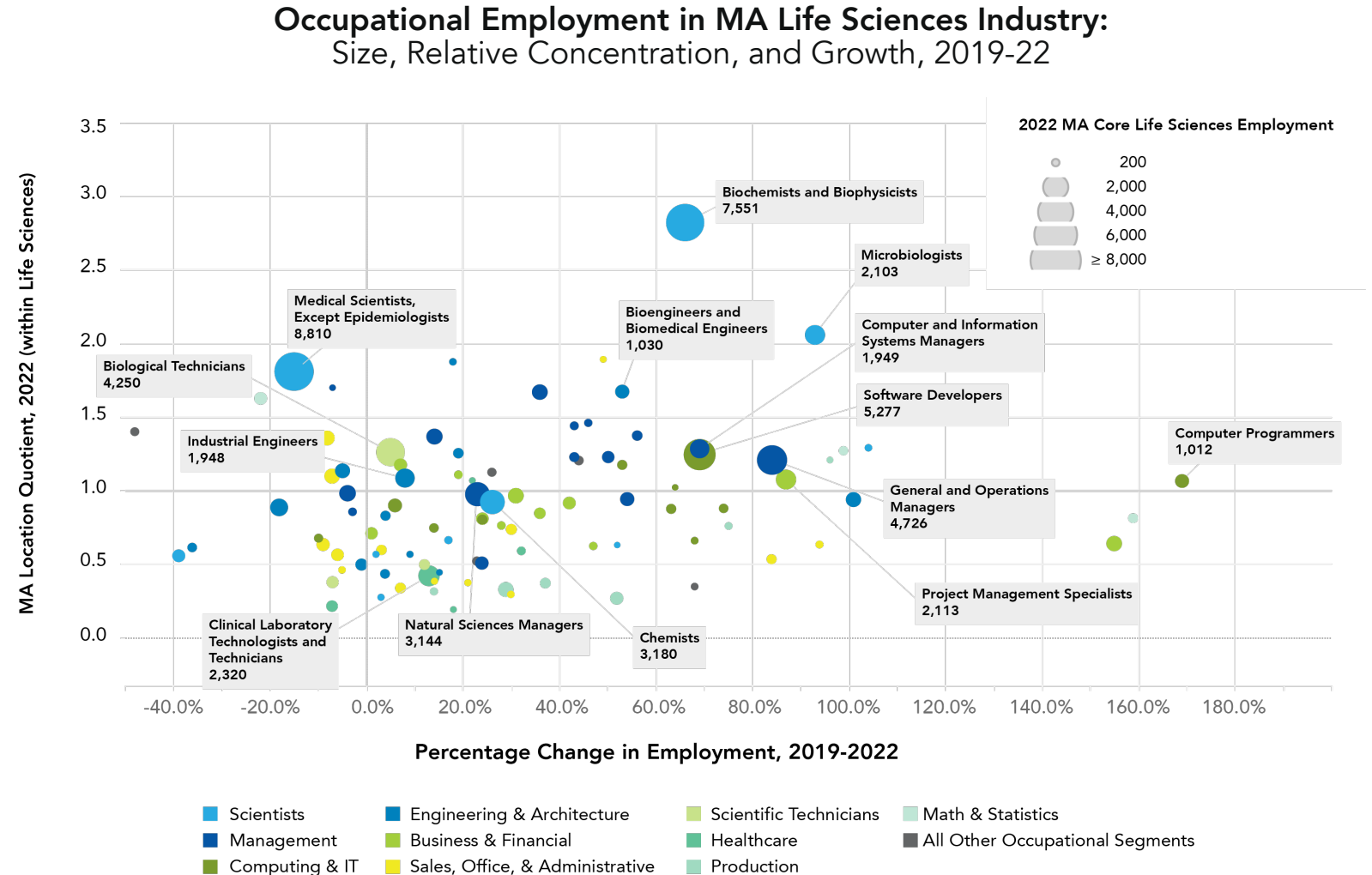


Performance & Position of Detailed Occupations Within Life Sciences

Unique Specializations in Life Scientists, Growth in Computing Jobs



- MA highly specialized in life scientist roles, deploying large cadres of biochemists and biophysicists, microbiologists, medical scientists
- Software developers, programmers, and IT managers experiencing rapid growth
- Managers, business support occupations remain large, fast-growing segments
- Specialized biotechnician workforce supporting production operations has continued to see steady growth



Source: TEconomy Partners' analysis of Lightcast Staffing Patterns Data, 2023.1

Projected Growth Trends Reaffirm the Importance of High Skills STEM Workers to the Life Sciences Industry's Future in the State

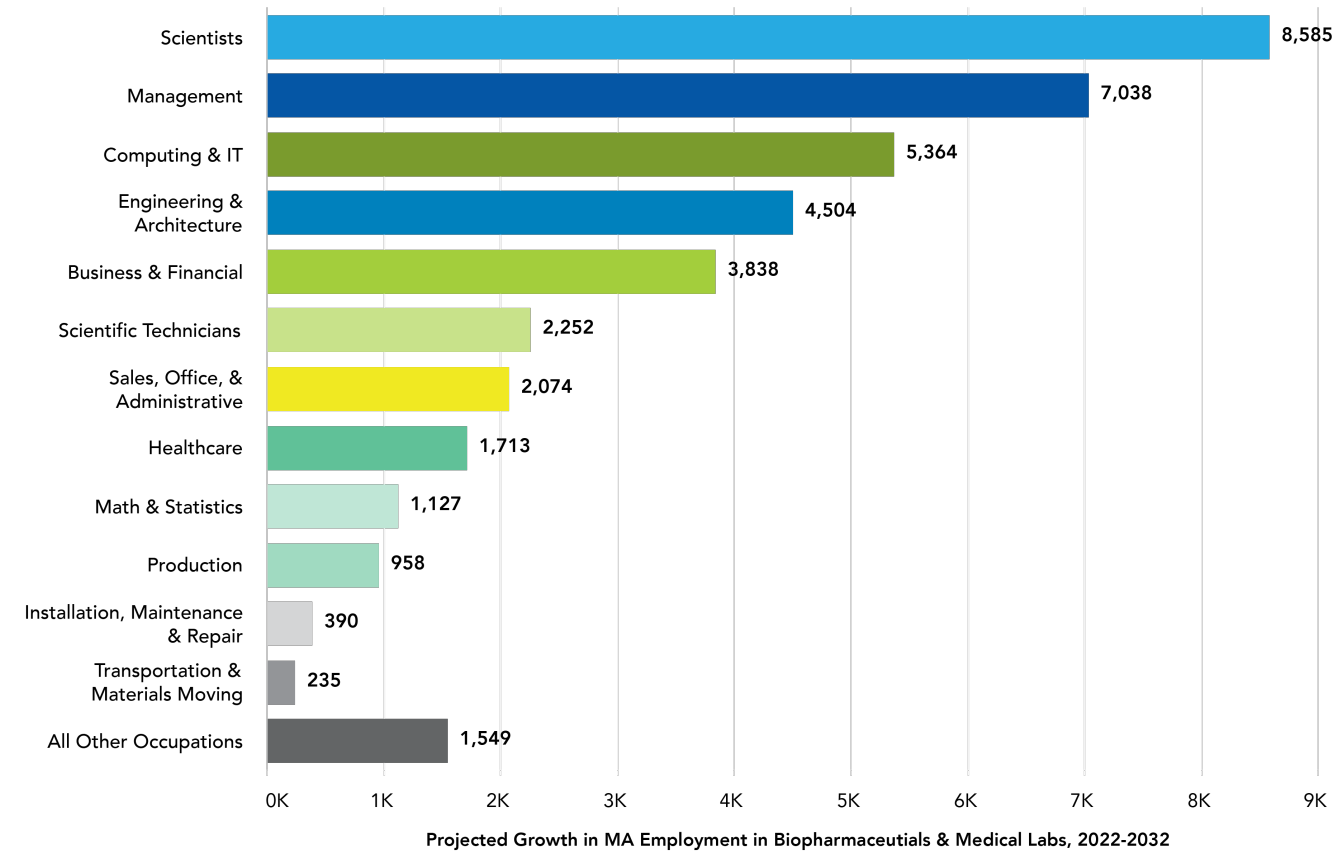


Projected job growth in leading life sciences occupational segments over the coming decade

| | |
|----------------------------|------------|
| Scientists | 35% growth |
| Management | 34% growth |
| Computing & IT | 49% growth |
| Engineering & Architecture | 39% growth |
| Business & Financial | 37% growth |
| Scientific Technicians | 38% growth |
| Math & Statistics | 56% growth |

Segments listed with at least 1k projected new jobs and >30% job growth from 2022-2032

Projected Occupational Growth Trends Within Biopharmaceuticals & Medical Labs, 2022-32



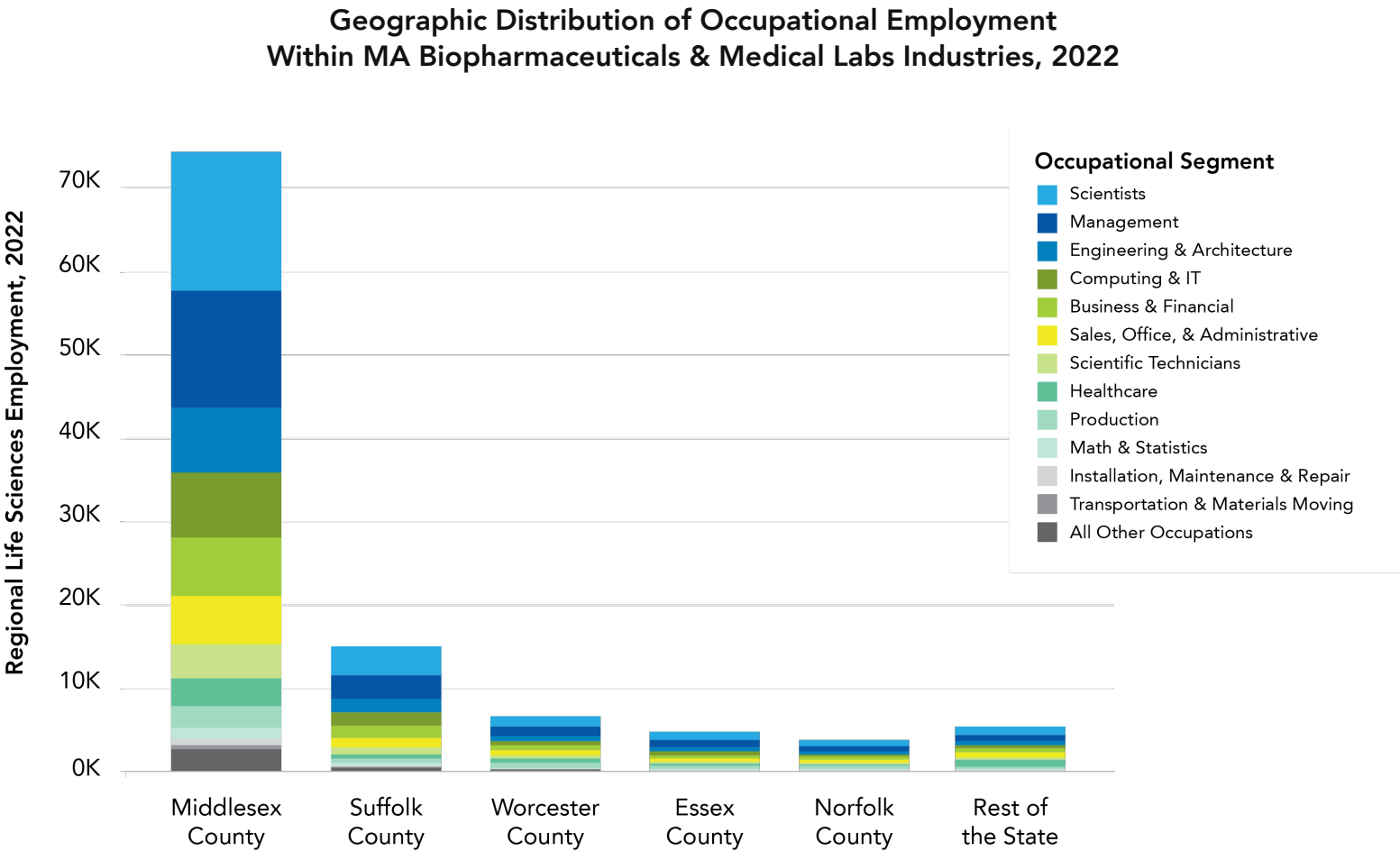
Note: Lightcast uses a combination of national (BLS), state/local, and internal projection methods. Lightcast occupation projections are based off of estimated industry data with projected, regionalized staffing patterns applied to the figures. As a result, the occupational projections will necessarily differ from BLS and state labor market information (LMI) occupation numbers.
Source: TEconomy Partners' analysis of Lightcast Industry Employment Data, 2023.1.

Geographic Footprint of the Life Sciences Industry Within Massachusetts



Over 74k life sciences workers encompassing nearly 70% of the state’s workforce are located in Middlesex County, with significant employment footprints across other key regions of the state

| Growth in life sciences jobs from 2019-2022 | |
|---|------------|
| Middlesex County | 19% growth |
| Suffolk County | 32% growth |
| Worcester County | 24% growth |
| Essex County | 11% growth |
| Norfolk County | 17% growth |

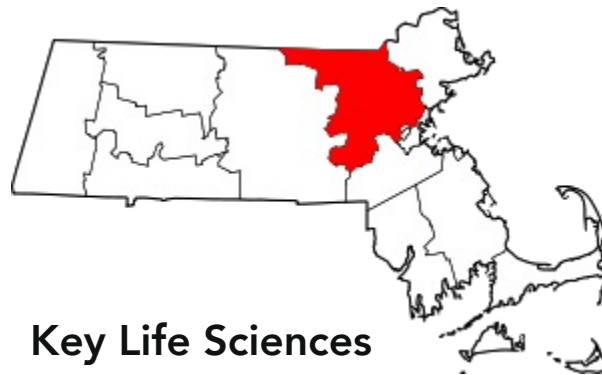


Source: TEconomy Partners’ analysis of Lightcast Staffing Patterns Data, 2023.1

Geographic Profile: Middlesex County

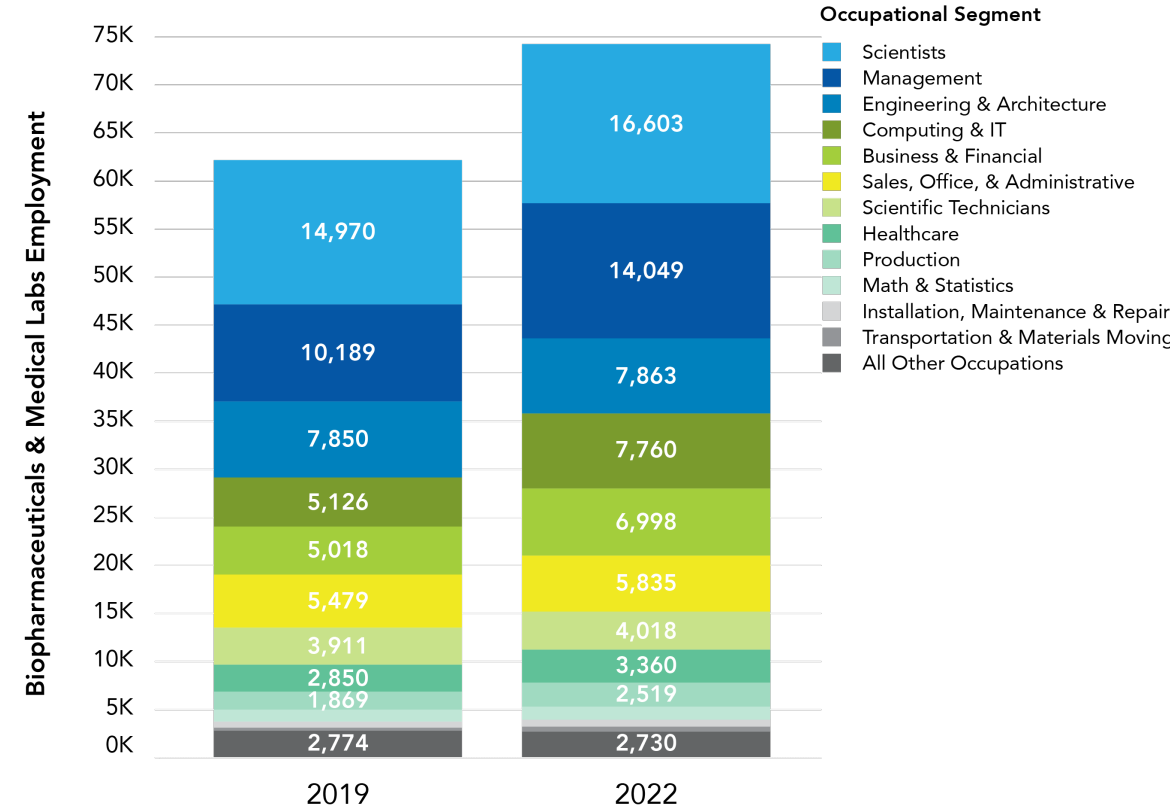


Middlesex County's life sciences workforce expanded by more than 12k jobs over 2019-2022, over 19% growth in employment



Key Life Sciences Employers

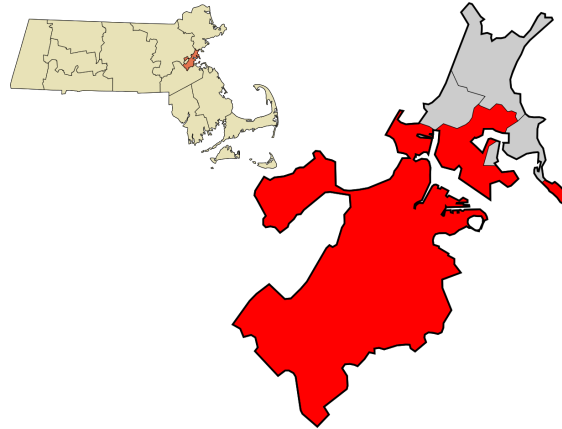
- Takeda Pharmaceuticals
- Sanofi
- AstraZeneca
- Biogen
- Novartis
- EMD Serono



Geographic Profile: Suffolk County

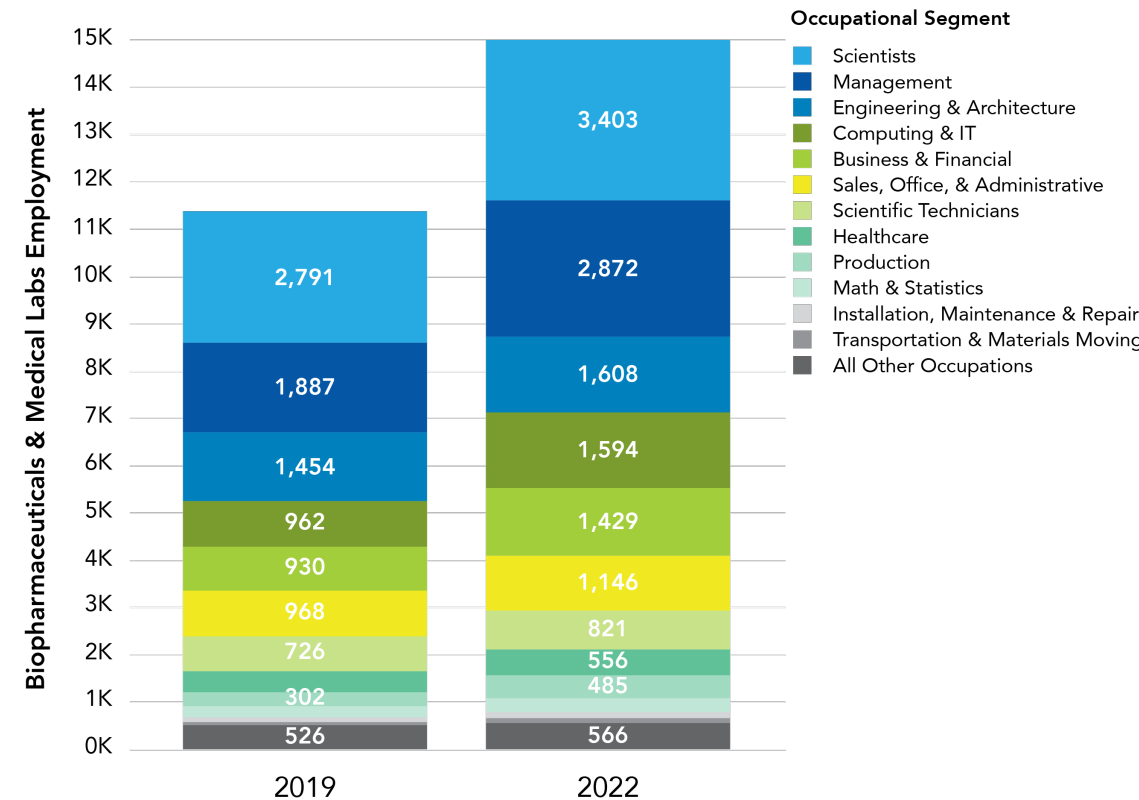


Suffolk County's life sciences workforce expanded by 3.6k jobs over 2019-2022, nearly 32% growth in employment



Key Life Sciences Employers

- Vertex Pharmaceuticals
- Ginkgo Bioworks
- Merck & Company
- Alexion



Geographic Profile: Worcester County

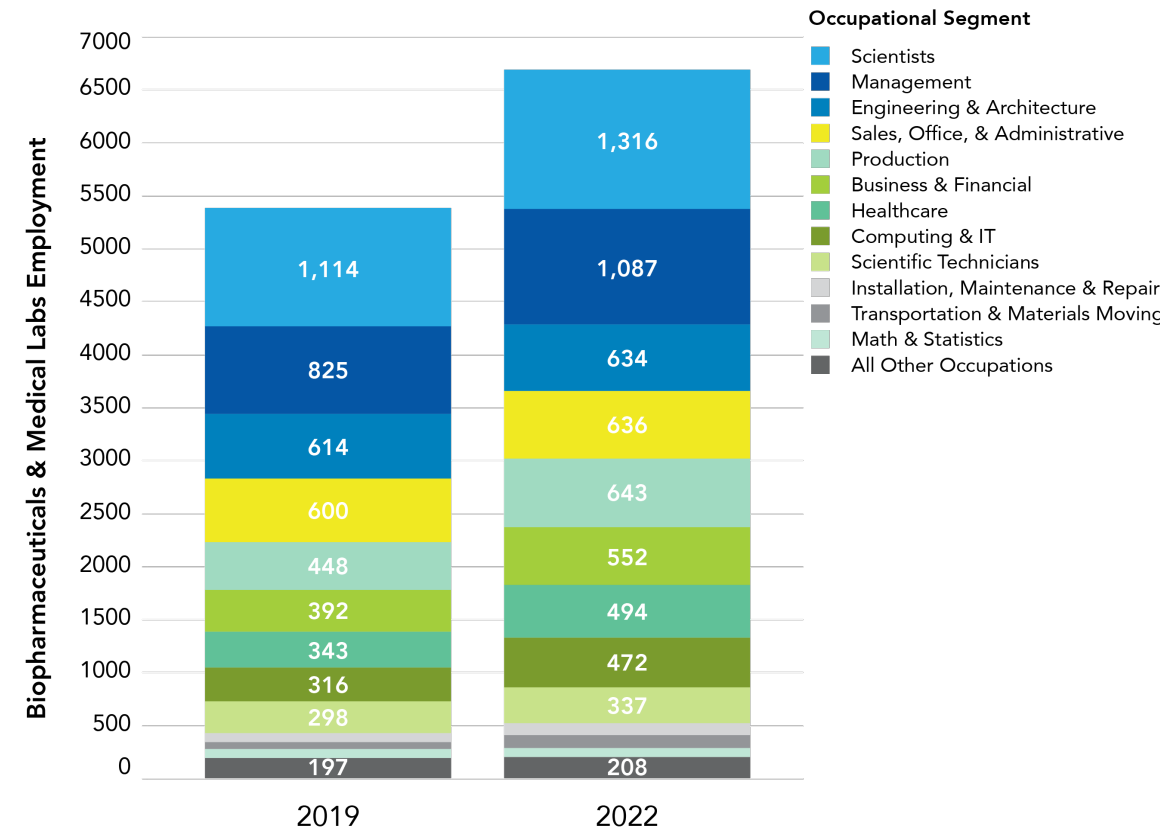


Worcester County's life sciences workforce expanded by 1.3k jobs over 2019-2022, more than 24% growth in employment



Key Life Sciences Employers

- AbbVie
- Bristol Myers Squibb



Geographic Profile: Essex County

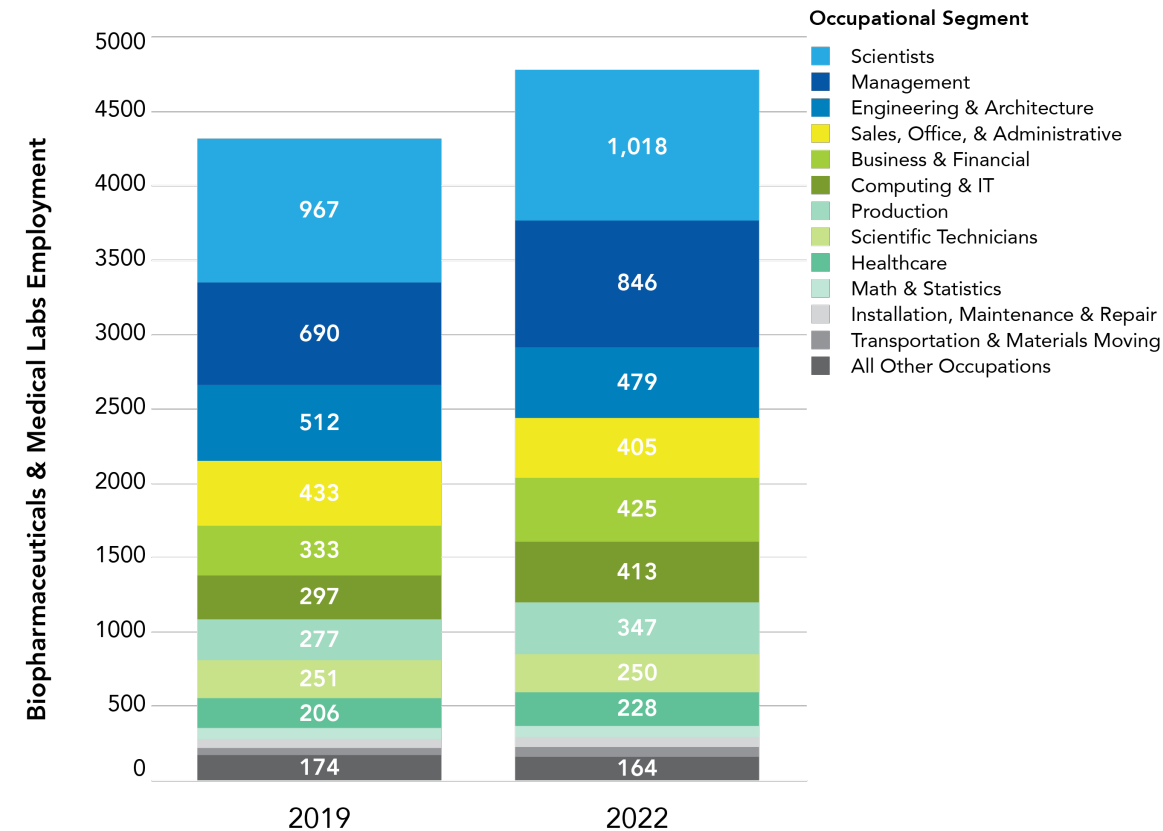


Essex County's life sciences workforce expanded by more than 500 jobs over 2019-2022, nearly 11% growth in employment



Key Life Sciences Employers

- Pfizer
- Millipore Sigma
- New England Biolabs



Geographic Profile: Norfolk County

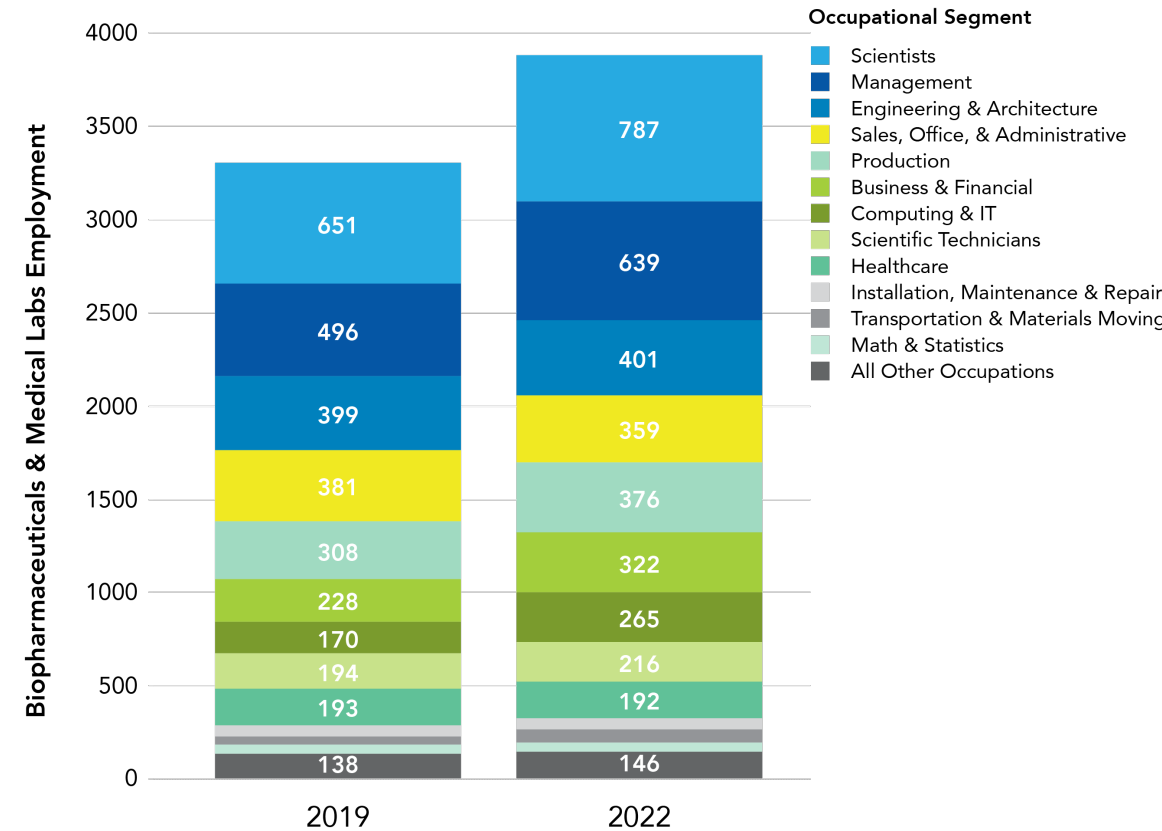


Norfolk County's life sciences workforce expanded by more than 600 jobs over 2019-2022, over 17% growth in employment



Key Life Sciences Employers

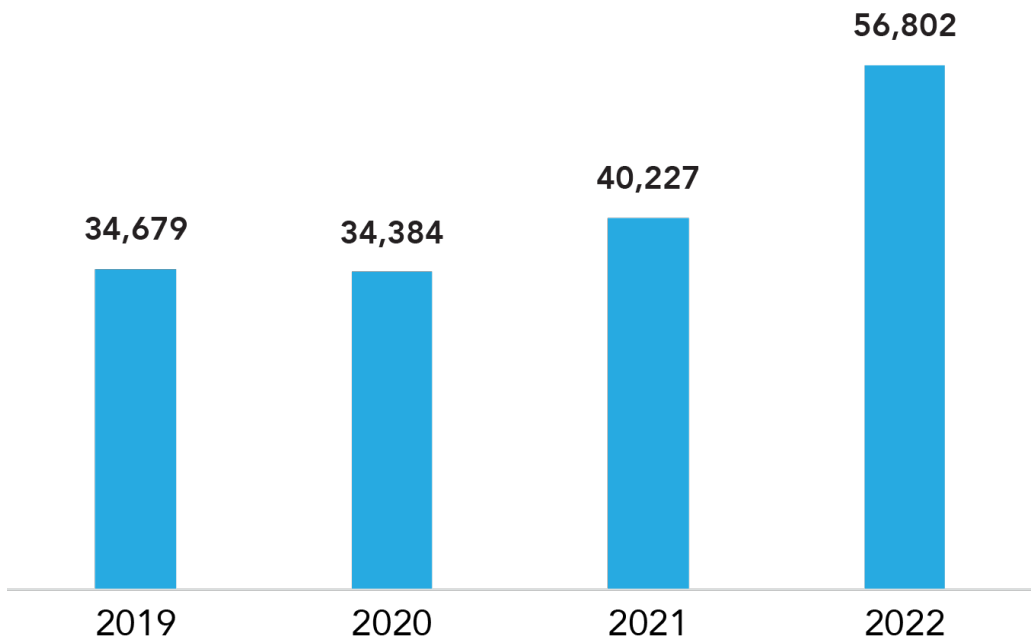
- Moderna
- Alnylam Pharmaceuticals
- Thermo Fisher Scientific



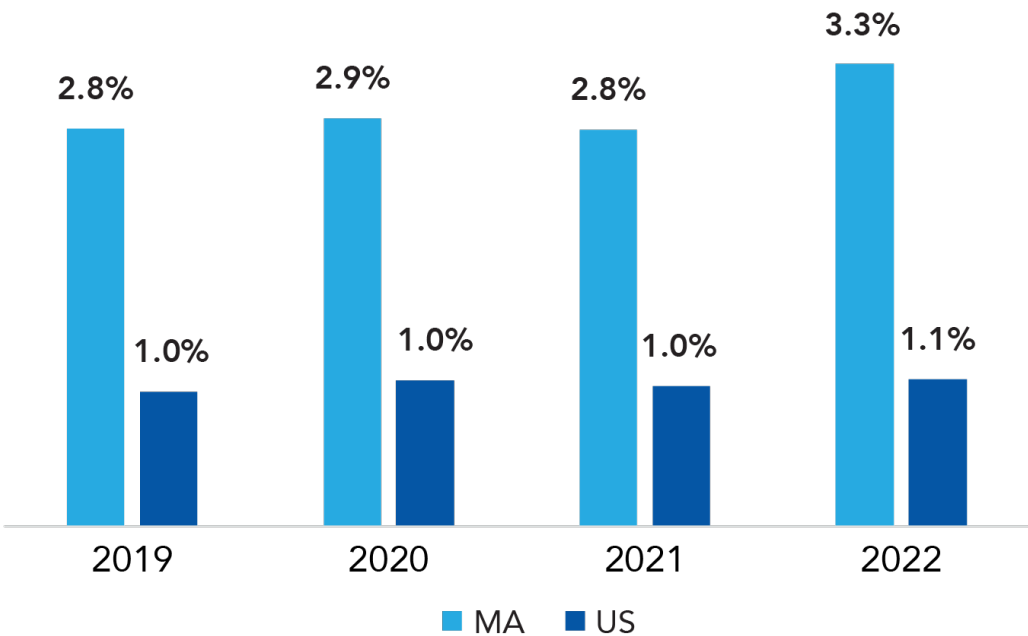
MA Saw Rising Life Sciences Job Posting Activity in 2022, Continues to Demonstrate Higher Postings Intensity than the Rest of Country



Life Sciences Job Postings, 2019-22



MA & U.S. Life Sciences Job Postings as a Share of Total, 2019-22

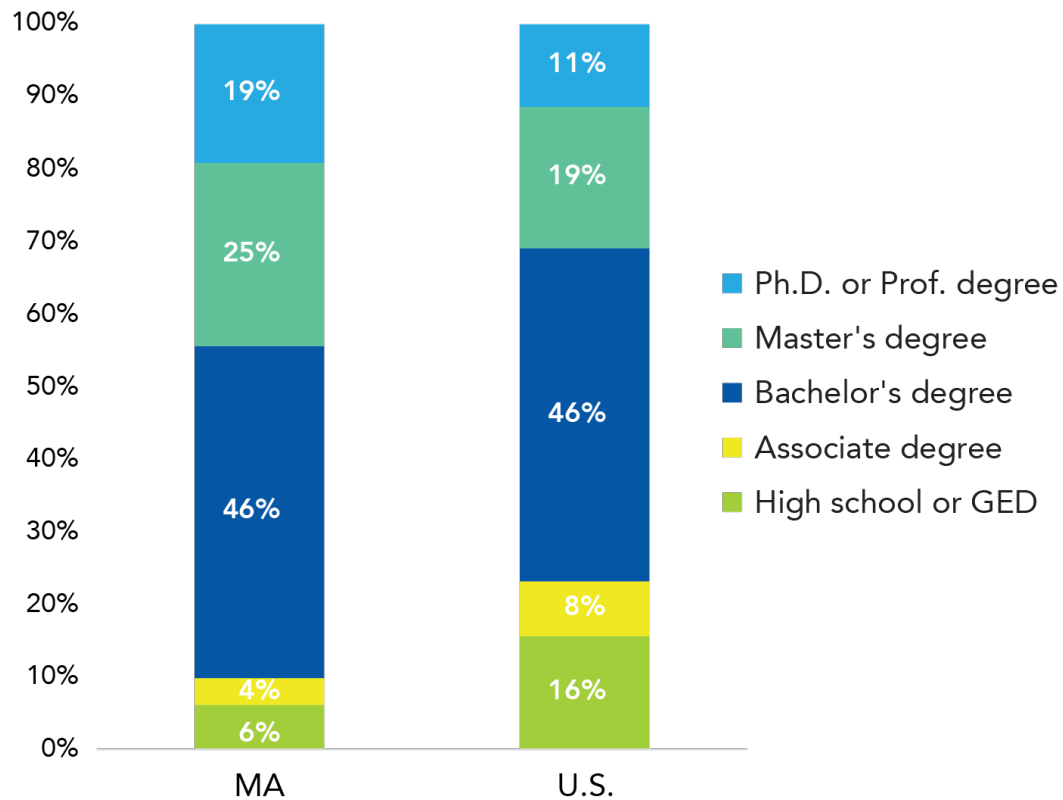


Note: postings data shown above includes only biopharmaceuticals and medical labs industry sectors; the individual years in trend analysis will not sum to cumulative totals due to unique postings that span across individual years.
Source: TEconomy Partners' analysis of Lightcast, JPA Database, 2023.1.

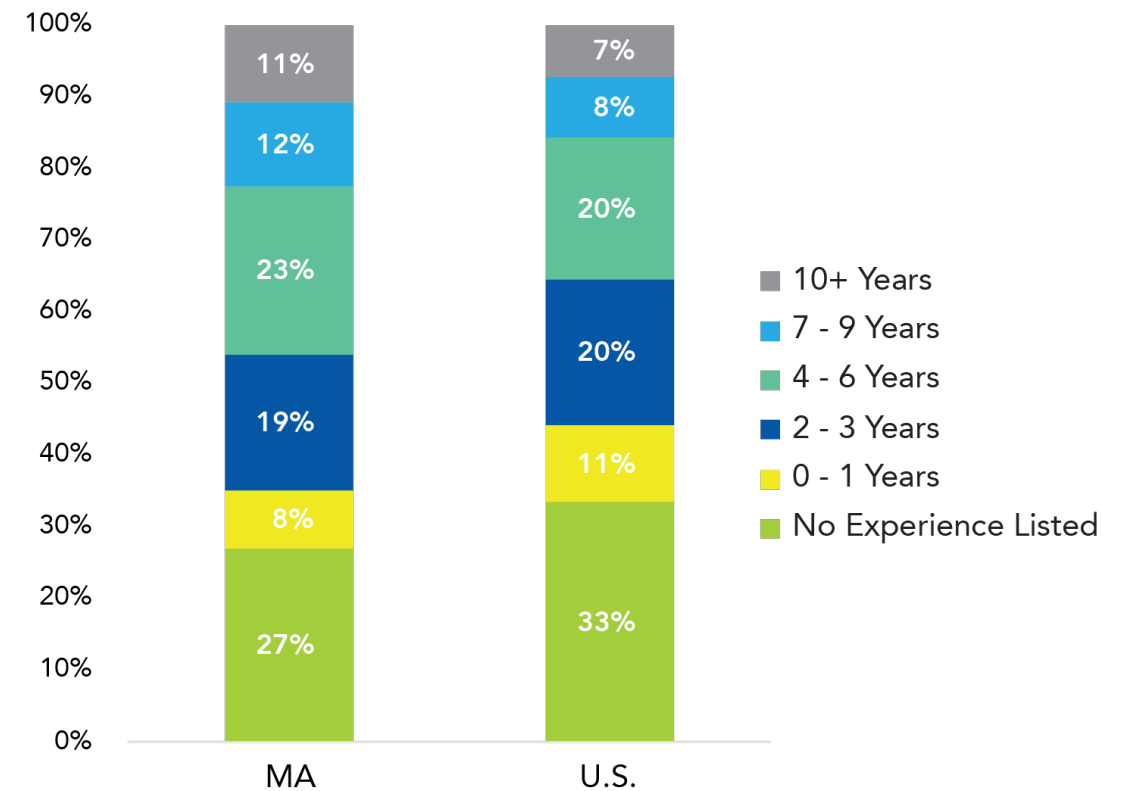
MA Job Demand Oriented Toward Higher Levels of Education and Experience, with 44% of Postings Preferring Masters or Higher



Education Requirements in Life Sciences
Job Postings, 2019-22



Experience Requirements in Life Sciences
Job Postings, 2019-22



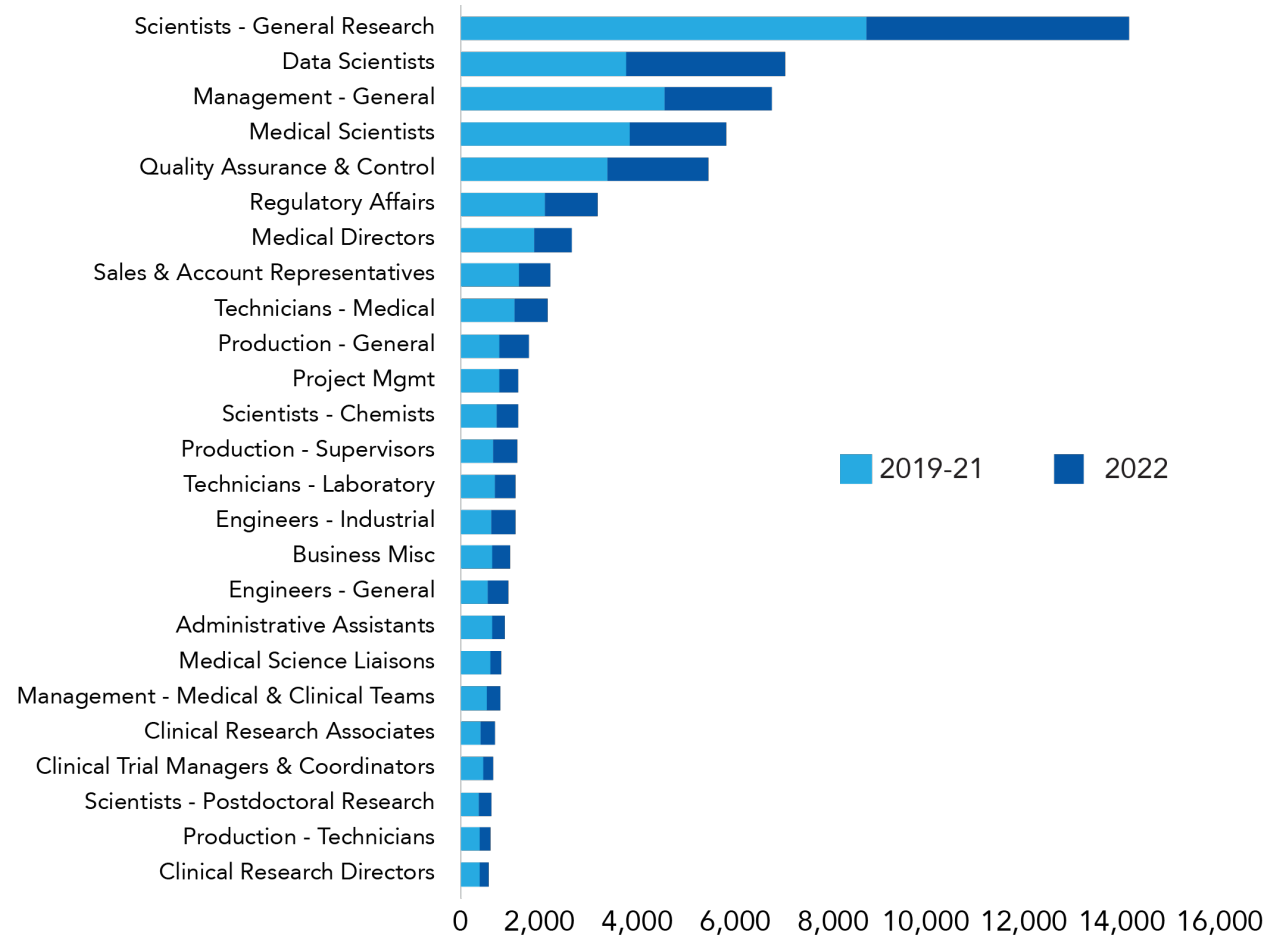
Note: postings data shown above includes only biopharmaceuticals and medical labs industry sectors
Source: TEconomy Partners' analysis of Lightcast, JPA Database, 2023.1.

Strong Demand for Scientific and Analytics Workers, Rising Manufacturing Activity in Job Postings



- A focus on 2022 relative to prior 3 years finds especially strong recent demand for production workers and supervisors; QC/QA; Industrial Engineers – all signals of rising manufacturing activity
- In addition, strong 2022 posting activity for Data Scientists, Clinical Research Associates

Leading Job Titles in MA Life Sciences Job Postings by Category, 2019-2022



Note: postings data shown above includes only biopharmaceuticals and medical labs industry sectors ; Lightcast limits information on job titles and corresponding numbers of postings to the top 1,000, limiting the ability to provide comprehensive totals by categories.

Source: TEconomy Partners' analysis of Lightcast, JPA Database, 2023.1.

Who's Hiring: Leading Companies Hiring in MA Life Sciences



- Key employers driving life sciences hiring in MA include major pharmaceutical manufacturers, life science contract R&D firms, and medical and analytical lab service providers
- Notably, 17 major employers had more than 2,000 unique life sciences job postings each in the state during this 4-year period

Top 20 Companies by Unique Job Posting Totals for 2019-22 in Descending Order

| |
|-------------------------------|
| Takeda Pharmaceutical Company |
| Sanofi |
| Moderna Therapeutics |
| Vertex Pharmaceuticals |
| Biogen |
| Pfizer |
| Charles River Laboratories |
| Johnson & Johnson |
| Quest Diagnostics |
| IQVIA |
| Bristol Myers Squibb |
| Broad Institute |
| AstraZeneca |
| Novartis |
| Alexion Pharmaceuticals |
| Foundation Medicine |
| AbbVie |
| MilliporeSigma |
| Eurofins |
| Labcorp Drug Development |

Note: postings data shown above includes only biopharmaceuticals and medical labs industry sectors
Source: TEconomy Partners' analysis of Lightcast, JPA Database, 2023.1.

Trends in Job Postings Highlight Increasing Importance of Data Sciences, Advanced Therapies Competencies for Life Sciences Workers



Data Science, Software, and Other Digital Skills

show significant increase in activity since 2019

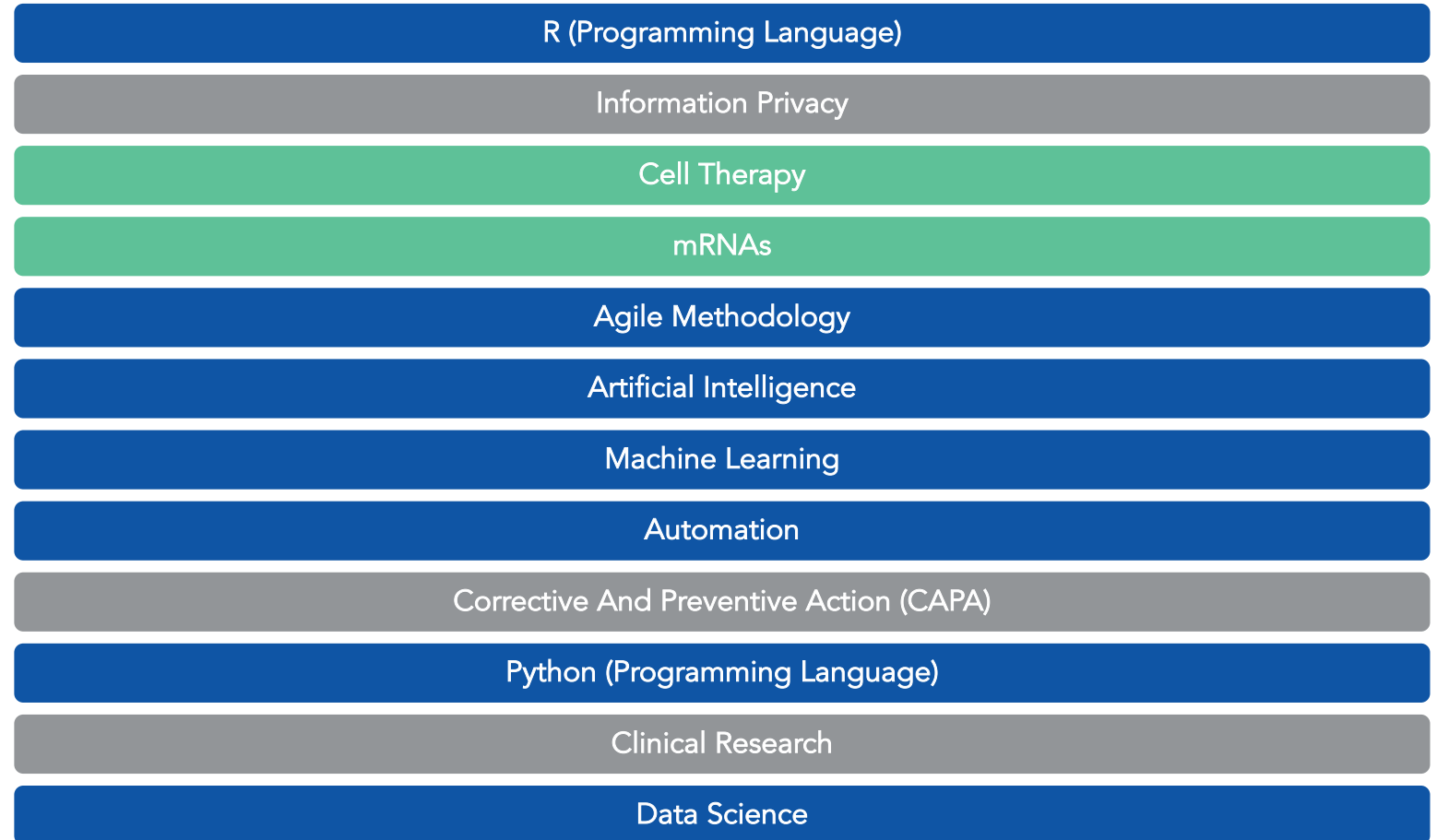
Novel Therapeutics Production Skills

highlight new industry research and manufacturing activity

Life Sciences Business & Research Skills

show persistent demand for regulatory compliance and clinical research talent

Top 12 Skills in Life Sciences Job Postings Ranked by Increase in Activity from 2019-2022



Note: postings data shown above includes only biopharmaceuticals and medical labs industry sectors
Source: TEconomy Partners' analysis of Lightcast, JPA Database, 2023.1.

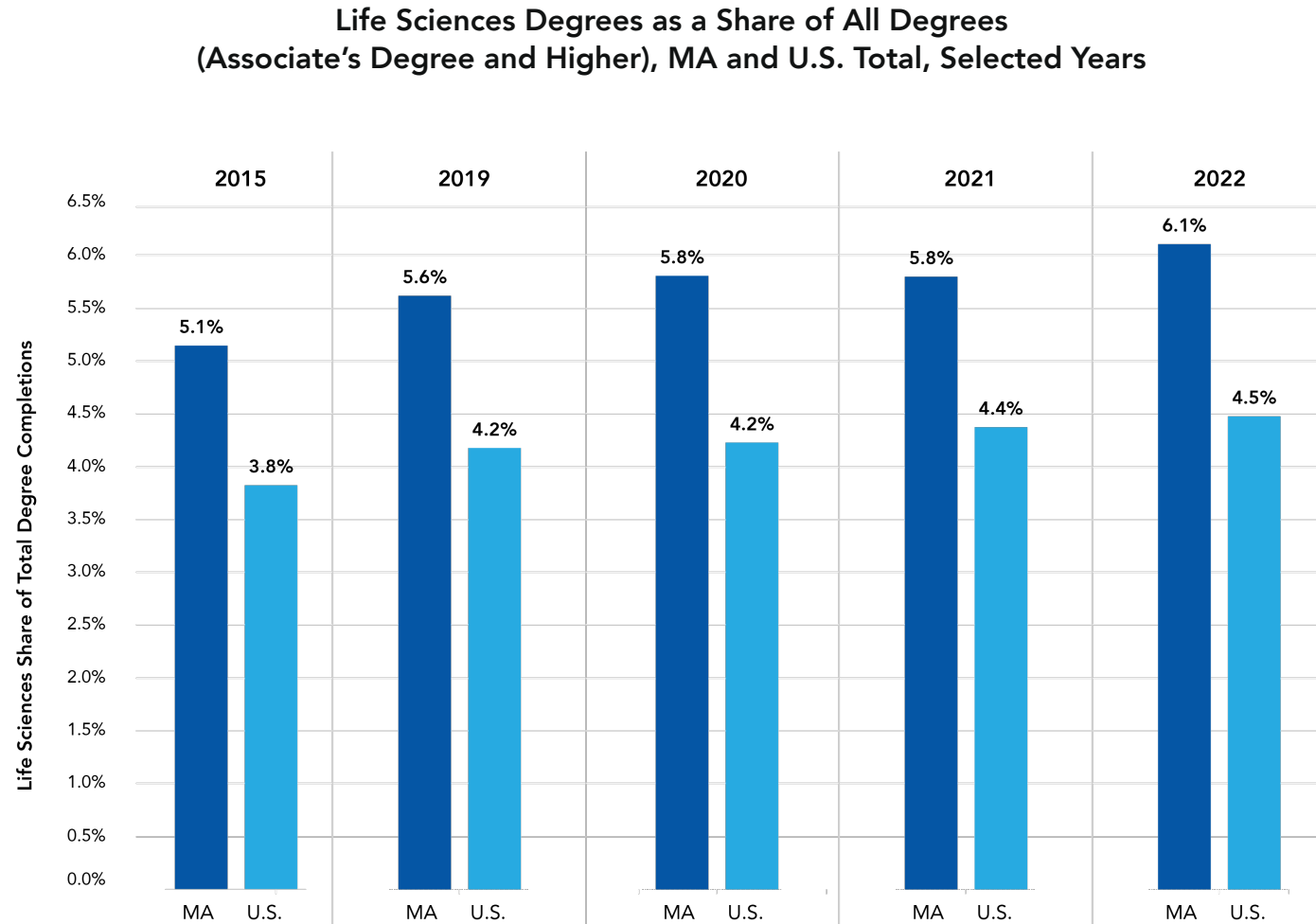


Massachusetts' Life Sciences Talent Pipeline: The Role of Educational Institutions in Generating Skilled Workers

MA Institutions Maintain a Higher Concentration in Life Sciences Degrees vs. National Average



- MA nearly 1.4 times more concentrated in life sciences degree production versus US
- State institutions generated an average of 7.4k life sciences degree graduates annually from 2019-2022



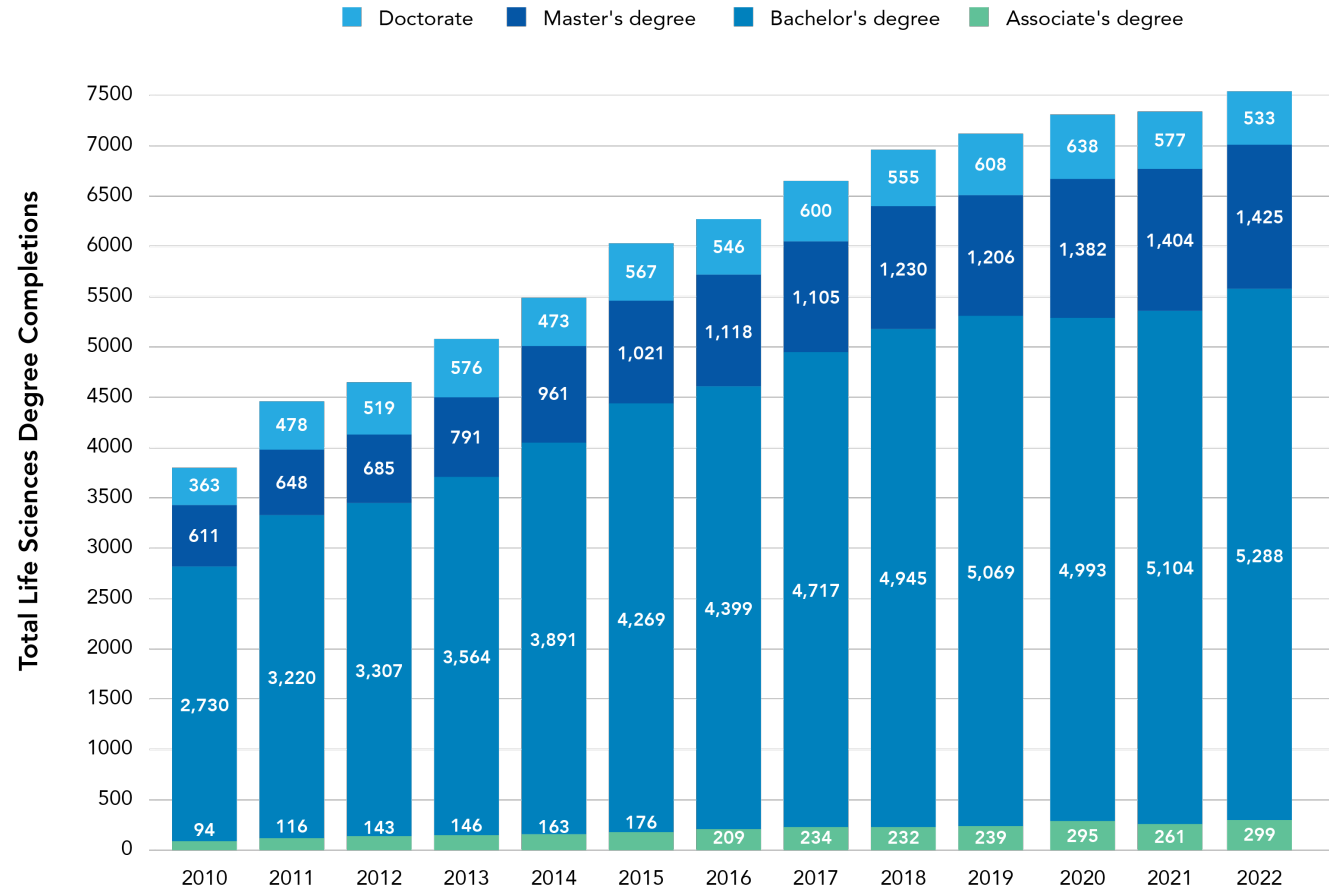
Source: TEconomy analysis of NCES IPEDS data

The Postsecondary Life Sciences Talent Pipeline Has Continued to Expand—2022 Sees New High



- After only 1% increase in life sciences degree production from 2020 to 2021, 2021-2022 saw rebound of 3% growth
- Renewed growth in the life sciences postsecondary pipeline is a promising sign for the state
- Note that these totals do not capture growing demand for occupations in secondary degree fields such as:
 - Computer sciences
 - Engineering & industrial production
 - Business & finance
 - Regulatory affairs and compliance

Trend in Postsecondary Life Sciences Degree Graduates in MA



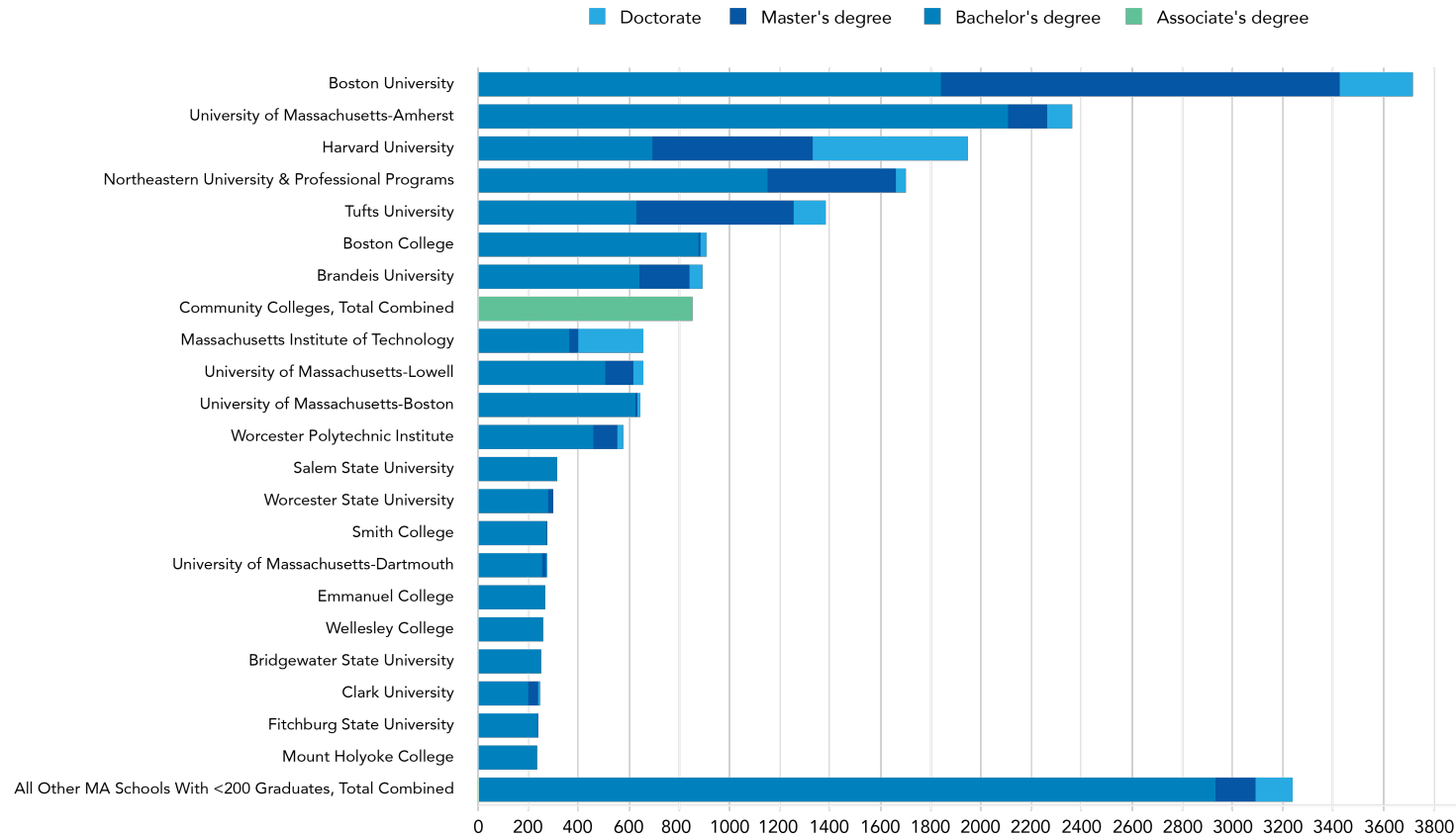
Note: The primary life sciences degree analysis includes all degrees in the biological and biomedical sciences (all NCES CIP Codes in the 26 series) and inclusive of bioinformatics/biostatistics; selected bio-specific degree fields within engineering; and biology technician and biotechnology lab tech degree fields. The analysis does not include professional degrees in health and clinical sciences per the focus of MassBioEd on the industrial and research ecosystem.

Source: TEconomy analysis of NCES IPEDS data

MA has Numerous Nationally-Recognized Public and Private Life Sciences Educational Programs Generating Significant Volumes of Graduates



Leading Massachusetts Institutions Generating Life Sciences Talent, 2020-2022 Life Sciences Degree Completions



Source: TEconomy analysis of NCES IPEDS data

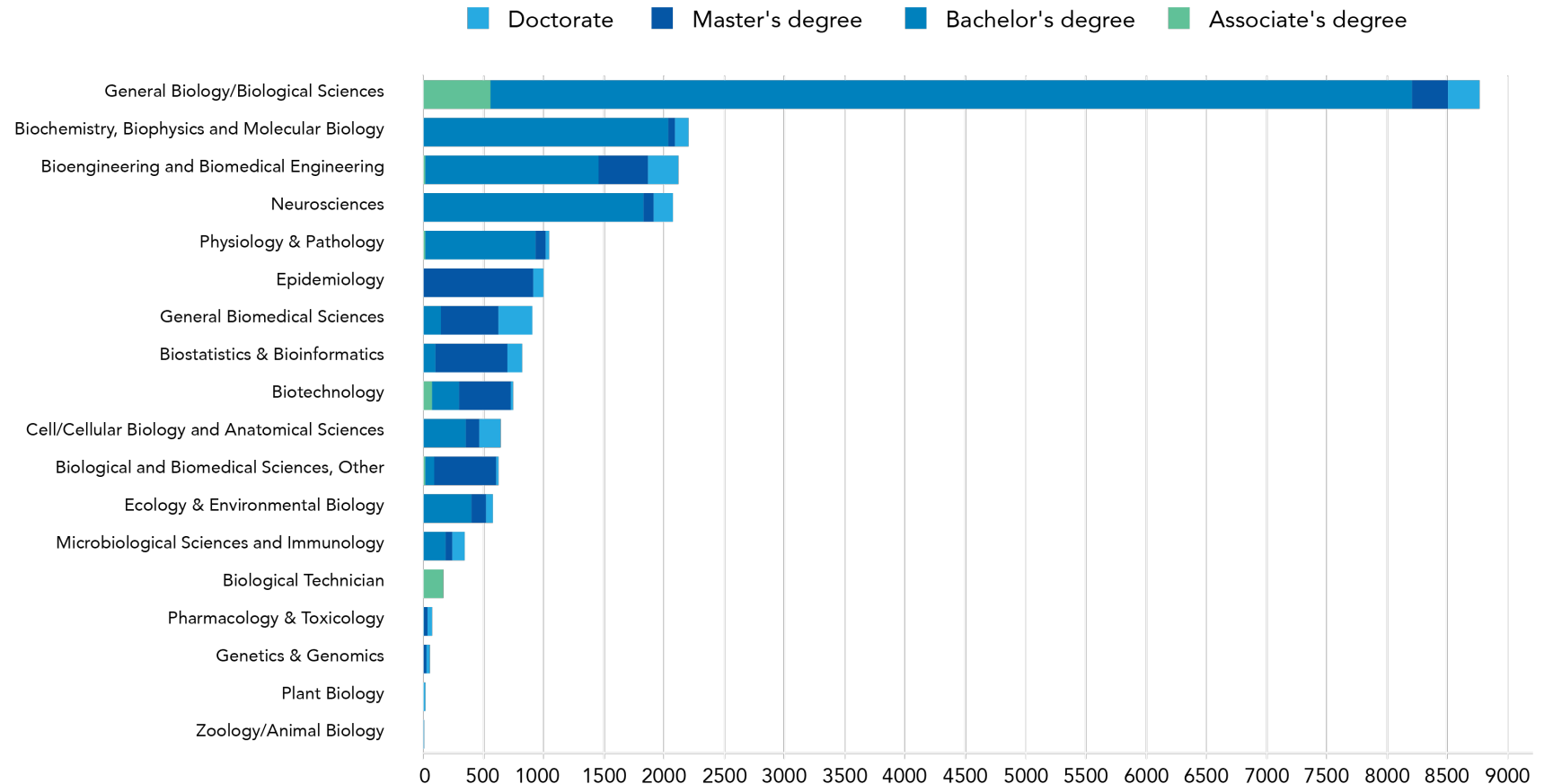
Note: See Appendix (slide 55) for summary of life sciences graduate totals from Massachusetts community colleges

MA Produces Significant National Shares in Specialized Graduate Level Fields



For example, MA produces nearly 11% of the nation's supply of biostatistics and bioinformatics program graduates, and over 16% of the nation's supply of epidemiology program graduates

Leading Life Sciences Degree Fields in Massachusetts, 2020-2022 Degree Completions

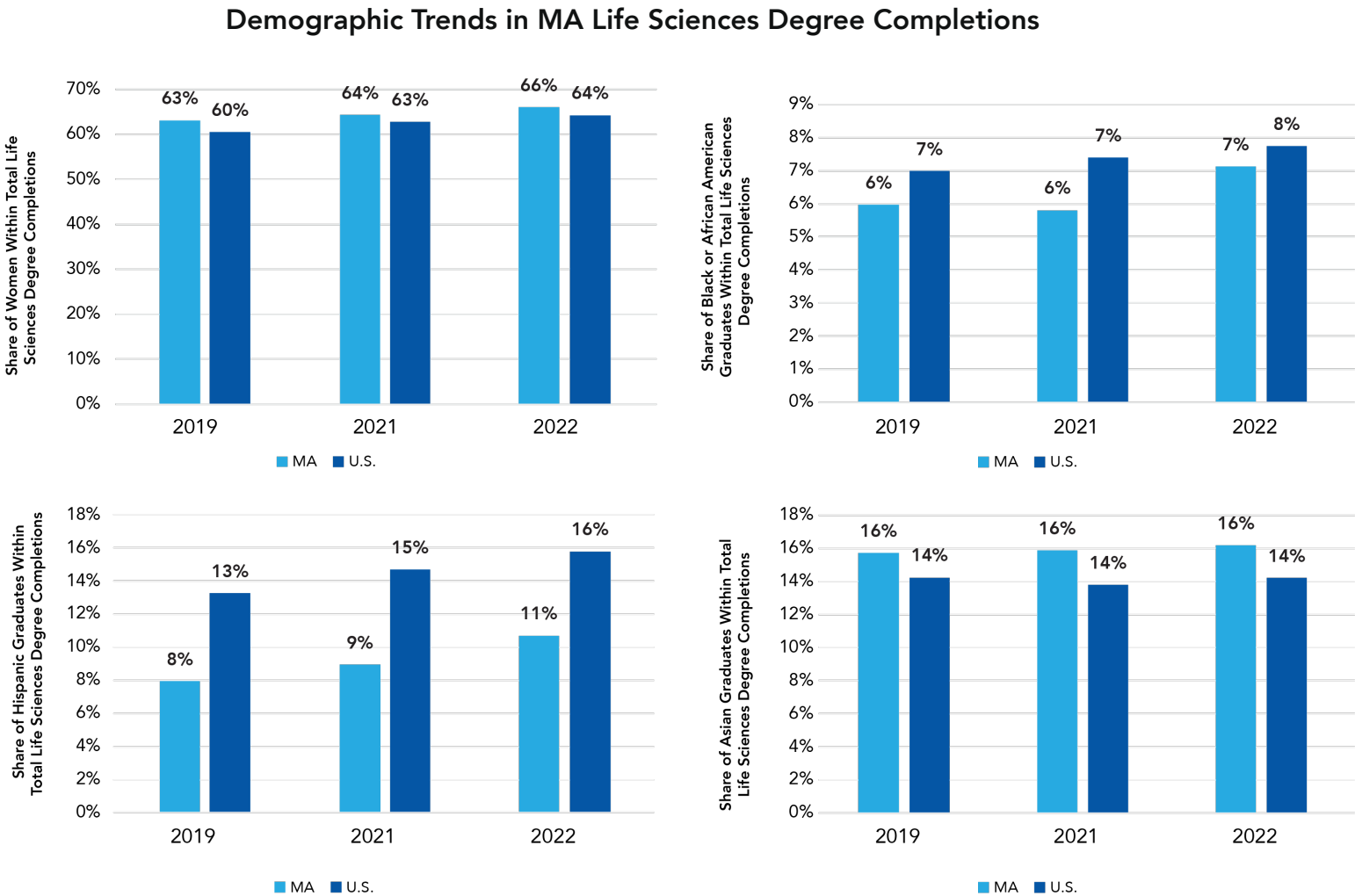


Source: TEconomy analysis of NCES IPEDS data

MA Slightly Leads Nation in Diversity of Life Science Grads by Gender, Slightly Lags Nation in Diversity by Race



The state has slightly increased its shares of women and minority life sciences graduates since 2019

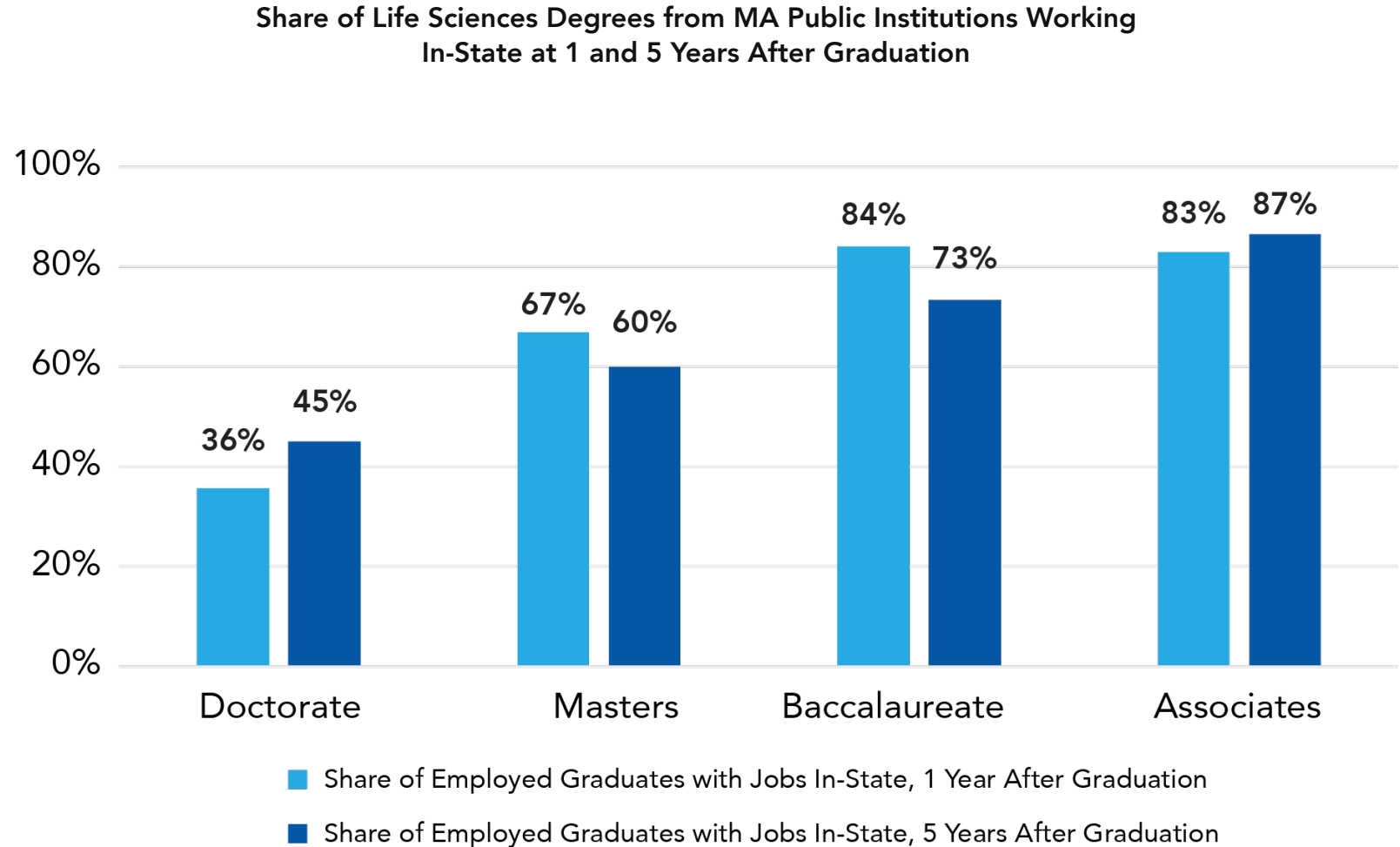


Source: TEconomy analysis of NCES IPEDS data

MA Retains Relatively High Shares of its Life Sciences Graduates Over Time



- MA public institutions report high in-state employment retention rates for Bachelor's and Associate's level bioscience and biomedical degrees
- 83% aggregate in-state retention of employed life sciences graduates one year after graduation across all degree levels



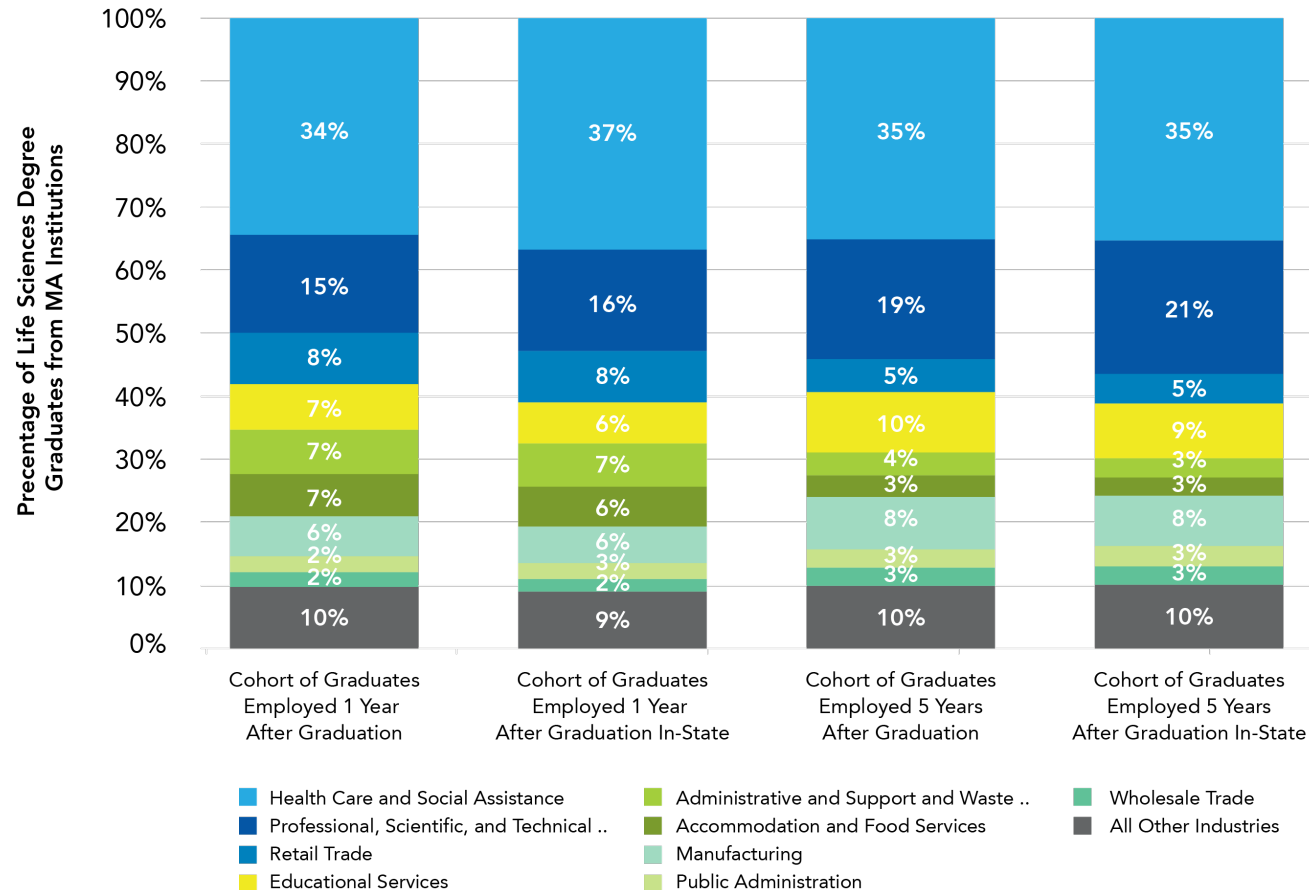
Note: PSEO data limited to MA partner institutions, includes only public institutions and an estimated 32% of coverage across all state graduates.
Source: TEconomy analysis of Census PSEO data.

MA Life Sciences Graduates are Widely Distributed Across Various Industries Beyond Life Sciences Sectors* Once They Enter the Workforce



- The majority of life sciences graduates in MA are employed in sectors outside of industrial life sciences at 1 and 5 years after graduation
- The top industry sector for new life sciences graduates was in healthcare, with 37% grads employed in-state 1 year after graduation and 35% working in healthcare 5 years post graduation

Industry Employment Flows of Life Science Graduates from MA Public Institutions by NAICS Sector



*Professional, Scientific, and Technical Services as well as Manufacturing industry sectors are the relevant categories for most biopharmaceuticals and medical labs industries outlined in this report.

Note: PSEO data limited to MA partner institutions, includes only public institutions and an estimated 32% of coverage across all state graduates

Source: TEconomy analysis of Census PSEO data



Key Findings, Insights, and Considerations for MA Life Sciences Workforce Development Efforts

Aligning Supply & Demand for MA Life Sciences Talent: Demand Continuing to Outpace the Talent Pipeline



- Projections indicate 6,617 average annual job openings in key life sciences occupations over next decade
- In recent years, the state's educational institutions have produced life sciences degree graduates in closely aligned fields that could supply, on average, 3,304 new workers annually
- The misalignment of talent supply remains for MA—life sciences degree programs at the state's colleges and universities cannot meet the demand for filling new job openings alone

**Comparison of Job Opening Trends for MA Primary Life Sciences Occupations
vs. "Supply" of New Higher Education Degrees Generated**

| Primary Life Sciences Occupational Groups | Degree Levels Generally Required for Entry | MA Average Annual Job Openings, 2019-2022 | Projected MA Average Annual Job Openings, 2022-2032 | MA Average Annual Degree Graduates in Relevant Fields, 2020-2022 |
|---|--|---|---|--|
| Life Scientists | Master's & Doctorate | 3,818 | 3,294 | 1,680 |
| Life Sciences Technicians | Associate's & Bachelors | 979 | 1,210 | 113 |
| Medical & Clinical Lab Technicians | Associate's & Bachelors | 1,329 | 1,411 | 803 |
| Life Sciences Engineers (biomedical only) | Bachelor's & Higher | 183 | 159 | 708 |
| Life Sciences Managers | Bachelor's & Higher | 511 | 543 | N/A |

Note: definitively linking supply and demand trends is difficult since new life sciences degrees may not translate directly to specific occupational roles and companies will hire from other labor pools; this analysis thus represents a high level way of assessing major imbalances in the workforce and is not a comprehensive analysis of all worker types needed in the industry. It is not possible to accurately isolate graduates specific to life sciences managerial roles as these occupations source talent from across a wide variety of degree types.

Source: TEconomy Partners' analysis of Lightcast Staffing Patterns Data, 2023.1, NCES IPEDS data; mapping of degree fields to occupations utilizes an Occupations to Degrees crosswalk developed by the Federal statistical system

Key Findings from Quantitative Analyses of Life Sciences Talent Dynamics



Massachusetts' life sciences maintains its identity as a hub for highly-skilled, highly specialized scientific and business jobs that support global life sciences operations

- Outlook for the industry remains positive, with strong recent growth and projected expansion of the workforce in the coming decade

Rapid growth of new workforce segments such as computing and IT as well as skilled production workers over the last three years highlight ongoing changes to the nature of life sciences work that will continue to unfold and require responsiveness to new talent demand from industry

While the talent pipeline remains anchored by world-class institutions and has shown promising signs of growth, the level of future demand is expected to exceed available supply in key industry roles, reaffirming a need to continue investing in scaling educational and training programs

- Projections indicate more than 6,600 average annual job openings in key life sciences occupations over next decade, but an average annual supply of only half of this amount from new graduates in closely aligned fields from the state's educational institutions
- While retention of graduates in-state does not appear to be a major barrier to growth based on data from public institutions, there are some indications that life sciences talent "leakage" to other industries and competition with other STEM-intensive sectors for skilled labor may be a key limiting factor to meeting demand



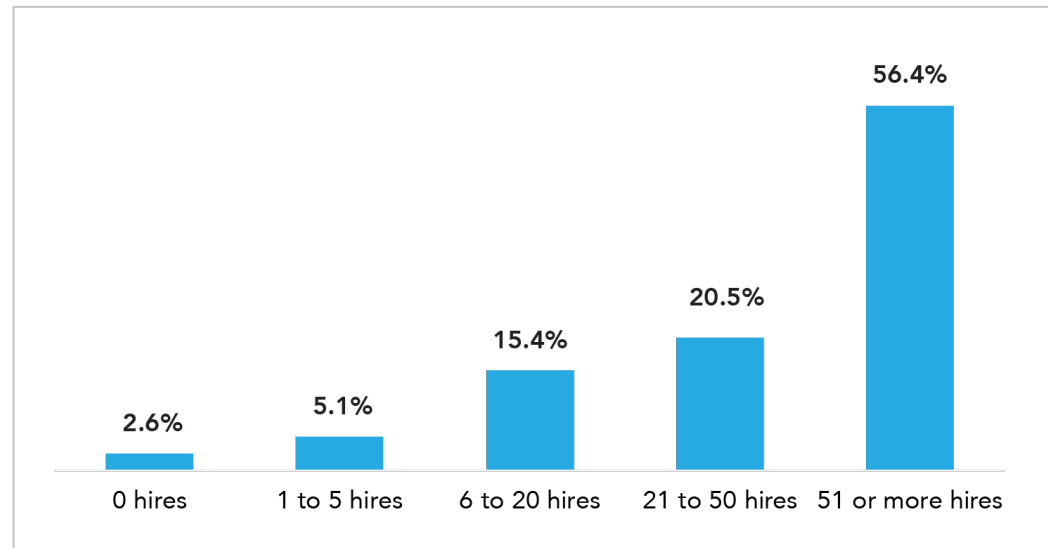
Employer Insights from CSBI Interviews & Survey

MA Life Sciences Companies are Actively Hiring, While Leveraging Remote Work to Meet Demand

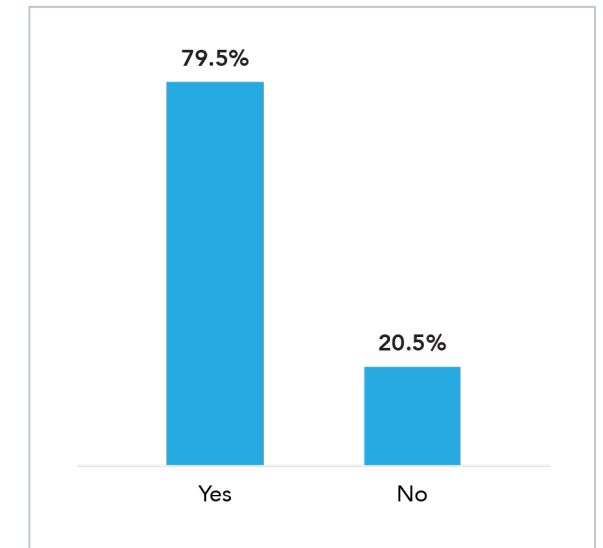


- Life sciences companies surveyed reported significant hiring activity throughout 2021 and 2022—56% reporting hiring 51+ new employees
- Nearly 80% of companies reported leveraging remote work options, primarily to access talent from other geographies (62%); and to compete with other industries, including Tech (55%)

Share of Respondent Life Sciences Industry Companies with New Hires in the Last 2 Years, by Level of Hiring Volume (n = 39)



Share of Respondent Life Sciences Companies with Remote Work Options (n = 39)

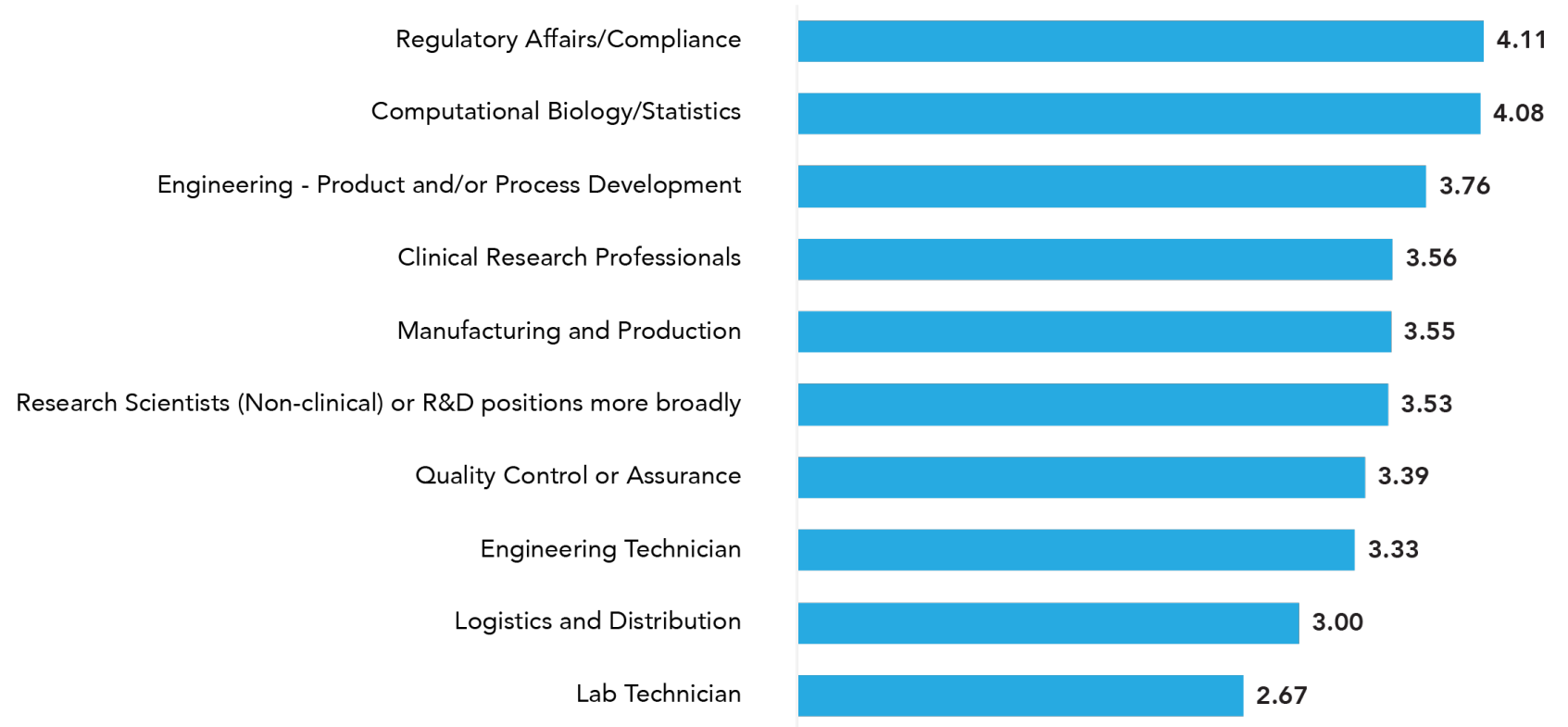


Many MA Life Sciences Companies Reported More Difficulty in Finding and Hiring Qualified Candidates in Certain Specialized Roles



Regulatory affairs as well as computational biology and bioinformatics are seen as the most challenging to hire

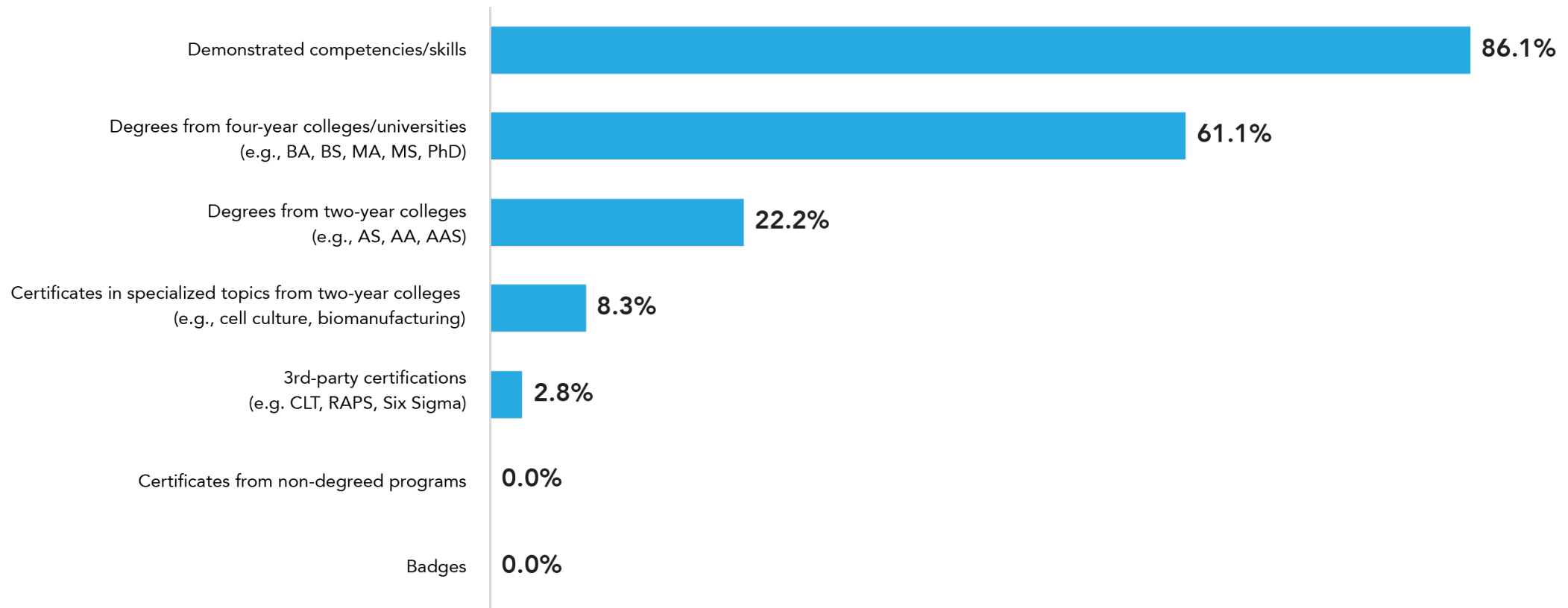
Life Sciences Occupational Roles Ranked by Respondents in Avg. Difficulty in Hiring Score, 5 = highest (n = 38)



Job Requirements for Entry-Level Positions at MA Life Sciences Companies Place Emphasis on College Degrees, Demonstrated Competencies



Share of Companies Surveyed Ranking Various Credentials as “Very Important” when it comes to hiring entry-level technical positions (e.g., lab or engineering technicians, skilled production workers, n = 36)



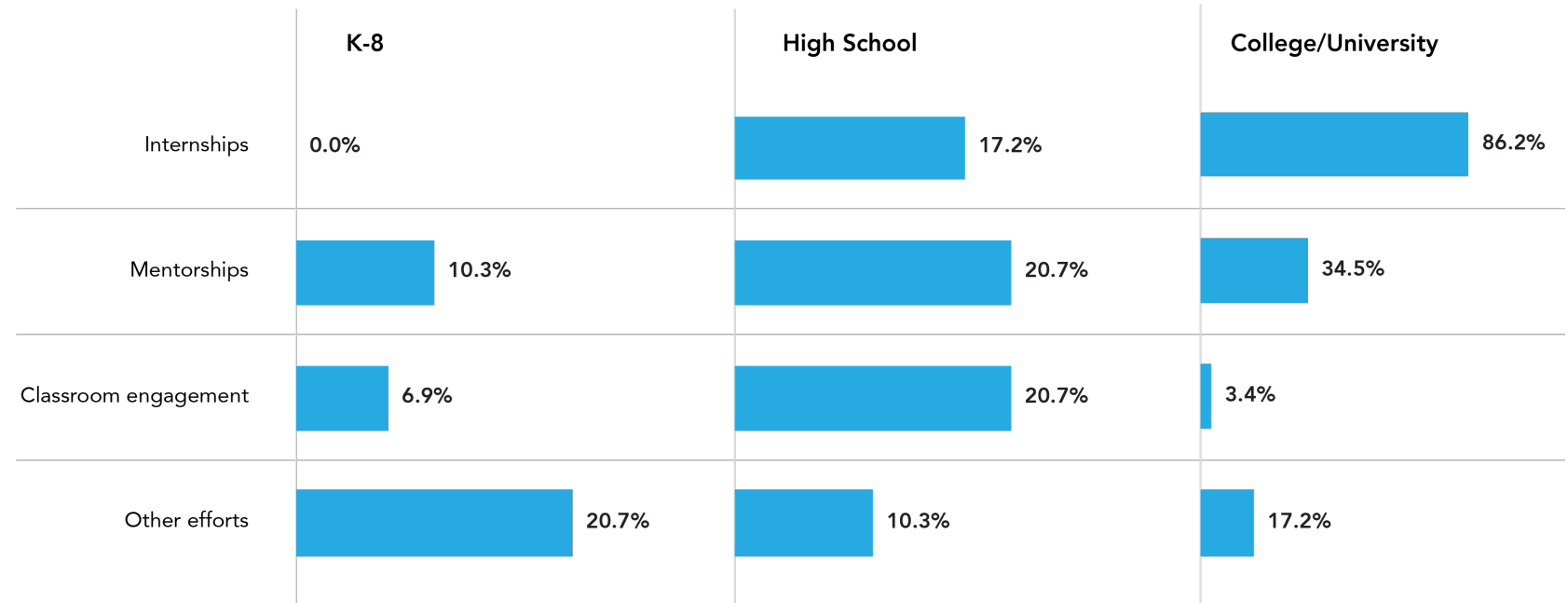
Source: CSBI and TEconomy Partners Life Sciences Industry Hiring Survey 2023.

MA Companies Are Engaging with K-12 and College Students in Varied Ways to Raise Career Awareness, Develop More Diverse STEM Talent Pipelines

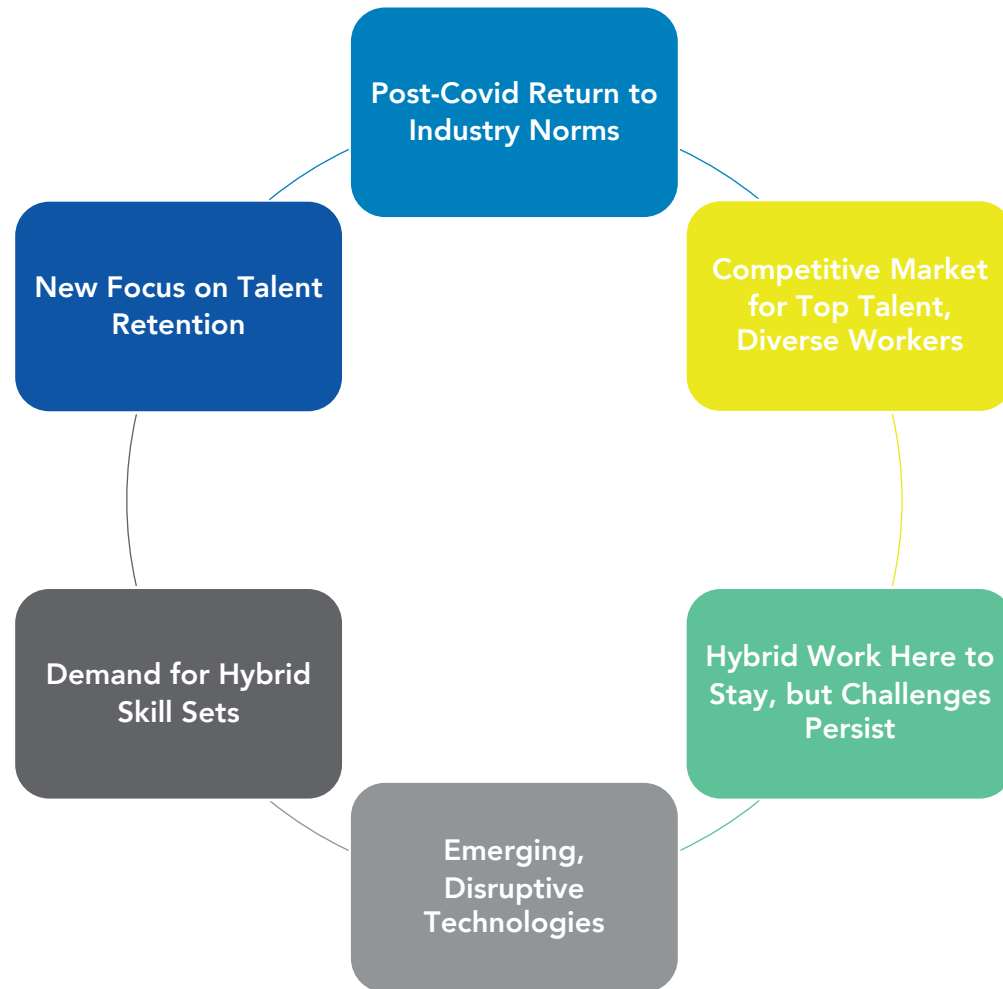


- Nearly 21% of companies reported some efforts in K-12 pipeline development efforts
- Traditional college internship models for building talent pipelines remain dominant

Share of Respondent Life Sciences Companies with STEM Pipeline Initiatives by Education Level (n = 29)



Additional Themes Emerging from Executive Interviews* Conducted as Part of the CSBI Workforce Trends Assessment



Companies participating in interviews:



windgapmedical

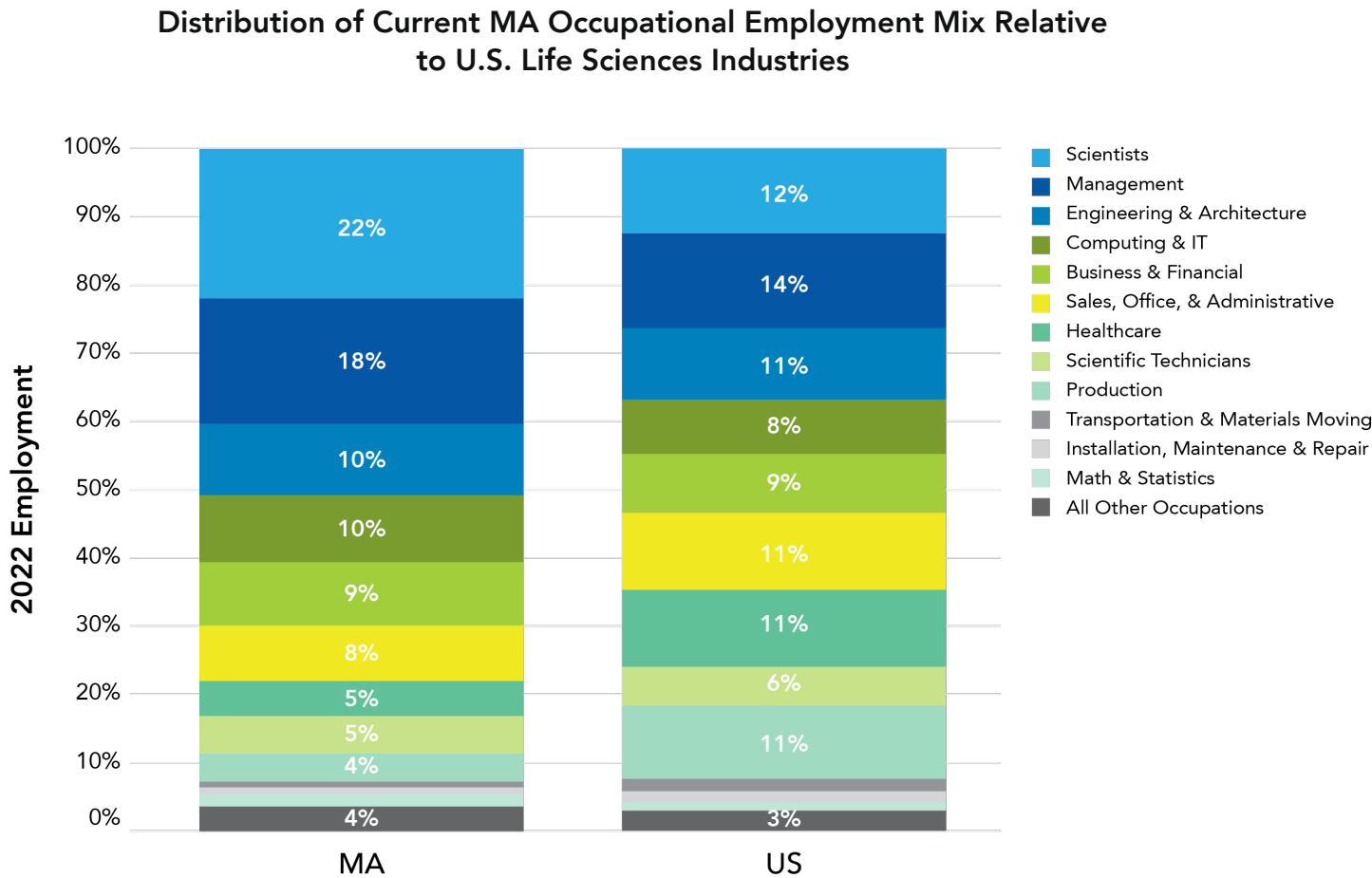


*In addition to survey responses, MassBioEd conducted 9 executive interviews with executives at major life sciences companies to inform qualitative assessments of talent demand drivers.

Appendix/Reference Slides

MA Life Sciences Industry is Anchored by its Specialized Scientific Workforce

The state employs a much greater concentration of life scientists than the overall U.S. life sciences workforce – over 10 percentage points higher as a share of the industry



Source: TEconomy Partners' analysis of Lightcast Staffing Patterns Data, 2023.1

Recent Growth Trends Across Key Life Sciences Workforce Segments Show Rebound from Pandemic Disruptions

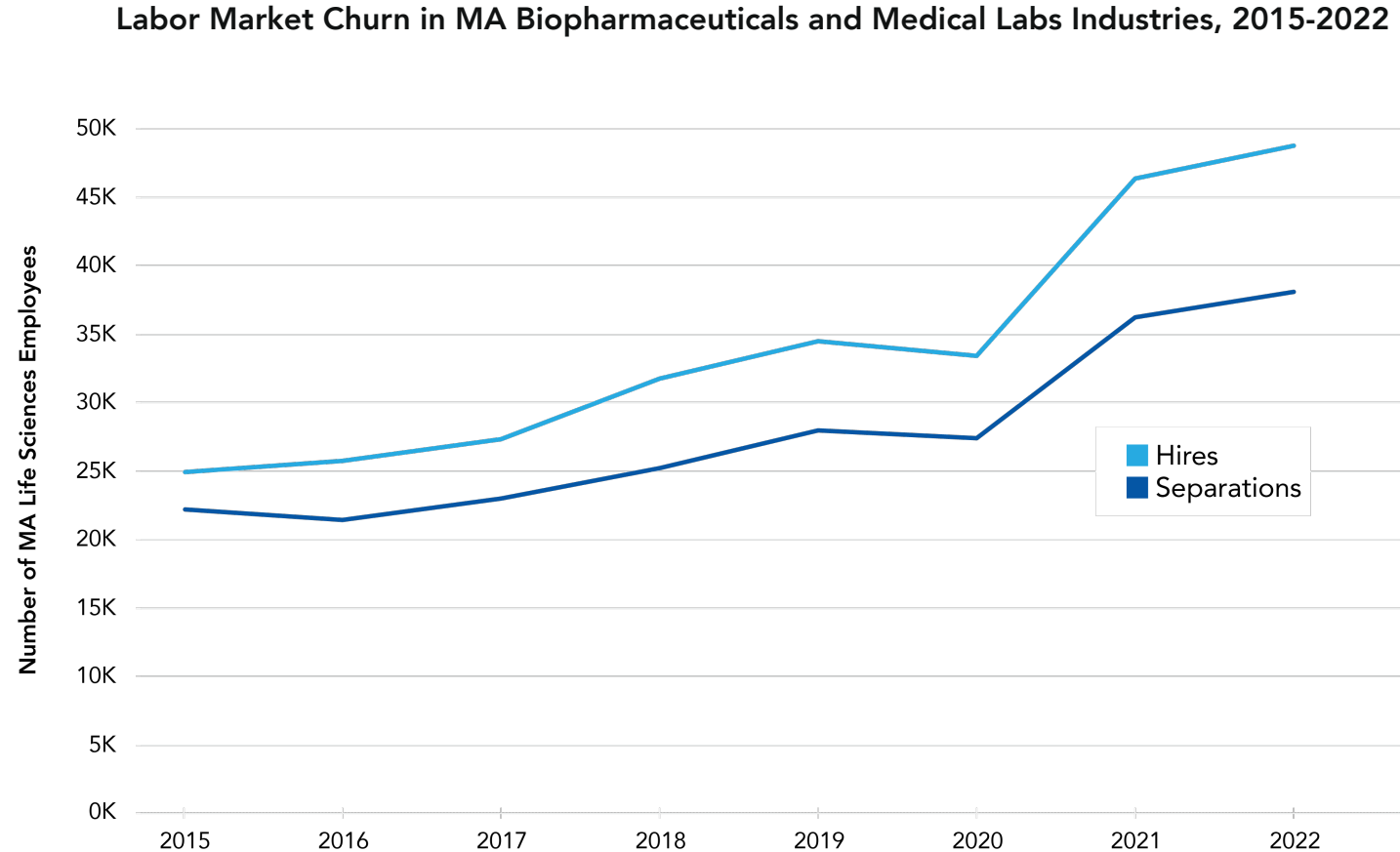
Performance of Leading MA Life Sciences Occupational Segments (>2k jobs),
Average Annual Pre-pandemic Years (2015-2019) and Post-pandemic Years

| MA Life Sciences Occupational Segment | 2022 Life Sciences Industry Employment | Average Annual Employment Change, 2015-2019 (pre-pandemic) | 2020-2021 Employment Change | 2021-2022 Employment Change |
|---------------------------------------|--|--|-----------------------------|-----------------------------|
| Scientists | 24,394 | 1,338 | 790 | 1,154 |
| Management | 20,570 | 1,401 | 2,178 | 964 |
| Engineering & Architecture | 11,614 | 573 | 399 | 595 |
| Computing & IT | 11,046 | 595 | 2,596 | 653 |
| Business & Financial | 10,262 | 661 | 1,381 | 524 |
| Sales, Office, & Administrative | 9,079 | 485 | -142 | 331 |
| Scientific Technicians | 5,987 | 191 | 192 | 304 |
| Healthcare | 5,689 | 249 | 112 | 192 |
| Production | 4,590 | -121 | 681 | 268 |
| Mathematics & Statistics | 2,029 | 109 | 127 | 134 |

Note: Excludes 2019-2020 change which reflected significant economic disruption from pandemic conditions
Source: TEconomy Partners' analysis of Lightcast Staffing Patterns Data, 2023.1

Life Sciences Hires Continue to Outpace Separations in MA, with Significant Uptick in Overall Activity After 2020

- Nearly 49k hires across biopharmaceuticals and medical labs industry sectors in 2022
- Hiring demand is projected to continue outpacing churn through 2024 indicating ongoing expansion and job creation

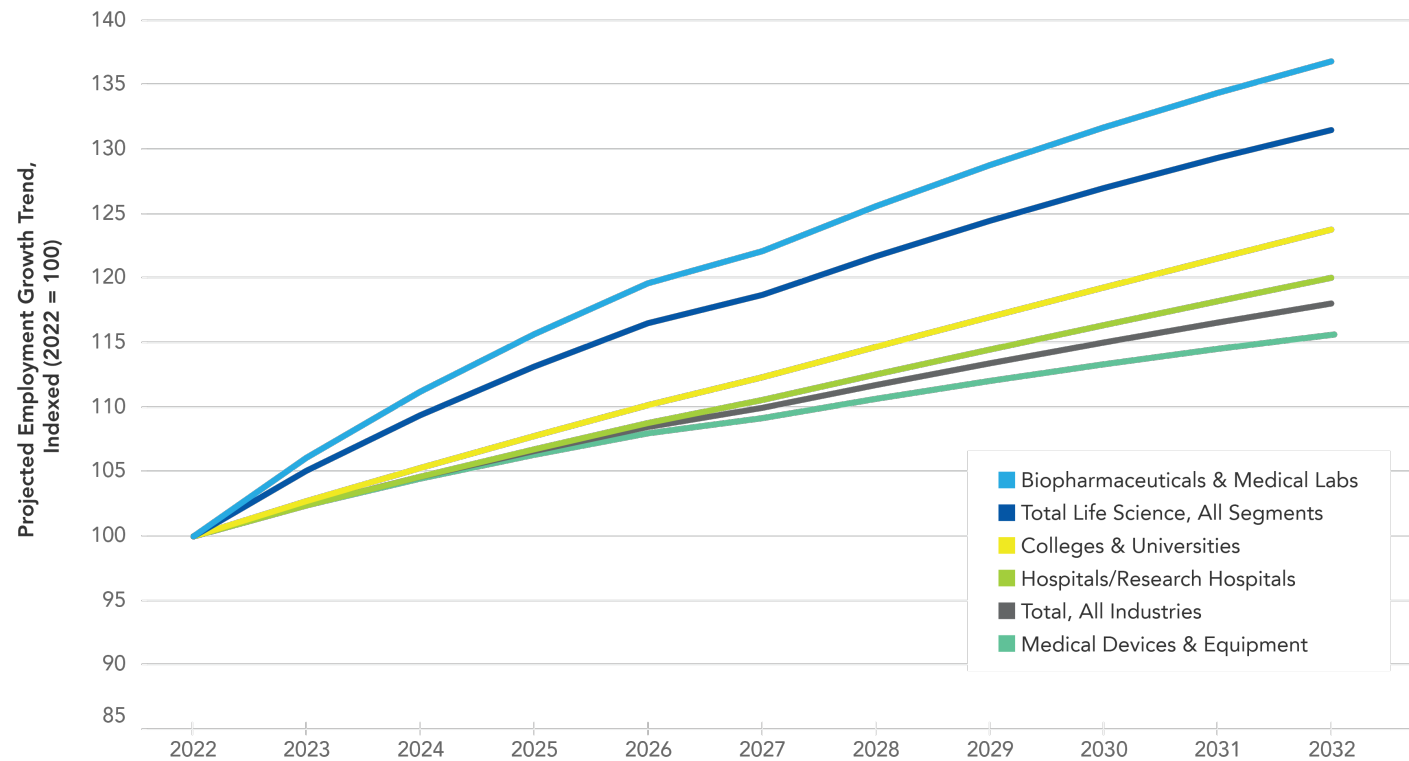


Note: Hires and separations from 2022 through 2024 are estimates by Lightcast.
Source: TEconomy Partners' analysis of Lightcast Industry Employment Data, 2023.1

Employment Projections Expect Strong Continued Growth, Led by Biopharmaceuticals & Medical Labs

While the overall MA economy is projected to grow its employment base by 18% by 2032, the life sciences industry is projected to grow by 32%, adding a projected 41,600 net new jobs

Projected Employment Growth Trends for MA Life Sciences Segments, 2022-2032

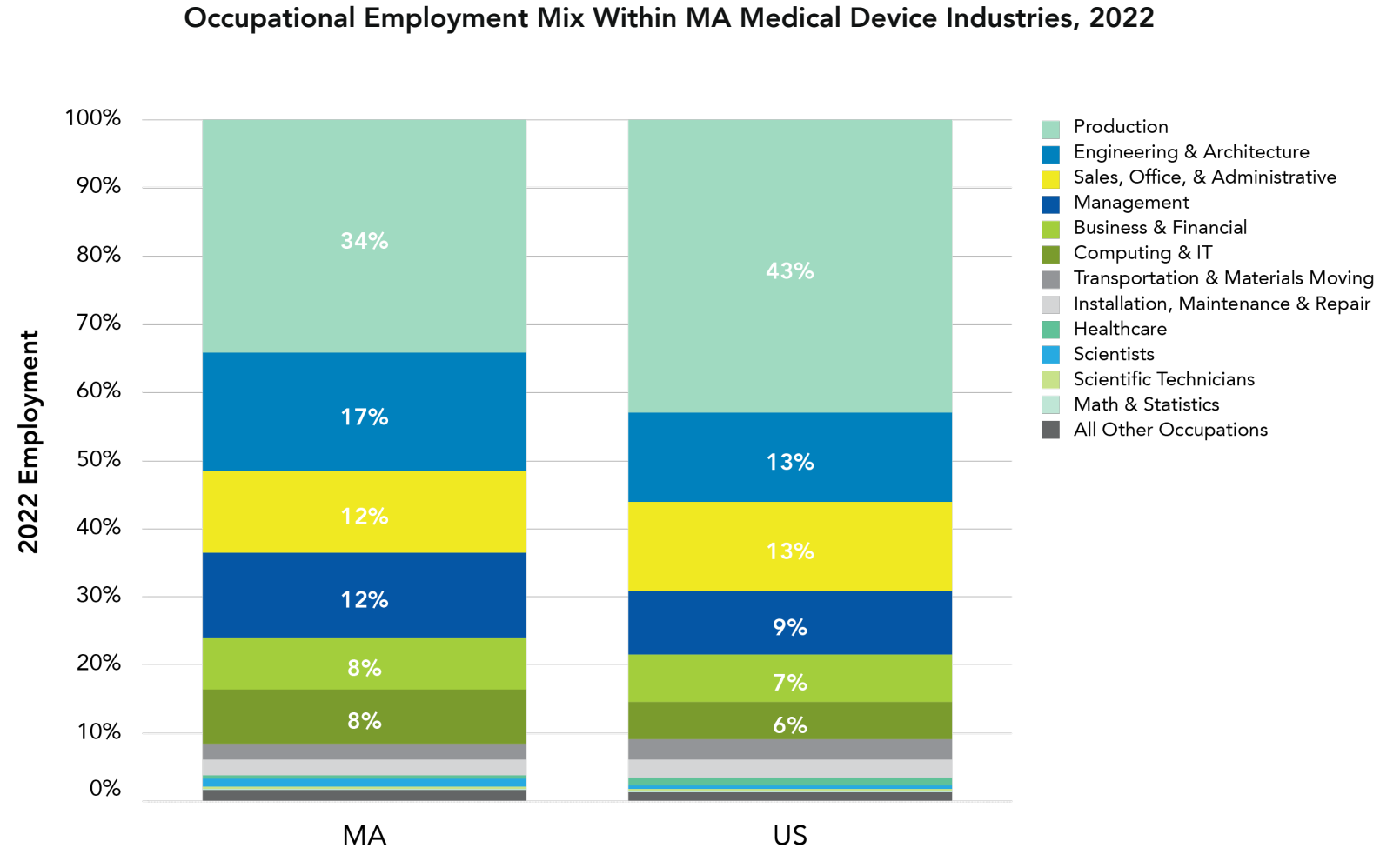


Note: Lightcast uses a combination of national (BLS), state/local, and internal projection methods. Lightcast occupation projections are based off of estimated industry data with projected, regionalized staffing patterns applied to the figures. As a result, the occupational projections will necessarily differ from BLS and state labor market information (LMI) occupation numbers.

Source: TEconomy Partners' analysis of Lightcast Industry Employment Data, 2023.1.

MA Medical Device Industry is Sizable, Plays a Complementary Role in Anchoring the State's Life Sciences Sector

- Medical device manufacturers employed 24.1k workers in 2022, have grown by nearly 4% since 2019
- The industry in MA is specialized across its engineering workforce, employing 4 percentage points more engineers than the national average



Source: TEconomy Partners' analysis of Lightcast Staffing Patterns Data, 2023.1

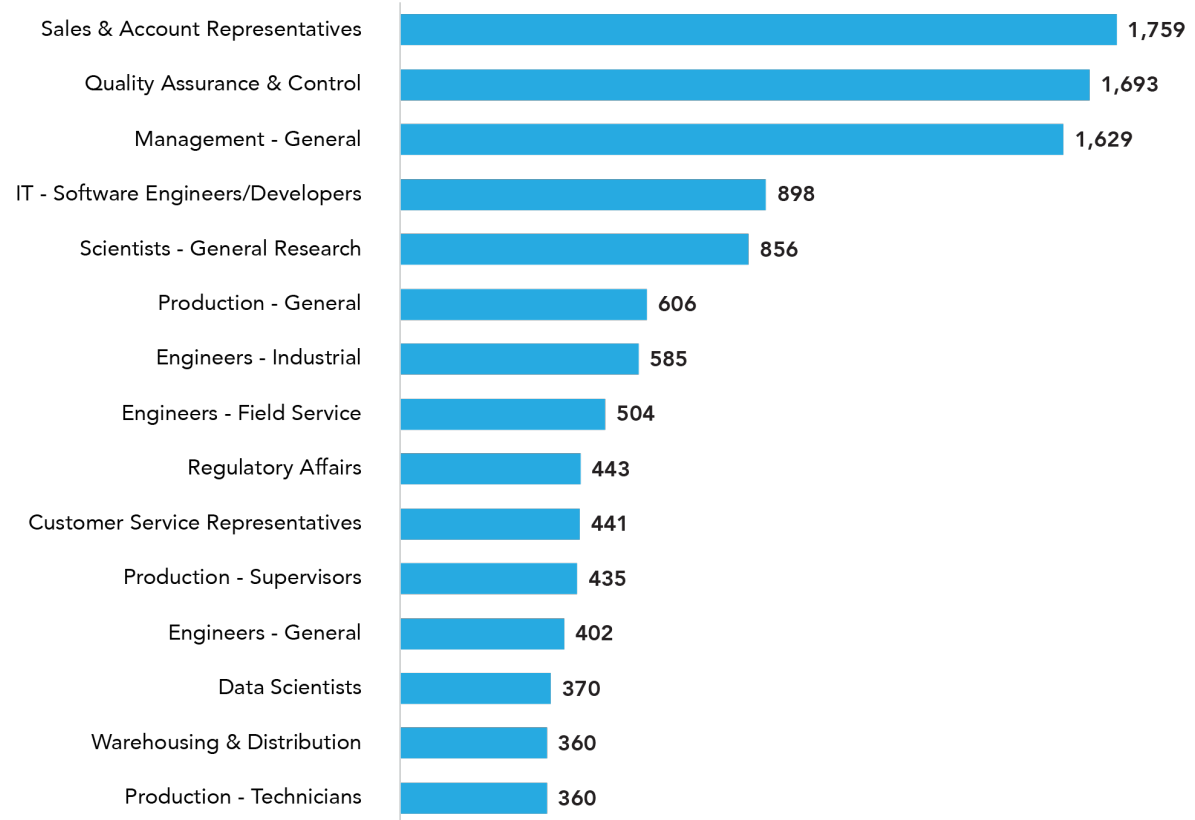
Hiring Demand in Medical Devices Sector Focused on Business Support, Quality Assurance, and Production Engineering Roles

Who's Hiring?

Leading Companies by Unique Job Posting Totals for 2019-22 in Descending Order

- Thermo Fisher Scientific
- Boston Scientific
- Waters
- Medtronic
- Philips Electronics North America
- PerkinElmer
- MilliporeSigma
- Instrumentation Laboratory
- Abiomed
- Insulet Corporation
- Hologic
- Abbott Laboratories

Leading Job Titles in MA Medical Device Job Postings, 2019-2022



Note: Lightcast limits information on job titles and corresponding numbers of postings to the top 1,000, limiting the ability to provide comprehensive totals by categories.
Source: TEconomy Partners' analysis of Lightcast, JPA Database, 2023.1.

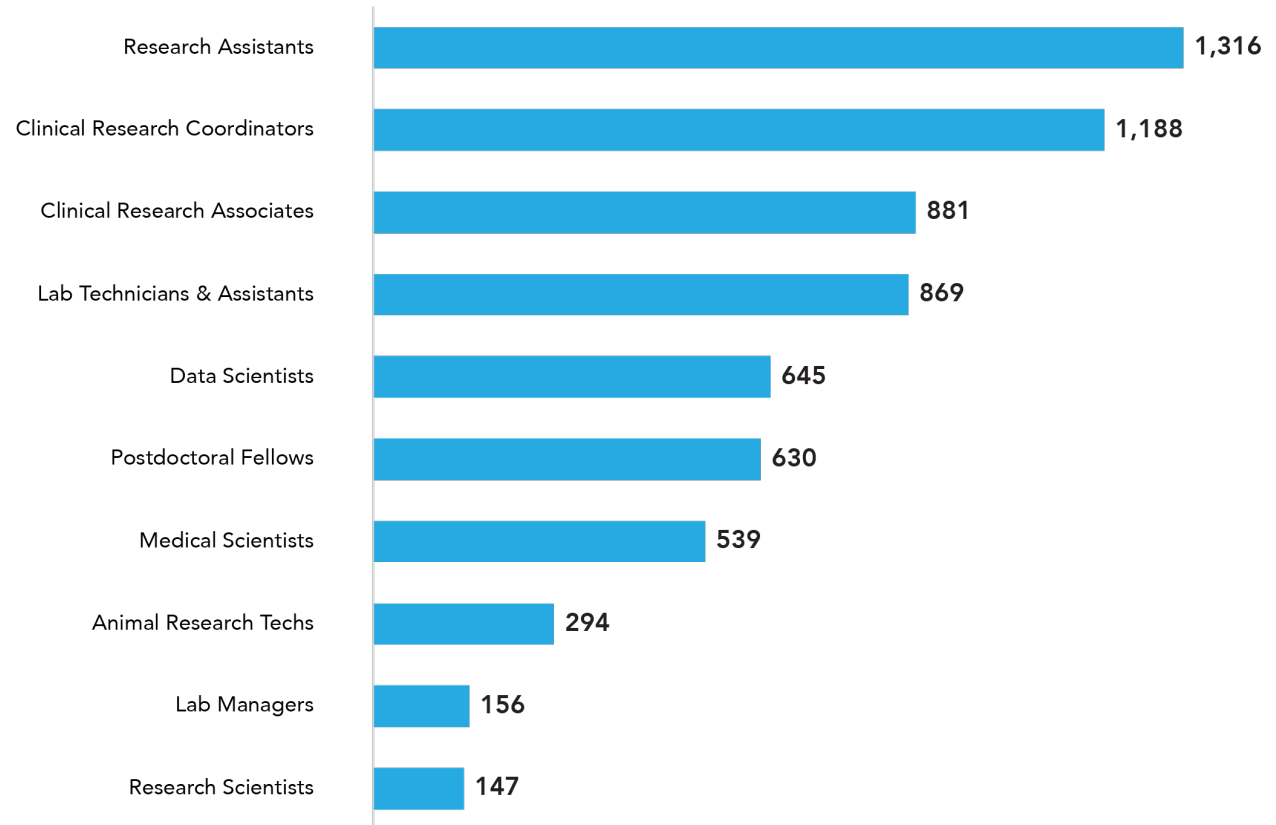
Hiring Demand in for Life Sciences Amongst Hospitals Focused on Clinical Research Professional Positions

Who's Hiring?

Leading Hospitals/Systems
by Unique Job Posting Totals for
2019-22 in Descending Order

- Massachusetts General Hospital
- Beth Israel Deaconess Medical Center
- Boston Children's Hospital
- Boston Medical Center
- Baystate Health
- Lowell General Hospital
- Tenet Healthcare
- Cambridge Health Alliance
- Southcoast Health
- Encompass Health

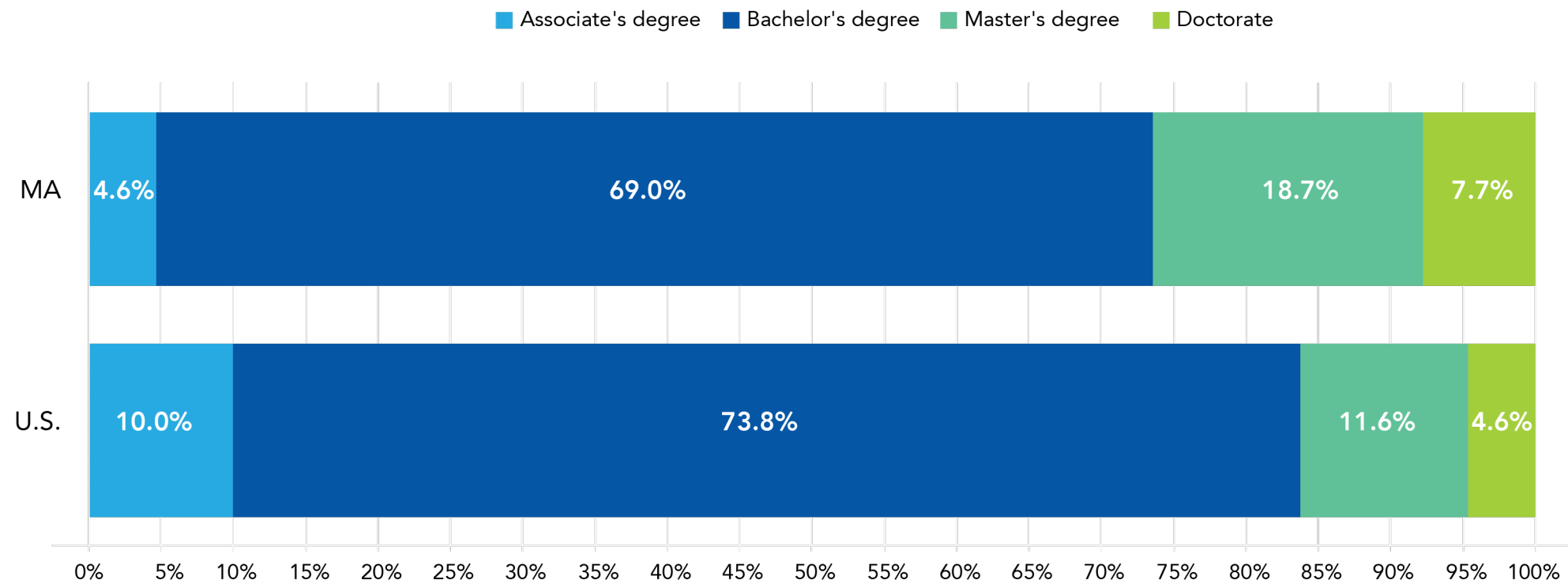
Leading Non-Patient Care Scientific and/or Research-Related
Job Titles in MA Hospitals Job Postings, 2019-2022



Note: Lightcast limits information on job titles and corresponding numbers of postings to the top 1,000, limiting the ability to provide comprehensive totals by categories.
Source: TEconomy Partners' analysis of Lightcast, JPA Database, 2023.1.

Postsecondary Life Sciences Degree Graduates in MA More Concentrated at Advanced, Graduate Levels

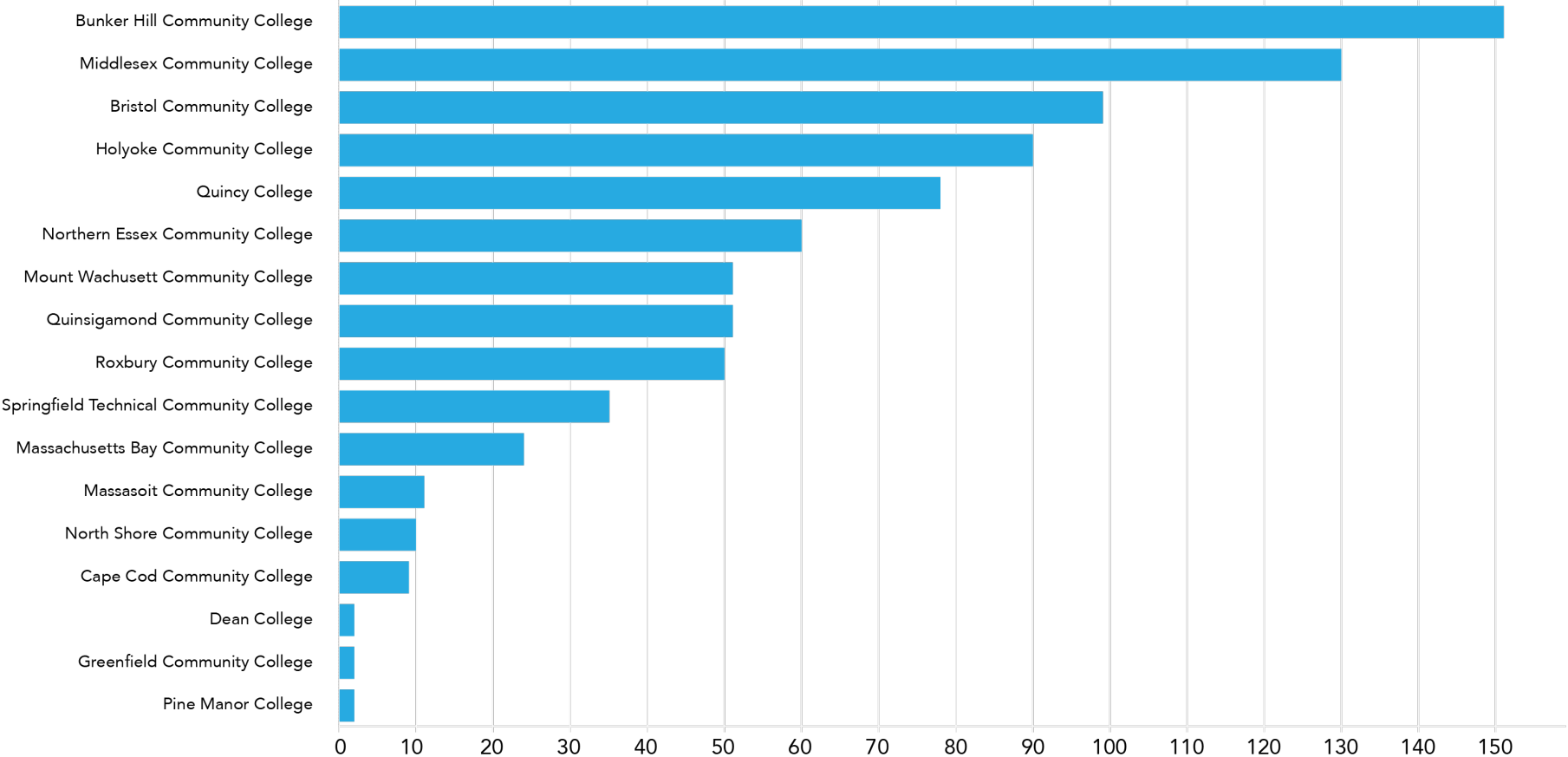
Life Sciences Degree Awards by Level, MA and U.S., 2020-2022



Source: TEconomy analysis of NCES IPEDS data

MA Life Sciences Talent Pipeline is Served by an Active Community College System, With Programs Generating Skilled Technician and Biotechnology Associates-Level Talent

MA Community Colleges Generating Life Sciences Talent, 2020-2022 Life Sciences Degree Completions



Source: TEconomy analysis of NCES IPEDS data

Further Insights & Themes from the Coalition of State Bioscience Institutes (CSBI) Workforce Trends Interviews, Survey

39 MA life sciences companies contributed responses to this year’s CSBI survey, with a focus on drug and pharmaceutical companies focus on R&D and manufacturing

MA CSBI Respondents by Industry Subsector

| Industry Subsector | # of Companies |
|--|----------------|
| Drugs and Pharmaceuticals | 22 |
| Research, Testing & Medical Laboratories | 7 |
| Medical Devices and Equipment | 4 |
| Industrial Biotech | 1 |
| Other Biosciences | 5 |
| Total | 39 |

MA CSBI Respondents by Operational Focus of Site

| Operational Focus Area | # of Companies |
|--|----------------|
| Research-focused | 16 |
| Integrated - Research and Manufacturing-focused | 11 |
| Manufacturing-focused | 6 |
| Other Area | 4 |
| Administrative and/or Office Only (e.g., HQ, Sales Office) | 1 |
| Contract Manufacturing | 1 |
| Total | 39 |

MassBioEd participated as the state partner for the biennial CSBI Workforce Trends Survey, which leverages responses from industry stakeholders to inform key demand drivers. The 2023 edition of the Outlook incorporates this industry-led perspective highlight relevant trends and themes that can inform key insights about “on the ground” conditions.

Source: CSBI and TEconomy Partners Life Sciences Industry Hiring Survey 2023.

Over the Next Year, MA Life Sciences Companies Expect Hiring to Continue, With High Volume Near-Term Needs in Research Scientists and R&D Positions as well as Manufacturing and Production Roles

Number of Companies Hiring Over Next 12 Months by Volume of Anticipated Hires and Role (n = 35)

| Role | 1 to 5 hires | 6 to 10 hires | 11 to 20 hires | 21 to 30 hires | 30+ hires |
|--|--------------|---------------|----------------|----------------|-----------|
| Research Scientists (Non-clinical) or R&D positions more broadly | 8 | 13 | 3 | | 1 |
| Quality Control or Assurance | 13 | 5 | 3 | | |
| Clinical Research Professionals | 15 | 3 | 2 | | |
| Computational Biology/Statistics | 15 | 2 | 1 | | |
| Engineering - Product and/or Process Development | 8 | 4 | 4 | | |
| Lab Technician | 9 | 3 | 3 | 1 | |
| Manufacturing and Production | 6 | 4 | 2 | 1 | 3 |
| Regulatory Affairs/Compliance | 12 | 3 | | | |
| Logistics and Distribution | 10 | 2 | 1 | 1 | |
| Engineering Technician | 7 | | 4 | | |

Additional Themes Emerging from Executive Interviews* Conducted as Part of the CSBI Workforce Trends Assessment

- **Life sciences companies are experiencing some return to normalcy in the wake of Covid** in terms of ability to compete for talent, leveling-off of salary expectations, and availability of talent in the Massachusetts labor market
- **However, top talent (particularly diverse talent) is still in high demand in a very competitive environment where life sciences competes against other STEM-intensive industries as well as other life sciences companies** (high prevalence of companies “stealing” top talent from one another), with demographic trends working against growing the talent base in MA
- **Hybrid work models are here to stay in life sciences, but are not optimal for all types of roles and teams** – while hybrid and remote work has opened up new markets to source needed talent and availability of remote options has remained consistent, it creates challenges in establishing a strong work culture and staffing certain types of business functions

*In addition to survey responses, MassBioEd conducted 9 executive interviews with executives at major life sciences companies to inform qualitative assessments of talent demand drivers.

Additional Themes Emerging from Executive Interviews* as Part of the CSBI Workforce Trends Assessment (continued)

- **Several emerging technologies are poised to further disrupt traditional life sciences workplace models led by a general shift towards large scale digitization of records and data**, including new types of precision manufacturing needed to enable gene and cell-based therapeutics, AI and machine learning-driven clinical and bioinformatics applications, and a transition from wet labs to “dry discovery”
- **There is a key need looking forward for hybrid skill sets that combine traditional life scientist skills in fundamental biology and chemistry with digital skills and computational modeling**, however this type of talent is in very short supply across tight labor markets
 - Companies are increasingly turning to skills-based hiring to fill these roles and source the right types of talent for the future
- In response to hiring challenges and renewed demand, **many MA companies are investing in retaining top talent and developing skilled workers from within their organizations through upskilling and other talent development initiatives**

*In addition to survey responses, MassBioEd conducted 9 executive interviews with executives at major life sciences companies to inform qualitative assessments of talent demand drivers.

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