Sector:	Life Sciences
Intermediary:	Life Science Washington
Contract:	K7835
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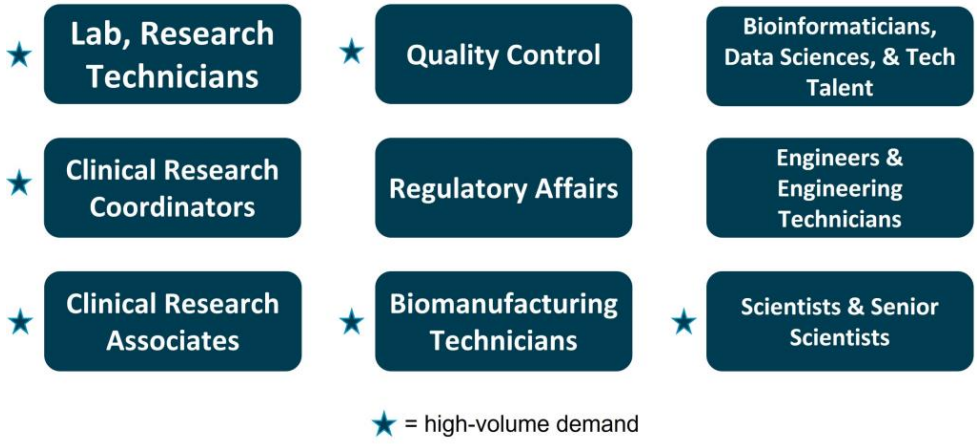
I. Executive Summary

Life Science Washington (LSW) was tasked to identify a cohesive workforce strategy as the sector intermediary for life sciences. LSW has engaged TEConomy Partners, LLC (TEConomy) to assist in conducting background research and strategy development through an approach that utilizes both quantitative and qualitative methods.

The project team has conducted detailed industry and occupational staffing patterns analyses for Washington's life sciences industry to inform how the state is unique in its industrial composition and underlying occupational makeup. The detailed occupational employment analyses, considering size, recent growth, relative concentration/specialization, wages, and other factors, in combination with conversations with 20 Washington-based life sciences companies, were used to identify a set of "high-demand, high-priority" occupations to inform strategic interventions and investments. These priority roles are summarized in Figure ES-1.

Figure ES-1: Identified High-Demand, High-Priority Life Sciences Industry Occupations



Source: TEConomy Partners' analysis.

In addition to the demand for specific occupations and skills, the industry interview discussions also raised strategic challenges and important workforce dynamics facing Washington life sciences companies, including:

- **A major emphasis by companies and biomedical research institutions on the need for real-world experience developed by working in labs or on production lines along with knowledge of business operations**. Many companies require several years of experience, for example, for

lab technicians, clinical research associates or scientists. This is a challenge and significant barrier for those seeking entry into the industry and important to address through initiatives put forth in the recommendations section.

- **A consistent theme emerged around a major need for career awareness of the industrial life sciences industry**. Students, teachers, and parents are unaware of the breadth of state companies and career opportunities and talent pipelines are suffering from this lack of awareness.
- **A lack of clear education and training pathways, credentials, and skills needed for the diversity of jobs in the industry.** The education and workforce system needs to establish a greater diversity of credentials, experiential learning, and recognized pathways (modular layering of on- and off-ramps training) to enable various career paths in response to demand across a wide swath of life sciences employers.
- **The need to significantly expand the limited higher education and workforce programs recognized by industry** to meet demand. There are a handful of programs at several community colleges and universities that focus on life science careers, but not enough volume for industry to consider them a primary channel to meet demand.
- **Several barriers to sourcing talent from outside the state have been emphasized by industry** which are difficult to overcome in the short term, including high cost of living in Greater Seattle, perception of more limited opportunity within the state industry cluster, competition with higher-paying industries, and difficulty incorporating remote work models that are in high demand by top talent.

These industry talent dynamics represent important areas for strategic interventions and investments.

Unlike other industries that might require large numbers of people in similar jobs, the life science industry faces a significant labor shortage, but the shortage is across a wide variety of jobs each with manageable demand. As a result, our strategy focuses on building or scaling a limited number of targeted industry-higher education partnerships that target the highest demand jobs while expanding credentials and pathways to specific jobs along with an innovative proposal to leverage the state's unique non-profit research infrastructure to help provide real-world laboratory experience to students. Since many life science companies are small or medium sized, research-focused organizations there's also a significant need for someone (either the intermediary or educational institutions) to coordinate and aggregate industry involvement in programs, internships, and awareness activities.

These priority areas are shown in Figure ES-2 and the detailed recommendations are presented in the final section of the report. Each strategic priority area includes key background information and the rationale for intervention, as well as the individual recommendations and investments associated with each area for consideration by Career Connect Washington (CCW).

Figure ES-2: Summary of Strategic Priorities for Washington's Life Sciences Workforce Challenges

Strategic Priority 1: Fund targeted higher education institutions to scale and expand new programs in partnership with a consortium of companies with similar talent needs to meet the needs of high demand jobs and roles.	**Recommendation 1.1:** Provide support for curriculum development/expansion and industry engagement at targeted institutions to scale existing programs by increasing capacity. **Recommendation 1.2:** Fund initiatives to replicate programs and broaden geographical reach through expansion to additional educational institutions.
Strategic Priority 2: Prioritize and proactively increase career awareness and career support functions (like navigators) to connect the life science industry and students.	**Recommendation 2.1:** For K-12 populations across the state, engage in career awareness to help students understand the diversity and accessibility of career opportunities within the life science industry. Programs like "You can be a Scientist!" developed by Bristol Myers Squibb offers such exposure. **Recommendation 2.2:** For 2-year and 4-year degree populations, fund career navigator positions at targeted higher education institutions to enhance career awareness and to help students understand and prepare for the diversity of career opportunities within the life science industry.
Strategic Priority 3: Advance diversity equity and inclusion (DEI) efforts through internships across the industry that provide personnel, resources, and support to expand diversity within in-state workforces.	**Recommendation 3.1:** Fund non-profit education partner to prepare students for the Life Science Washington Scholars Internship Program to advance DEI within the life sciences industry by supporting, preparing, and matching diverse talent to Washington companies.
Strategic Priority 4: Develop a Technical Residency Program by leveraging state-of-the-art laboratory infrastructure at non-profit research institutes that can provide hands-on experiential learning and development of diverse market-ready life science skills.	**Recommendation 4.1:** For senior roles, scientists and medical professionals go through fellowships or residencies. We need a similar residency program to provide real-world lab experience for 2-and 4-year undergraduates. Our non-profit research institutes have the capability, capacity, and highly specialized facilities to train individuals in critically needed lab skills. So, there's an opportunity to partner our colleges with our world-class non-profit research institutes to provide a **Technical Residency** program that combines a degree or credential program with real-world laboratory experiences.
Strategic Priority 5: Maintain Sector Intermediary to coordinate and scale industry involvement in awareness, education, and workforce initiatives.	**Recommendation 5.1:** Since most life science companies are small to medium sized, research-focused companies, they lack the internal resources or scale to engage productively with education and workforce partners. A sector intermediary is needed to help companies participate in curriculum development, internship programs, career awareness activities, and coordinate new initiatives like the technical residency.

II. Industry Engagement

LSW is hearing from its constituent companies a common and consistent set of issues and challenges in identifying, recruiting, hiring, and retaining workforce and talent. There is a recognition among Washington life sciences industry stakeholders that the current emphasis on recruiting talent into the state is not a viable long-term solution due to several regional and broader workforce dynamics. As a result, LSW and its member companies have a need to better understand the dynamics of industry demand for, and the state's current supply of, industry talent to address solutions, namely:

- What life science industry roles and occupations demonstrate the greatest aggregated needs across companies, with respect to size, concentration, and growth, and therefore have outsized importance for in-state talent development?
- What is the current ability in Washington to meet the talent demands of the industry with respect to these strategically important occupational groups and areas of expertise?
- How and to what degree do talent demand and supply align for these important life science industry roles today and into the near future?
- What should LSW and its ecosystem partners in education, workforce, and talent development do to meet the industry's talent needs for strategically critical occupational groups into the near future?

To answer these key questions, LSW and TEConomy have engaged both life sciences companies and education and workforce training leaders throughout Washington in a series of interviews and small group meetings complemented by in-person presentations of key findings to life sciences leaders and stakeholders to socialize our findings and to solicit further input, reactions, and feedback for refinements. This outreach and industry engagement on the talent "demand" side is summarized in Table 1. Corporate interviews generally included both a human resources or talent acquisition executive with an understanding of real-time talent demands, as well as an operational leader (e.g., COO, CSO) with a forward-looking outlook to inform workforce and skills needs into the future.

Table 1: Summary of Industry Interviews Completed During the Project

Life Sciences Company Interviews Completed	
• AGC Biologics • Allen Institute for Brain Science • Alpine Immune Sciences • Altasciences • Benaroya Research Institute • Bristol Myers Squibb • Fred Hutchinson Cancer Center • FUJIFILM Sonosite • Jubilant HollisterStier • Katrina Rogers Consulting	• Kineta, Inc. • NanoString • Omeros Corporation • Pacific Northwest National Laboratory • Partner Therapeutics • Sana Biotechnology • Seagen • Shape Therapeutics • Stryker Emergency Care • Zymeworks

Interim project findings were presented at the following venues to share insights and to solicit feedback:

- Life Science Washington Board Meeting, April 6, 2023
- Life Science Innovation Northwest 2023 Conference, April 26, 2023
- East West Summit 2023 Conference, June 14, 2023

Based on feedback received following these presentations, the findings resonated well with attendees.

Most participating individuals represented biotechnology, drug discovery, and small molecule companies and few medical device companies comprised the first phase of collecting data regarding industry needs.

III. Industry Needs Analysis

Setting the Context: Washington's Large Life Sciences Industry Has Unique and Varied Strengths, Seeing Strong Growth

Washington's life sciences industry employs more than 43,000 in 2,600 individual business establishments located throughout the state—a large employment footprint that places Washington among the nation's second quintile of all states.[1] Understanding what makes Washington unique in the life sciences, and where growth has occurred is critical for setting the context for underlying workforce and talent demand.

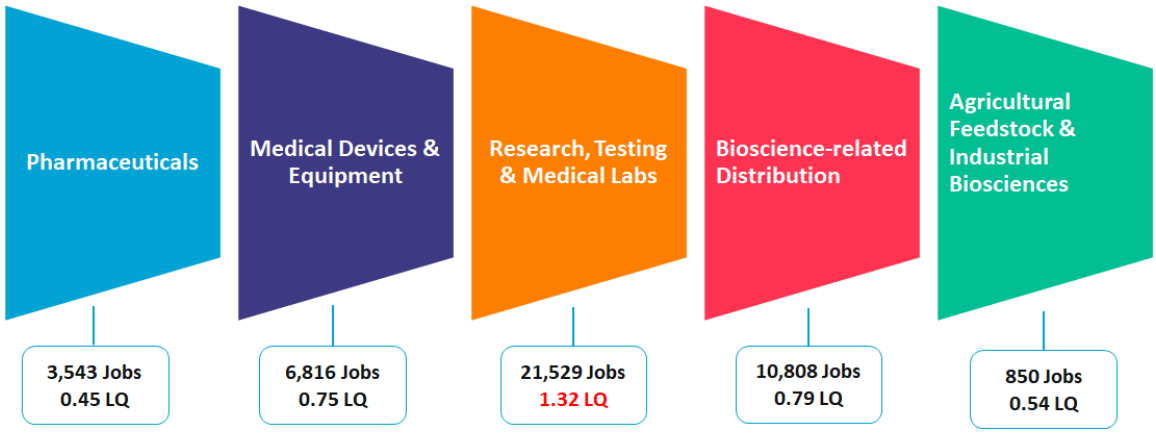
The life sciences industry can be challenging to define due to its diverse mix of technologies, products and markets, R&D focus, and companies themselves. The industry includes companies engaged in advanced manufacturing, research activities, and technology services but has a common thread or link in their application of knowledge in the life sciences and how living organisms function. At a practical level, federal industry classifications do not provide for one over-arching industry code that fully encompasses the life sciences. Instead, TEConomy and the Biotechnology Innovation Organization (BIO) in biennial national reports over two decades have developed an evolving set of major aggregated "subsectors" that group the life sciences into five major components, as shown in Figure 1.[2] LSW has embraced and utilized this definition for its industry tracking and impact assessments.

Washington's life sciences industry which includes majority jobs in the biotech industry is anchored by its large and highly "specialized" research, testing, and medical labs subsector, which accounts for nearly half of industry jobs and much of the industry growth, particularly in pre-commercial biotech and other life sciences R&D operations. The subsector has a significantly outsized employment concentration relative to the national average, as measured by its location quotient (LQ).[3] In fact, Washington is 32% more concentrated in subsector employment relative to the nation (LQ is 1.32).

At the same time, the industry also has a large footprint in medical device manufacturing and sizable and rapidly growing pharmaceutical manufacturing employment.

[1] Based on analysis by TEConomy Partners and BIO in the latest national biennial biosciences industry report.
[2] For a detailed list of federal NAICS industry classifications that make up the life sciences industry, see the Appendix to this report.
[3] Employment concentration is a useful way to gauge the relative importance of an industry to a state or regional economy. State location quotients (LQs) measure the degree of job concentration within the state relative to the national average. States or regions with an LQ greater than 1.0 are said to have a concentration in the sector. When the LQ is significantly above average, 1.20 or greater, the state is said to have a "*specialization*" in the industry.

Figure 1: The Life Sciences' Five Major Subsectors and Washington Employment Levels and Location Quotients, 2021



LQ = Location Quotient, where 1.0 = national avg. concentration.
Source: TEConomy Partners' analysis of Lightcast QCEW industry data, 2023.1.

The state's life sciences industry is growing at a strong pace, with employment increasing by nearly 12% from 2018 through 2021 at a rate that just outpaces the rapidly growing national industry. Driving this strong growth for Washington has been double-digit growth contributions since 2018 by the research, testing, and medical labs (up 18.6%), and pharmaceutical manufacturing subsectors (up 15.8%). And while medical device and equipment growth is up just 0.9% since 2018, this and other industry subsectors all have underlying "churn" and employee turnover replacement needs associated with individuals leaving the industry for other sectors, retirements, or other career changes.

Examining the detailed components that make up each subsector, the "bubble" chart in Figure 2 plots three key position and performance variables—industry employment size (size of bubble), growth (horizontal axis), and relative concentration as measured by LQs (vertical axis). What stands out for Washington in particular are the sectors in the upper right quadrant that have exhibited growth since 2018 as well as being positioned high up the vertical axis with an above average or specialized employment concentration in the state, namely:

- The green bubbles for research, testing, and medical labs strengths showing the two large R&D segments spanning emerging biotech companies, as well as corporate and non-profit biomedical, global health, and other life sciences research activities, largely concentrated in Greater Seattle.
- The dark yellow bubble for electromedical device manufacturing, indicating the highly specialized strengths in Washington in producing ultrasound equipment for medical imaging, defibrillators, and more.
- The red bubble for biologics production in the pharmaceuticals subsector, showing the rapid growth of firms shifting from R&D and discovery into full-fledged production facilities for cell and gene therapies. This subsector represents a major area of new and emerging biomanufacturing talent demands.

Each of these areas has distinct workforce and talent demands and must be considered as key components of a broad-based talent strategy.

Figure 2: Washington Life Sciences Industry—Current Position & Recent Performance Across Detailed Industry Size, Concentration, and Growth, 2021

Source: TEConomy Partners' analysis of Lightcast QCEW industry data, 2023.1

Identifying High-Priority, High-Demand Occupations and Roles in Washington's Life Sciences Industry for Targeted Interventions

The "staffing patterns" or occupational composition of Washington's individual life sciences subsectors can be compared to that for the nation to best understand what occupations and roles are most meaningful in their growth, size, and concentration for Washington. In an already highly "STEM"-intensive industry, Washington stands out further in its demand for technical talent. For example:

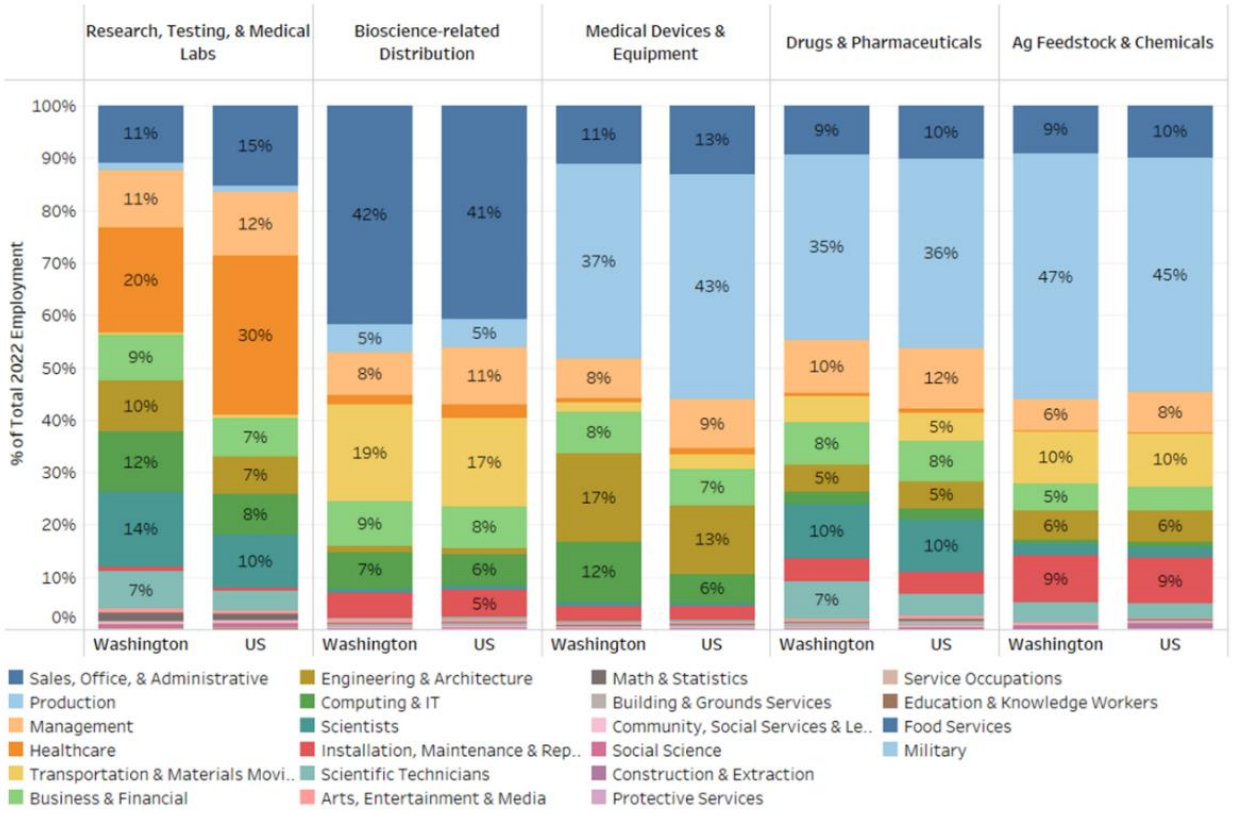
In an already highly "STEM"-intensive industry, Washington stands out further in its demand for technical talent.

- In the high-level occupational structure set out in Figure 3, key occupational labor segments such as computing and IT and scientist roles are more prominent in the research, testing, and medical labs sector in Washington compared against the U.S., indicating the differentiated way in which the state is leveraging talent within the life sciences.

- In pharmaceutical manufacturing, the state is more concentrated in scientific technician roles versus the nation.
- In medical device manufacturing, production roles are still prominent in Washington, but they make up a somewhat lower share of overall employment while engineering and IT occupations are more concentrated relative to the nation.

These nuances and characteristics reveal how Washington's life sciences industry is unique and are indicative of the workforce dynamics at play in the state and have allowed for probing further on these topics in more detailed analysis and interview discussions.

Figure 3: Life Sciences Industry Employment by Major Occupational Group and Industry Subsector, WA and U.S., 2022



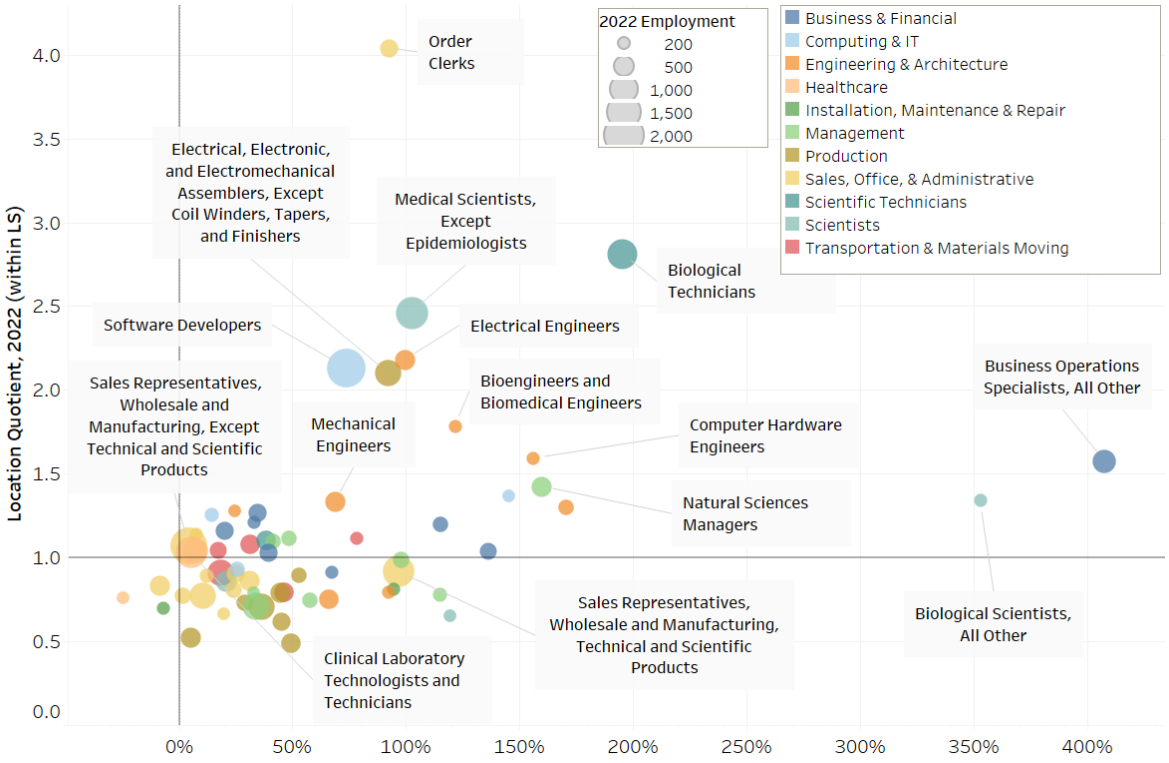
Source: TEConomy Partners' analysis of Lightcast Staffing Patterns Data, 2023.1.

Examining the underlying dynamics at a more granular level of occupational detail finds a number of both high- (typically requiring a 4-year degree or higher for entry) and middle-skilled (typically requiring more than a high school diploma but less than a 4-year degree for entry) roles within the life sciences industry growing at rapid rates or showing outsized concentrations in Washington relative to the national average as measured by location quotients (see Figure 4).

What stands out among the detailed occupational groups demonstrating a combination of high growth and specialized concentration in Washington, i.e., a competitive advantage for Washington in the upper right quadrant includes the breadth of:

- Engineering occupational strengths, typically found in the medical device manufacturing subsector including electrical, mechanical, and biomedical engineers.
- IT occupational strengths—found across the life sciences and with new emphasis applying AI to drug discovery applications and bioinformatics—including software developers and computer hardware engineers.
- Scientific strength including medical and biological scientists.

Figure 4: Employment Size (Size of bubble), Concentration, and Growth Since 2015 for Occupations Within Washington's Life Sciences Industry, 2022



Source: TEConomy Partners' analysis of Lightcast Staffing Patterns Data, 2023.1.
Note: Limited to those occupations within the life sciences industry with at least 200 employees.

Identifying High-Demand, High-Priority Occupations Within Washington's Life Sciences Workforce

Several key metrics and thresholds were used to identify an initial set of high-demand life sciences industry occupations from the data analyses. These were then combined with the qualitative input and insights from employers to form the final set of high-demand, high-priority occupations. Key questions and associated measures guided the initial data analysis filtering approach, asking:

Criteria for selecting high-demand, high-priority occupations for targeted interventions:

- ✓ **Critical mass of employment**
- ✓ **Growth dynamics**
- ✓ **Concentration, specialization (relative importance)**
- ✓ **Competitive wage profile**
- ✓ **Projected demand**
- ✓ **Industry input**

- Where are there sizable occupational employment footprints within the life sciences industry? Examine critical mass of occupational employment:
    - The state should have an existing base of occupational employment in key occupations driving demand (i.e., not "starting from scratch").
    - Defined for these analyses as having at least 100 jobs in a given occupation within life sciences sectors in 2022.
- Where are growing occupational segments demonstrating demand within the sector? Examine growth dynamics:
    - Occupations that are demonstrating significant growth indicate higher demand.
- Where are occupational segments that are critical to the makeup and operations of the sector that represent competitive advantages for Washington? Examine specialization via location quotients and shares of total workforce as well as competitive wage profile:
    - Highly specialized occupations for which the life sciences account for large shares of the workforce represent key needs for the state.
    - Competitive wages are key to attracting and retaining workforce.
- Where are occupations that are anticipated to support the future growth of the industry? Examine hiring patterns, turnover, and projected growth:
    - Projected needs for the industry can indicate future workforce constraints and the need to scale up.

When considering occupations within the life sciences industry in Washington that exhibit some combination of strong recent growth, high concentration in the state relative to national averages, and a strong employment outlook into the future considering projected demand over the coming decade, the occupations shown in Table 2 then further stand out as an initial, filtered set of "high-demand, high-priority" industry roles.

Table 2: Identification of High-Demand, High-Priority Life Sciences Jobs in Washington through Quantitative Approaches

High-Skills Roles (Typically Requiring BA/BS and Higher Degrees to Enter)	Middle-Skills Roles (Typically Requiring More than a HS Diploma but Less Than a 4-year Degree to Enter)
Biological Technicians	Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers
Business Operations Specialists, All Other	Phlebotomists
Software Developers	Life, Physical, and Social Science Technicians, All Other
Project Management Specialists	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products
Natural Sciences Managers	Chemical Technicians
Electrical Engineers	Agricultural Technicians
Market Research Analysts and Marketing Specialists	Engineering Technologists and Technicians, Except Drafters, All Other
Medical Scientists, Except Epidemiologists	Packaging and Filling Machine Operators and Tenders
Accountants and Auditors	Bookkeeping, Accounting, and Auditing Clerks
Computer Hardware Engineers	Clinical Laboratory Technologists and Technicians
Information Security Analysts	Chemical Equipment Operators and Tenders
Computer and Information Research Scientists	
Management Analysts	
Biological Scientists, All Other	
Soil and Plant Scientists	
Industrial Production Managers	
Web and Digital Interface Designers	

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

To corroborate and further probe the findings from the quantitative analyses of industry staffing patterns, the project team has also assessed workforce demand using recent job postings data (Figure 5). The job postings data have the benefit of utilizing industry-relevant job titles as opposed to the federal SOC occupational structure shown in the figures and tables above, and so are able to highlight key areas of high demand such as scientists in general research, quality control and quality assurance roles (QA, QC), data sciences, regulatory affairs, and clinical trial coordinators. In addition to these critical life sciences roles, the strong hiring demand for the technician, IT, scientific, and engineering workforce are further confirmed via the job postings of industry.

Figure 5: Leading Technical and Production-Related Job Titles in WA Life Sciences Job Postings, 2020-22 (Cumulative)

Source: TEConomy Partners' analysis of Lightcast, JPA Database, 2022.4 data set.
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.

Qualitative Input on High-Demand, High-Priority Roles

Interview discussions with life sciences companies have corroborated the high-demand roles filtered through the quantitative analyses. Companies highlight and emphasize several areas of strategic talent needs they are facing now and into the near future (next 1 to 2 years), including:

- Biomanufacturing technician, quality control/assurance, and other skilled production talent to support rapidly growing manufacturing activity in the pharmaceutical subsector.
- Scientists and senior scientist roles to support the research and development activities within early-stage startups, mid-size and large life science companies.
- Specialized talent to support clinical, regulatory, and other business support functions as companies scale and bring products to market.
- Bioinformatics, data sciences, and other IT/tech talent in biotech and other corporate research operations, including an emerging emphasis on AI expertise for drug discovery.

- Lab technicians to support both clinical and biomedical research operations.
- Experienced, top scientific talent experienced, for example, in areas such as immunotherapies.
- Experienced engineers and supporting engineering technicians in medical device production operations.

These occupational areas were clear priorities of the Washington life sciences companies and biomedical research institutions engaged for this effort, are vetted, and confirmed through the quantitative analyses, and are highlighted in Figure 6. Companies indicate that many of these roles require today or will require in the near future, high-volume hiring needs (delineated with a star in the graphic) while others such as senior scientists are high priorities for their business needs but at lower hiring volumes.

Figure 6: Identified High-Demand, High-Priority Life Sciences Industry Occupations

Source: TEConomy Partners' analysis.

Recognizing the focus of this effort for and with CCW is designed to establish, develop, and invest in programs and initiatives to advance early-career talent pipelines, the focus of subsequent investments and recommendations are oriented towards those high-demand, high-priority occupational areas where this need fits. So, this excludes from the recommendations interventions related to developing highly "experienced" scientific and engineering talent.

In addition to the demand for specific occupations and skills, the interview discussions also raised strategic challenges and important workforce dynamics facing Washington life sciences companies, including:

- **A major emphasis by companies and biomedical research institutions on the need for real-world experience developed by working in labs or on production lines along with knowledge of business operations**. Many companies require several years of experience, for example, for lab technicians, clinical research associates or scientists. This is a challenge and significant barrier for those seeking entry into the industry and important to address through initiatives put forth in the recommendations section.

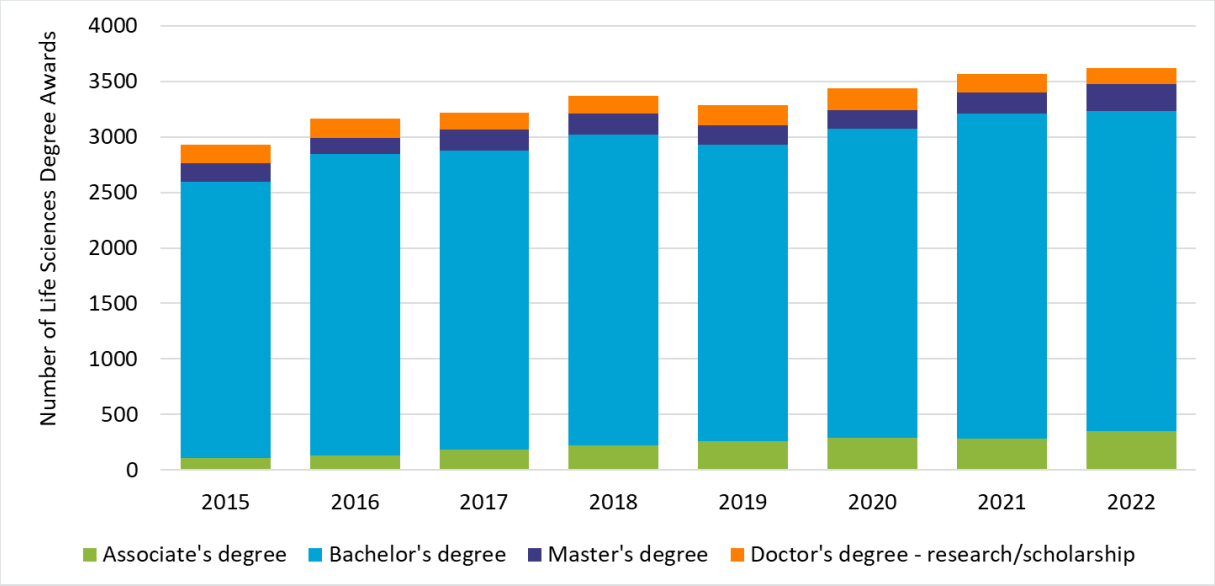
- **A consistent theme emerged around a major need for career awareness of the industrial life sciences industry**. Students, teachers, and parents are unaware of the breadth of state companies and career opportunities and talent pipelines are suffering from this lack of awareness.
- **A lack of clear education and training pathways, credentials, and skills needed for the diversity of jobs in the industry.** The education and workforce system needs to establish a greater diversity of credentials, experiential learning, and recognized pathways (modular layering of on- and off-ramps training) to enable various career paths in response to demand across a wide swath of life sciences employers.
- **The need to significantly expand the limited higher education and workforce programs recognized by industry** to meet demand. There are a handful of programs at several community colleges and universities that focus on life science careers, but not enough volume for industry to consider them a primary channel to meet demand.
- **Several barriers to sourcing talent from outside the state have been emphasized by industry** which are difficult to overcome in the short term, including high cost of living in Greater Seattle, perception of more limited opportunity within the state industry cluster, competition with higher-paying industries, and difficulty incorporating remote work models that are in high demand by top talent.

These industry talent dynamics represent important areas for strategic interventions and investments.

IV. Program Landscape Analysis

Washington postsecondary education institutions play a critical role in anchoring the state's pipeline for life sciences talent. The total number of graduates with associate's degrees and higher in fields most closely aligned with life sciences has risen nearly 24% since 2015 to approximately 3,600 total completions in 2022. While the state's life sciences talent pipeline has grown, it has slightly underperformed the overall U.S., where life sciences degree volumes rose by more than 28% during the same period. As shown in Figure 7, the state's growth trend in degree volume also faltered in 2019 where there was a slight decline in graduate volume relative to 2018 levels before recovering in subsequent years.

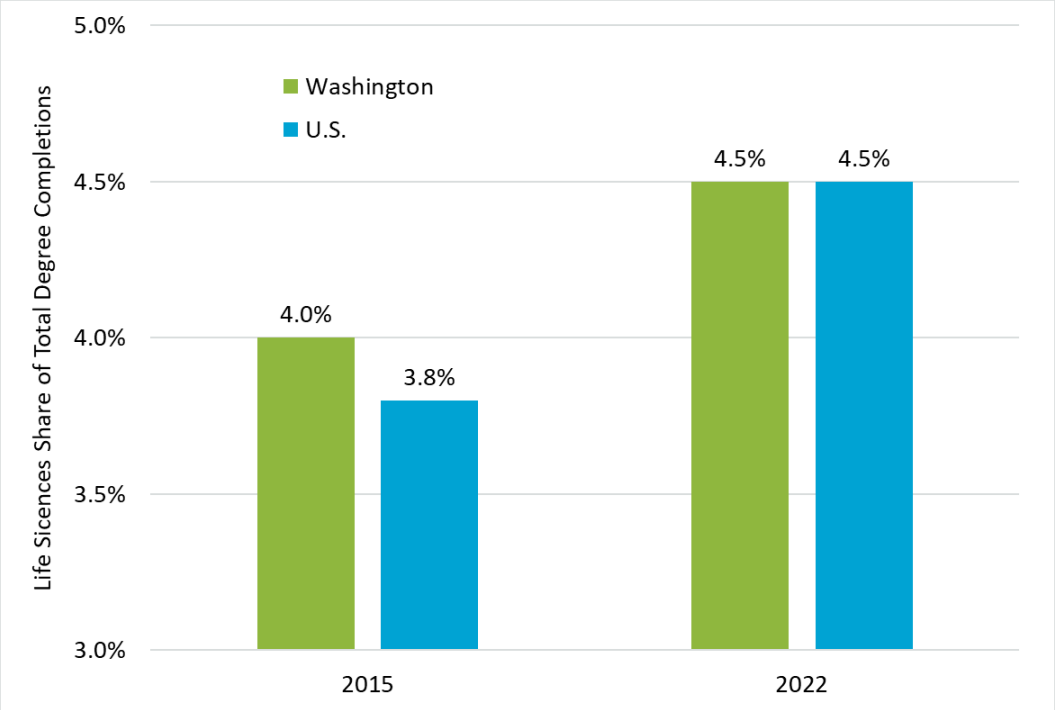
Figure 7: Trend in Postsecondary Life Sciences Degree Graduates in Washington, 2015-22



Note: The 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.
Source: TEConomy Partners' analysis of NCES IPEDS data.

As a share of all degrees, life sciences degrees have made up a consistent proportion of total degree volume over time, roughly matching U.S. levels of concentration in key life sciences degree fields (Figure 8).

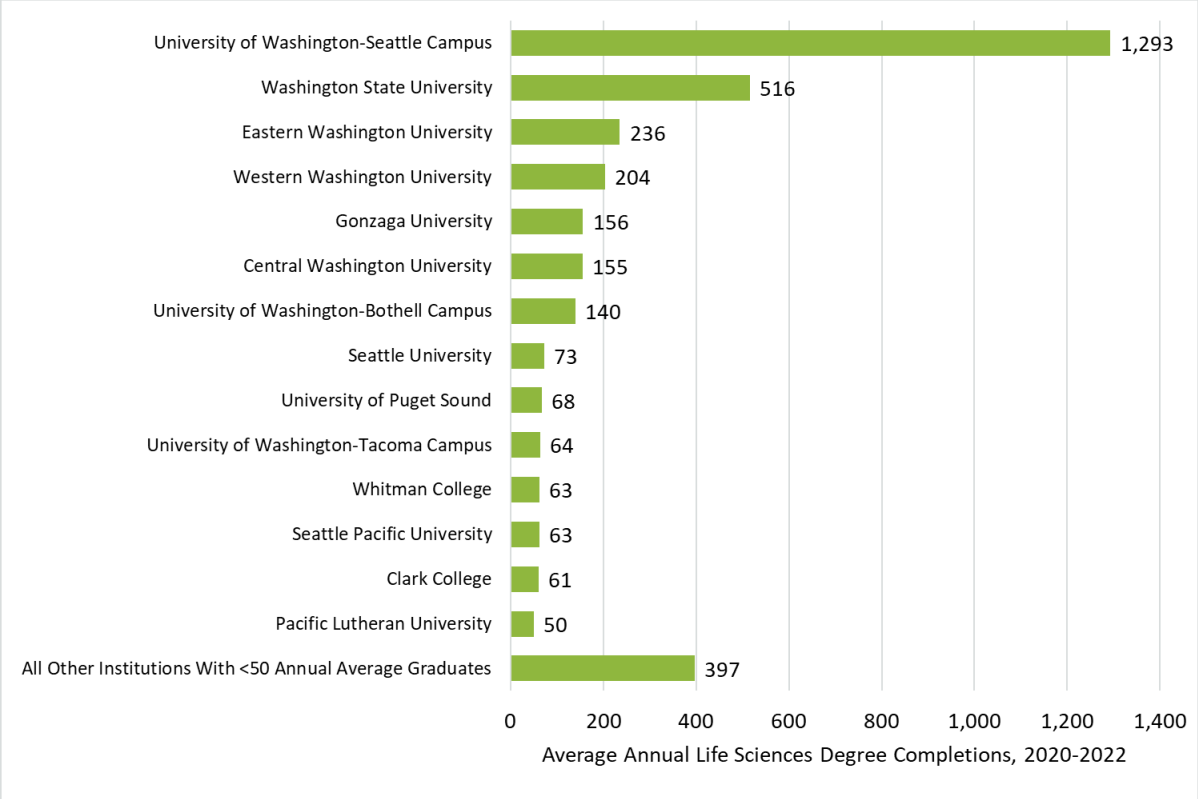
Figure 8: Life Sciences Degrees as a Share of All Degrees (Associate's Level and Higher), WA and U.S. Total, 2015 and 2022



Source: TEConomy Partners' analysis of NCES IPEDS data.

Life sciences degree production, however, is highly concentrated in the state at key institutions, specifically the University of Washington (Seattle campus) and to a lesser degree Washington State University, with lower numbers of graduates from other institutions. Recent degree production over the last three years shows an average annual level of just over 3,500 life sciences graduates per year, with over one third of that total produced by the two aforementioned institutions. Volumes of life sciences degree production at the associate's level that are most closely aligned with the biotechnician workforce are very low overall, with technical certificate program completions in life sciences also averaging fewer than 10 awards per year since 2015. Nascent programs at the University of Bothell offer career opportunities, but require further faculty and curriculum support to meet the capacity. These dynamics paint a challenging picture for the talent pipeline, with most of the production of talent supply constrained to a limited group of institutions and limitations on the ability to produce some of the technician level talent that is in highest demand from industry site locations bringing new operations online.

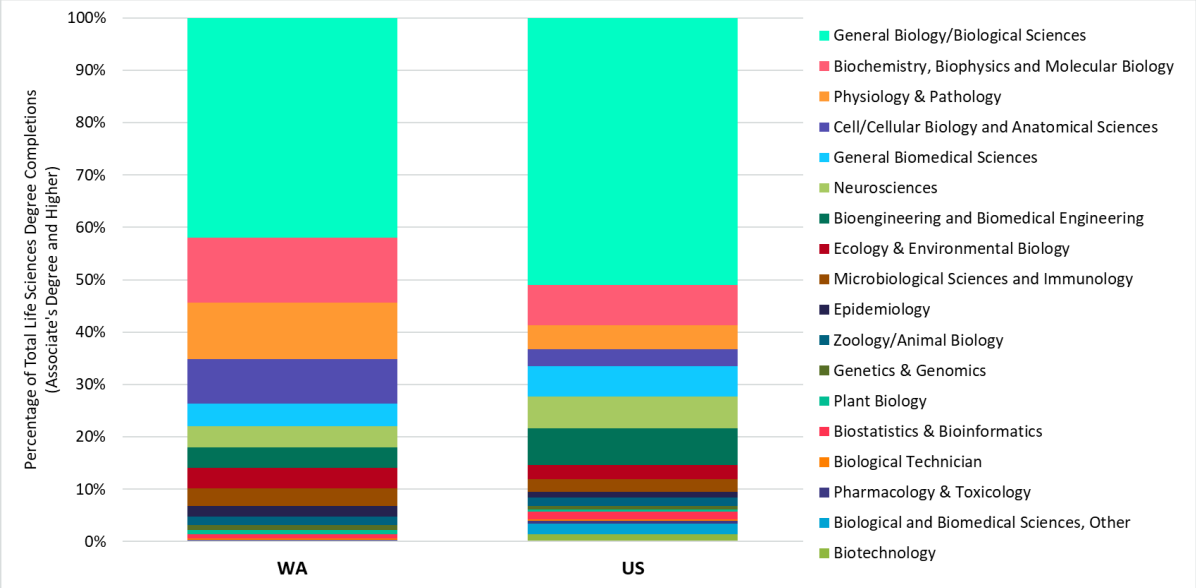
Figure 9: Leading Washington Institutions Generating Life Sciences Talent, Average Annual Life Sciences Degree Completion Levels (Associate's Level and Higher), 2020-22



Source: TEConomy Partners' analysis of NCES IPEDS data.

Washington educational institutions tend to produce more specialized degree field graduates relative to the mix of U.S. life sciences graduates (Figure 10). In 2022, the state had significantly higher specializations in biochemistry and molecular biology, physiology and pathology, and cellular biology relative to the national graduate mix, reflecting the specialized programs that exist at state institutions with industry conversations affirming graduate quality from these life sciences programs is generally high.

Figure 10: Composition of Life Sciences Degree Fields in Washington and U.S., 2022 Degree Completions



Source: TEConomy Partners' analysis of NCES IPEDS data.

Life sciences companies have formed both formal and informal partnerships with Washington postsecondary institutions and specific programs to meet their talent needs. The institutions and programs in Table 3 were cited numerous times in company interviews, particularly with those companies in the pharmaceutical manufacturing and research, testing, and medical labs subsectors in the Greater Seattle region as having graduates well aligned with industry talent demands.

These programs are meeting a variety of talent needs from highly flexible, certificate level programs where companies appreciate the ability to develop talent rapidly and effectively with hands-on skills and industry-relevant experiences, even in a "stackable" manner to deep scientific and technical STEM programs generating talent at the bachelor's and higher levels. While partnerships with WSU were cited as more limited in industry interview discussions—in part due to the intense concentration of life sciences companies beyond Eastern Washington in Greater Seattle. While the WSU College of Medicine is new it has a number of highly relevant programs that can serve as talent pipeline for life sciences industry throughout Washington.

Table 3: Existing Postsecondary Education and Training Programs Cited Regularly by Life Sciences Companies as Well-Aligned with Industry Talent Needs in Both Formal and Informal Talent Partnerships

Institution	Key Program(s)
Shoreline Community College	Biotech Programs including Biomanufacturing (Certificate); and Lab Specialist (AAAS, Certificate)
University of Washington-Seattle	Computational Biology/Bioinformatics (Master's, PhD) Biomedical Regulatory Affairs (Master's, Certificate) PharmD, including joint MBA program (PhD, Masters) Mechanical Engineering (BS and Higher Degrees) Electrical Engineering (BS and Higher Degrees) Biomedical Engineering (BS and Higher Degrees)
University of Washington-Bothell	Master's Programs in Engineering (MS) Biochemistry specialization in Chemistry program (BS) PharmD-MBA Concurrent Degree Program in conjunction with UW school of pharmacy (PhD, MBA)
Lake Washington Institute of Technology (LWTech)	Biomedical Device Assembler (Certificate)
Eastern Washington University	Biotechnology option for Biology degree (BS)

Customized Credentials. Employers have emphasized the strong value of highly customized programs designed for hands-on experiential learning and partnerships that should be scaled up to meet the expected demand into the near future. Many employers cite ongoing partnerships with Shoreline Community College's associate's and "stackable" certificate credentials which prepare students for entry-level roles as Biomanufacturing Associates and Quality Control personnel at regional therapeutics companies. Similarly, customized training partnerships at UW-Bothell have been raised in discussions as an example of programs that work well for employers.

Four-Year Institutions. The state's universities are generally perceived as producing a pipeline of high-quality graduates with skills that are aligned with industry needs in selected programs, particularly at the University of Washington, which is serving the large, dynamic, and rapidly growing industry cluster in Greater Seattle. There is strong demand, for example, for top talent (PhD, master's levels) in areas such as Bioinformatics, for which UW has a world-class graduate program.

While partnerships with WSU were cited as more limited in industry interview discussions key WSU programs were identified as especially applicable, and noted in some conversations with industry include the following:

- Bioinformatics Graduate Certificate
- Joint PharmD/MBA, PharmD/Engineering master's program and certificate options
- Biology with varied optional focus areas, including those vital to developing professionals in the agricultural biosciences space including plant biology and entomology.
- Pre-veterinary and animal care programs within the Zoology major

Additional institutions and/or specific programs have been cited more as one-off examples where companies are sourcing candidates in specialized areas of need in Washington. These include:

- Bellevue College
- WSU Veterinary Program
- Clover Park Technical College's Histology Certificate
- UW Tacoma

At the same time, exciting new efforts are underway to advance additional life sciences talent development capacity and to meet the needs of companies who are shifting toward skills-based competency hiring and view demonstrated skills and competencies as very important to sourcing and hiring candidates. Two of these new initiatives include:

- UW-Bothell's new Center for Biotechnology Innovation and Training (CBIT), just recently launched in 2022 and supported by federal and industry funding, the new research and education initiative is designed to[4]:
    - Provide a trained, skilled workforce to support the growing biotechnology industry in Bothell and the greater Puget Sound region;
    - Facilitate cutting edge biotechnology research for faculty and students in collaboration with industry; and
    - Work with a variety of public and private partners to foster new opportunities in the biotech field nationally.
- Washington's recent approval of the "BACE" credentialing initiative as an Industry Recognized Credential (IRC) for entry level life sciences technician roles, and described by the organization that has developed it, Biotility out of the University of Florida as:
    - "The Biotechnician Assistant Credentialing Exam (BACE) is an industry-recognized exam offered by Biotility designed to assess core skills and knowledge sets defined by the bioscience industry. The exam framework is based on a DACUM analysis, detailing the competencies foundational to technician level positions. Reviewed and updated annually with oversight from a national advisory board, the BACE remains current to industry needs nationwide."[5]

The BACE initiative represents an important step in advancing demonstrated skills and competencies in hiring entry level lab techs especially targeting high school graduates. TEConomy's recent national *Life Science Workforce Trends* report, conducted in partnership with the Coalition of State Bioscience Institutes (CSBI) and of which LSW is a partner, has surveyed U.S. life sciences human resource executives and found a major emphasis on "demonstrated competencies" in hiring. In fact, in the 2021 Hiring Survey 59% of responding companies cited these demonstrated competencies and skills as "very important" in terms of how they view or rank various credentials and degrees.[6] While broad industry

[4] Sourced from UW-Bothell, CBIT website. For more information see: https://www.uwb.edu/stem/research/cbit.
[5] See: https://biotility.research.ufl.edu/bace/.
[6] TEConomy Partners and CSBI, "2021 Life Sciences Workforce Trends Report: Taking Stock of Industry Talent Dynamics Following a Disruptive Year," June 2021.

acceptance of specific credentialing in life sciences represents an effort that requires ongoing coordination, Washington has an opportunity to build on its work in creating the infrastructure to administer the BACE testing and credentialing program to meet the need for scaling standardized certification in entry level technician roles.

Interview discussions with academic leaders at both the established institutional programs and new CBIT initiative identified several challenges, gaps, and key dynamics to help inform the strategic recommendations, including:

- While the established programs are well aligned with industry demands, many are graduating relatively modest annual cohorts of talent and companies are clamoring for more graduates. Industry reports persistent challenges in limited numbers of graduates, attrition out of the region and state, and fierce competition for STEM talent in key "secondary" (non-life sciences) degree programs such as engineering, IT, and data sciences from other state and regional industries, in particular Washington's large and leading Tech cluster. Discussions with Shoreline's biotech leadership reveal that sustained long period of state level support has recently helped the program meet its infrastructure and resource needs, but the challenge now is the lack of student interest in the program and attracting significant numbers of students to enter. There is a clear need to not only scale up these programs, but also to better connect graduates with the life sciences industry.
- Shoreline's certificate and associate degree programming is seen as especially well-aligned with industry needs and flexibility and companies would like to see an expansion/replication of this hands-on, industry-relevant programming at other community colleges and/or universities in other regions of the state.
- Since it was just adopted in Washington as an IRC, there is a need to educate and inform companies of the value proposition for the BACE credentialing initiative and validate the breadth of its utility.
- Advancing diversity, equity, and inclusion has been elevated in recent years as a leading priority for the life sciences industry and its academic partners, and engaging underrepresented populations remains challenging. There is a need for life sciences-specific career awareness and connections, such as targeted internships and mentoring in the sector.

V. Recommendations

A set of strategic priorities and associated recommendations for Washington's life sciences talent situation have emerged out of the data analyses and discussions with industry and academic leaders. Some represent and recommend new efforts around industry coordination, while others represent a need for more targeted, tactical investments and initiatives as well as scaling up existing programs that function well in meeting the needs of industry. These priority areas are shown in Figure 11 and the detailed recommendations are presented below. Each strategic priority area includes key background information and the rationale for intervention, as well as the individual recommendations and investments associated with each area for consideration by CCW.

Figure 11: Summary of Strategic Priorities for Washington's Life Sciences Workforce Challenges

Strategic Priority 1:

Fund targeted higher education institutions to scale and expand new programs in partnership with a consortium of companies with similar talent needs to meet the needs of high demand jobs and roles.

Strategic Priority 2:

Prioritize and proactively increase career awareness and career support functions (like navigators) to connect life science industry and students.

Strategic Priority 3:

Advance diversity equity and inclusion (DEI) efforts through internships across the industry that provide personnel, resources, and support to expand diversity within in-state workforces.

Strategic Priority 4:

Develop a Technical Residency Program by leveraging state-of-the-art laboratory infrastructure at non-profit research institute partners that can provide hands-on experiential learning and development of diverse market-ready life science skills.

Strategic Priority 5:

Maintain Sector Intermediary to coordinate and scale industry involvement in awareness, education, and workforce initiatives.

Strategic Priority 1: Fund targeted higher education institutions to scale and expand new programs in partnership with a consortium of companies with similar talent needs to meet the needs of high demand jobs and roles. Additionally, the state should work to scale programs that meet the need for specialized, future-ready skills that are critical to the future of the industry.

The Strategic Challenge and Rationale for Intervention:

Life sciences executives have regularly cited several existing college and university programs where graduates are well aligned with the skills and expertise demanded by industry. The programs vary from highly flexible, certificate-level programs where companies are engaged around the ability to develop talent quickly and effectively with hands-on skills and experiences, to deep scientific and technical programs generating talent at the bachelor's and higher levels. Local companies are continually sourcing and hiring graduates from these programs, but cite persistent challenges in limited cohort numbers, attrition out of region and out of state, and lack of growth in the pipeline of students entering postsecondary education programs aimed at developing life sciences skills. For graduate and postgraduate programs producing highly specialized STEM talent, there is also fierce competition for graduates with other industries in particular the state's leading software and "tech" industry cluster.

However, many of these programs today graduate small cohorts on an annual basis and stakeholders have placed consistent emphasis on overall supply constraints. For example, the latest 2022 data from the National Center for Education Statistics (NCES)-IPEDs data on total Washington graduates from these programs finds:

- 29 total graduates in Biostatistics/Bioinformatics at the MS and PhD levels
- 141 total graduates in Bioengineering/Biomedical Engineering at the BS and higher levels
- 9 total graduates in the Biology/Biotechnology Technician programs at the associate's level, and discussion with Shoreline noted an anticipated 14 students enrolled in the upcoming Biomanufacturing 10-week certificate program cohort.

Student pipelines into these programs represent a major issue, as cited by discussions with Shoreline Community College where the program has received state support over the past decade to slowly build an infrastructure and have the resources to educate larger student cohorts but is now unable to recruit them into the program. As cited in the industry needs analysis, student career awareness represents a major challenge and merits its own Strategic Priority in these recommendations. In addition, the new program coming online at UW-Bothell's Center for Biotechnology Innovation and Training (CBIT) will need to be supported to expand curriculum and industry partnerships. Expansion of BACE credentialing needs further validation in terms of its alignment with industry needs and requires further investigation as another option in terms of supporting entry level lab technicians talent supply.

Recommendation 1.1: Provide support for curriculum development/expansion and industry engagement at targeted institutions to scale existing programs by increasing capacity.

Programs across the state which serve various parts of the life sciences ecosystem have differing needs which can be addressed through targeted investments to scale existing program activity. Some targets for significant state investment should include:

- The Shoreline programs are seen as highly effective and considered well resourced, but output needs to be scaled dramatically. Discussions with companies indicate a near-term need for hundreds of graduates from the combined AAAS and certificate programs—levels that far exceed those generated today. Opportunities exist to involve industry in building career awareness to help scale participation in degree programs.

- The new CBIT initiative at UW-Bothell needs multi-year support to expand curriculum, hire faculty and launch industry partnerships to alleviate the workload on existing faculty and staff who are stretched thin. CCW should invest to enable the full build-out of the Center, in particular supporting expansion of the leadership team which is expected to be the primary driver of industry partnerships as well as the physical place-based infrastructure for training and education.

- The University of Washington has numerous critical programs for the life sciences industry, serving as the state's primary developer of talent in 4-year and graduate degrees aligned with traditional life sciences skill sets. Because its graduates are seen as high quality, there is often intense competition for a limited supply both with other STEM-intensive industries as well as amongst companies within the life sciences industry. CCW should invest to ensure UW-Seattle and UW-Bothell have the resources required to scale up in the near term, in particular significant investments to allow for cluster hires of faculty and consistent faculty salary resources in key life sciences-related areas such as bioengineering and bio- and healthcare informatics to improve degree production. Conversations with UW stakeholders noted that there are significant supply constraints facing the ability of the university to produce graduates, with potential talent sometimes flowing to universities in neighboring states due to lack of capacity. Stakeholders also noted the potential for investment to provide funding for internal competitive awards designed to expand multidisciplinary areas critical to the future of life sciences such as large-scale healthcare and bioinformatics data management, medical imaging, and other digital health-related applications.

- Washington State University (WSU) is an untapped source for talent. As mentioned previously, the university offers several 4-year degree programs aligned with industry roles. To expand the talent pool, it would be vital to create a statewide recruitment strategy that increases the visibility and awareness of talent graduating from WSU.

- Additionally, as early-stage start-ups start to grow and transition into clinical trials and manufacturing phases of therapeutics and device development there will be a growing need for new programs to sustain the talent supply needs.

As new technology and innovation is being developed and scaled, new workforce programs need to be continually created to support the growth of demand.

Recommendation 1.2: Fund initiatives to replicate programs and broaden geographical reach through expansion to additional educational institutions.

The Life Sciences Industry is constantly evolving and expanding as companies are growing and developing larger biomanufacturing facilities within the state of Washington.

- The Washington life sciences ecosystem needs not only additional scale in these programs, but also broadened geographical reach with regional "nodes" being a key priority to better meet company needs close to site locations engaged in testing, production, and distribution operations. Ongoing discussions indicate potential replication of the Shoreline programs out to Everett Community College, Eastern Washington University, Bellevue College, and Seattle Community College to name a few. CCW should consider investing in these critical expansions to scale up capacity and better meet regional demand, while at the same time supporting career awareness initiatives to ramp up student intake.
- WSU as a state university offers unexplored opportunities to build statewide educational connections to strive for developing in-state talent and build a healthier local talent pool.
- Jubilant HollisterStier based in Spokane, WA is a major hiring company especially for biomanufacturing roles in the area. The lack of educational training has required them to adapt and create training modules and offer appropriate incentives to attract high school students to transition into their company. While they have highly successful training programs that others could replicate they need help increasing career awareness in high schools and helping students understand that modern manufacturing is very different from working on a shop floor.
- The BACE credentialling exam opens pathways for entry level lab technician roles. While federal funding exists for supporting the credentialing identifying avenues to educate member companies about the credential and getting larger buy-in is critical to make the credential valuable to both employers and employees.

Strategic Priority 2: Prioritize and proactively increase career awareness and career support functions (like navigators) to connect life science industry and students.

The Strategic Challenge and Rationale for Intervention:

As established at the outset of this report and confirmed through industry interviews and consistent input received by LSW, the current situation for life sciences talent sourcing in Washington relies heavily on recruiting talent from out of state and "poaching" talent from other companies and biomedical research institutions. This is not sustainable in a high-growth, dynamically evolving life sciences talent cluster and Washington risks losing companies re-locating to other states or regions with more robust and reliable talent pipelines. A major theme and contributing factor driving this dynamic cited across most discussions with industry and academia is a lack of awareness in Washington of the industry in general, as well as the robust and high-quality career opportunities and extensive pathways available to students and early-career professionals. The majority of graduates are often not exposed to industry opportunities during their education, limiting the opportunity for learning about careers in life sciences. Education leaders cite this challenge as a critical limiting factor for growing and scaling up postsecondary education and training programs. This situation calls for dedicated career navigation resources, as well as the ability to coordinate company engagement with students in a flexible "plug and play" dynamic across a variety of engagement options. Life Sciences companies are eager to engage with K-12 and college populations and coordinate with other STEM sectors to expand on career awareness.

To address these challenges, key recommendations are put forth under this Strategic Priority area.

Recommendation 2.1: For K-12 populations across the state, engage in career awareness to help students understand the diversity and accessibility of career opportunities within the life science industry. Programs like "You can be a Scientist!" developed by Bristol Myers Squibb offers such exposure.

It is recommended that CCW continue to support through career exploration and program builder to scale programs to enable life sciences companies and their personnel to engage in a variety of efforts to engage students early and often in their educational tracks, spanning K-12 schools through postsecondary education and even among Washington's existing workforce transitioning from other industries.

Industry best practices suggest a range of approaches are effective in engaging students, as well as their teachers, and even parents in career awareness building and allowing companies and industry employees to find ways to plug into these activities flexibly and appropriately. With the sector intermediary as a facilitator, the following approaches should be considered for student and early-career engagement:

- K-12 classroom visits and career days coordinated with curriculum and staff
- After school and summer STEM activities and camps
- Company tours and "Manufacturing Day" opportunities
- Career mentoring
- Industry awareness within Biology and Chemistry classes
- Corporate internships

- Collegiate senior project and capstone engagement (e.g., those highly utilized in engineering degree programs)
- Industry personnel serving as a guest lecturer, speaker, or joint teaching
- Donations of industry-grade equipment and lab kits for classroom experiments

Companies like Bristol Myers Squibb have been heavily invested in spreading career awareness within the state. Through their "You can be a Scientist" program targeting underserved middle schools they have been educating and building excitement within this population. The life sciences are also increasingly competing in key areas for IT and tech talent where companies often begin to engage students early in their college education—often now as soon as the 2nd year of college degree programs. It is therefore critical to engage with students in these early college years using a variety of approaches to build awareness of career pathways in life sciences.

Recommendation 2.2: For 2-year and 4-year degree populations, fund career navigator positions at targeted higher education institutions to enhance career awareness and to help students understand and prepare for the diversity of career opportunities within the life science industry.

With challenges finding students to scale its biotech/biomanufacturing professional technical programs, Shoreline Community College (SCC) has hired and utilized a dedicated "Career Navigator" position to play a key role in directly assisting students to enter the programs, to see them through college, and to connect them to industry for careers. The Navigator conducts student information sessions, works to recruit and orient prospective students, and literally assists them in "navigating" everything from accessing funding resources for schooling to helping to ensure accountability and tracking students through program completion. At the same time, the Navigator is establishing relationships with life sciences employers, assisting with student internship placements, and connecting students with job opportunities. According to program leadership at SCC, this function and tool has been a success. Discussions with other Washington colleges, including with Eastern Washington University have shown a strong interest in accessing this function as a key resource for student to college connections and there is support for expanding this model and approach to other regions or "nodes" in the Washington life sciences ecosystem.

It is recommended that CCW provide sustained funding and support for an additional one to two Career Navigators at other postsecondary institutions in Washington state to enable this proactive service and tool for connecting students with college programs on the west and east side of the state and ultimately into life sciences careers. The Career Navigators will be critical for the state i.e., identify educational pathways and training content that can serve as an entry point for new and existing students and workers in developing the necessary skills to enter the workforce or further their education and training. The state's current life sciences workforce development ecosystem is largely driven in silos by individual institutions and their partnerships with existing companies, but a broader approach is necessary to aggregate resources and scale the talent pool. The core set of skills could feature both introductory and advanced skill sets delivered through coursework and training at educational institutions but validated across the ecosystem through industry-academic advisory groups such that subsequent education, training, and credentialing required to enter various roles in the life sciences workforce can occur in flexible, modular ways. Coordinating both industry acceptance of critical set of skills as well as additional industry recognized credentials (IRCs) is critical to broad-based growth in the talent pipeline across several institutions in a consistent way.

Strategic Priority 3: Advance diversity equity and inclusion (DEI) efforts through internships across the industry that provide personnel, resources, and support to expand diversity within in-state workforces.

The Strategic Challenge and Rationale for Intervention:

The industry has both a strategic and immediate talent demand need to advance diversity, equity, and inclusion or "DEI", in part through student and early career connections. The life sciences industry in Washington is keen to diversify its workforce to encourage varied approaches to innovative problem solving. As complexities are increasing within research and innovation spaces, it is becoming evident that there is a need for increasing representation within the life sciences ecosystem. The lack of accessibility to industry, career awareness, wraparound support, mentorship, and expectation of fitting into the system has impacted representation of underserved and diverse communities. Additionally, the prevailing narrative that students need to pursue higher education as the sole path to career success in life sciences has deterred numerous individuals, resulting in systematic under representation for certain demographic groups and populations.

The persistence of interpersonal and structural inequities faced by underserved and underrepresented communities has impacted representation within the workforce. The life science industry has shown their understanding of the urgency of the issue and is involved at grassroots levels in improving representation. Increasing opportunities for individuals from underserved populations requires a dedicated program that offers accessibility to opportunities, financial and infrastructure support, multiple professional and programmatic mentors to navigate various stages of personal and professional development. To overcome these issues there needs to be sustainable long-term support for such programs that support underserved communities in mitigating inequities, connecting them to various career and internship opportunities, and tracking longitudinal growth of individuals.

Recommendation 3.1: Fund non-profit education partners to prepare students for the Life Science Washington Scholars Internship Program to advance DEI within the life sciences industry by supporting, preparing, and matching diverse talent to Washington companies.

Systemic changes occur when grassroots initiatives are in alignment with top-down initiatives and identifying common ground becomes critical. Life Science Washington (LSW) facilitated a DEI Workgroup that over a span of 6 months developed best practices for Life Sciences internship program and adapted learnings from Life Science Cares Internship program in Boston to develop the Life Science Washington Scholars Internship Program (LSWSIP). LSW has played a critical role in supporting and advocating for life science companies and providing connections to build a healthy life science ecosystem and has over 500 life science companies as members. In the State of Washington, the Washington State Opportunity Scholars (WSOS) provides scholarships and support services to eligible candidates from underserved and underrepresented communities to pursue education and provide career guidance. We recommend that WSOS receive support to build out the Life Science Washington Scholars Internship Program (LSWSIP) with Life Science Washington.

The life science industry has shown urgency and is involved at a grassroots level in improving representation as companies and industry leaders realize the value of diverse perspectives towards problem solving and innovation. The critical aspects to improving representation relies on (1) identifying a pool of candidates, (2) having operational capacity involving recruiting, providing career and

professional development training, (3) matching individuals within the cohort with appropriate life science industries, and (4) tracking the career paths of individuals.

WSOS will select a cohort of 15-20, 3rd year (juniors) learners pursuing a 4-year degree, provide them with career guidance support, and work with LSW to match them with industry mentors in partnership with LSW to prepare them for internship opportunities. This program is being proposed as a pilot, but it will be important to provide regular support for the coordinator(s) to be able to manage multiple cohorts, provide longitudinal study tracking individuals and eventually scale the program to over 100 scholars. DEI initiatives require long-term support at such grassroots level to mitigate inequities and following the career journey of individuals will provide evidence-based support to continually refine the program.

Strategic Priority 4: Develop a Technical Residency Program by leveraging state-of-the-art laboratory infrastructure at non-profit research institutes that can provide hands-on experiential learning and development of diverse market-ready life science skills.

Recommendation 4.1: Partner our colleges with our world-class non-profit research institutes to create a multi-year Technical Residency program that combines a degree or credential program with real-world laboratory experiences.

The Strategic Challenge and Rationale for Intervention:

Industry requires significant hands-on training before hiring. For senior roles, scientists and medical professionals go through fellowships or residencies. We need a similar residency program to provide real-world lab experience for 2-and 4-year undergraduates. Our non-profit research institutes have the capability, capacity, and highly specialized facilities to train individuals in critically needed lab skills. So, there's an opportunity to partner our colleges with our world-class non-profit research institutes to provide a **Technical Residency** program that combines a degree or credential program with real-world laboratory experiences. This program's aim is to support the high demand jobs of lab technicians, clinical associates and technicians, and scientists at scale. Unlike traditional apprenticeship and internship models the Technical Residency is aimed to meet the requirements of diverse high demand roles and needs to be built such that it offers diverse skills and real-world experience in life sciences.

We propose developing an 18–24-month Technical Residency Program where the coursework offered by education institutions is integrated with the training delivered by the research institutes as is done for nurses, doctors, and graduate research assistants and fellows. Phase I of the Technical Residency Program will be identifying the talent supply side and providing coursework and career/industry awareness as managed by educational institutions. We have identified Shoreline Community College, University of Washington, Bothell and Seattle Campus, as well as Washington State Health Sciences Spokane as the initial partners in terms of identifying the learner population who would be suitable candidates for the Technical Residency. These educational institutions have built strong ties with Industry partners and will be leveraged to increase the awareness and the importance of lab and clinical technicians. Phase II of the Technical Residency program involves the coalition of multiple research institutes e.g., Allen Institute for Brain Science, Benaroya Research Institute, Fred Hutchison Cancer Center, Institute of Systems Biology, Pacific Northwest National Laboratory, Pacific Northwest Research Institute, and Paul G. Allen Research Center at Swedish Cancer Institute to provide the hands-on training hence leveraging the state-of-the-art lab and infrastructure facilities. In this phase the individuals could choose at least three lab rotations to gain hands-on training and eligibility to be job ready for scientists, lab and/or clinical associates and technicians roles.

Additionally, we learned that despite the high demand for the clinical research professional workforce, and a shortage of talent in the pipeline there is currently a gap in industry career path guidance and broadly recognized certification and credentialing. So, there's an opportunity to integrate into the curriculum development the work done by the Association of Clinical Research Professionals (ACRP), a national organization devoted to clinical research professional advocacy that supports individuals and life science organizations globally by providing guidelines for community, education, and credentialing programs. Using ACRP resources, including a clinical research professional skills and competencies roadmap, LSW can work with educational partners to adopt coursework and certifications that can help

to create programs with documented proficiencies in clinical management which supplement basic education in healthcare delivery or life sciences.

Greater Seattle is home to numerous major biomedical and global health related research institutions—Fred Hutchinson Cancer Center, the Allen Institute, Benaroya Research Institute, Center for Infectious Disease Research/Seattle Children's Research Institute, and others—who currently serve in an ad hoc capacity as major training centers for hundreds of research lab technicians and clinical research coordinators and associates, and scientist roles identified as high-demand/high-priority for the industry. While the research institutes have the capability and capacity to train people in these roles, they can't match industry salaries due to their non-profit pay scales related to Federal grant funding. As a result, they are stuck in a situation where they provide a period of intense training at these institutions, typically followed by the trainee/employee leaving after 1 to 2 years for another career opportunity in the private sector or to attend medical or other graduate schools. This dynamic, including "poaching" by other employers of early-career lab techs and clinical research professionals, in part driven by wage differentials, is a major concern and challenge for these institutions.

Recognizing the realities of this "informal" and sizable training and experiential learning dynamic, and the non-profit status of these institutions, LSW and TEConomy have held discussions about directing funding to support this training as a pillar of our recommendations toward bridging the college to work experience gap. Several employers, via initial discussions, have been receptive to this potential arrangement. For early career professionals/recent graduates, this could offer a highly valuable credentialling opportunity to pare with their degrees, and for the research institutions, funding could help offset this investment in training that often yields little in "ROI" when an employee leaves or is recruited by a local firm. At the same time, more formal "residency" programming and attention could enable the research institutions to capture a greater share of college/university talent and expect to retain some share of these students post-training.

Further discussions and roundtables are needed to design a sustainable, robust residency program that centers around the learners' needs, while also being economically and logistically feasible for the research institutes. Based on several conversations with research institutes we have learned that these facilities have intermittently forged partnerships with existing higher education institutions based around investment of internal resources to support small cohorts of experiential learners. Identifying appropriate financial models to further support these efforts is imperative to incentivize the research institutions to scale the capacity and throughput of these efforts as one way of addressing talent constraints. To ensure the success of the partnership between educational institutions and the coalition of research institutions, a standardized financial and administrative process should be implemented that supports the key stakeholders including technical residents, curriculum developers and faculty at educational institutions, staff at research institutions, and coordinator(s) involved in managing the cohort and activities to support the Technical Residency programs.

A functional, scalable technical residency program would be a huge win for both industry and our world-class research institutes. We recommend providing funding to design the program, identify the critical core operating agreements that need to be in place, and solidify the financial arrangements that need to be in place to enable technical residencies partnerships to exist at scale.

Strategic Priority 5: Maintain Sector Intermediary to coordinate and scale industry involvement in awareness, education, and workforce initiatives.

Recommendation 5.1: Since most life science companies are small to medium sized, research-focused companies, they lack the internal resources or scale to engage productively with education and workforce partners individually. A sector intermediary is needed to help companies participate in curriculum development, internship programs, career awareness activities, and coordinate new initiatives like the technical residency.

The Strategic Challenge and Rationale for Intervention:

There is both a lack of awareness and coordination among life sciences industry Human Resources executives and companies in the state across potential areas of common demand for skills and experience. This is a common situation nationally outside of leading life sciences industry ecosystems, but the dynamic creates complications for coordination with higher education and workforce training around critical marketable skills.

Discussions with industry stakeholders highlighted this lack of programmatic coordination, with efforts typically led by regional "champion" individuals or groups and coordinated through individual relationships with specific companies. To achieve results at scale, the state needs to better understand regional efforts and organize industry, academic, and public stakeholders around common goals. To that end, LSW can undertake several actions to continue to build its role as an enabling intermediary for the state's life sciences workforce efforts. LSW will play the coordinating role for several ecosystem functions, including:

- Regular meetings of Human Resources and Talent Acquisition personnel for life sciences companies to discuss ongoing workforce dynamics and talent-related challenges. This will require frequent one-on-one and consortium-based discussions to continually work on the evolving life science ecosystem.
- Facilitate partnerships and highlight available state funding opportunities to create workforce-related initiatives and actions that include universities, research institutions, and industry stakeholders. E.g., connecting CBIT leadership with Industry partners to strengthen public-private partnerships.
- Work with K-12 systems and higher education programs to coordinate the involvement of life science companies for career awareness programs.
- Coordinate with educational institutions and Career Navigators to build programs that support multiple institutions and catalog modular credentialing and experiential learning to build diverse career pathways that align with industry demand.
- Connect scholars from Washington State Opportunity Scholars with consortium of companies to strengthen the internship experience for underserved and qualified individuals.
- Facilitate coalition of research institutes to build the Technical Residency Program and connect higher education institutions to pilot and scale the program. Provide Industry insight to create modular programming that aligns with critical life science skills and builds a talent pool that serves to fill diverse high demand jobs.

- Sponsored events that showcase life sciences talent and partner organizations. E.g., increasing the talent pool by partnering with WSU and expanding the awareness of the programs developed there.
- Life Science Washington through the Career Center offers a platform for companies to share their job openings and offer others career awareness functions for members to support talent sourcing efforts across the ecosystem.

Appendix

Table A-1: The TEConomy/BIO Life Sciences Industry Definition Utilized in this Report

Life Sciences Subsector	NAICS Code	NAICS Description
Agricultural Feedstock & Industrial Biosciences		
	311221	Wet Corn Milling
	311224	Soybean and Other Oilseed Processing
	325193	Ethyl Alcohol Manufacturing
	325311	Nitrogenous Fertilizer Manufacturing
	325312	Phosphatic Fertilizer Manufacturing
	325314	Fertilizer (Mixing Only) Manufacturing
	325320	Pesticide and Other Agricultural Chemical Manufacturing
Drugs and Pharmaceuticals		
	325411	Medicinal and Botanical Manufacturing
	325412	Pharmaceutical Preparation Manufacturing
	325413	In-Vitro Diagnostic Substance Manufacturing
	325414	Biological Product (except Diagnostic) Manufacturing
Medical Devices & Equipment		
	334510	Electromedical and Electrotherapeutic Apparatus Manufacturing
	334516	Analytical Laboratory Instrument Manufacturing
	334517	Irradiation Apparatus Manufacturing
	339112	Surgical and Medical Instrument Manufacturing
	339113	Surgical Appliance and Supplies Manufacturing
	339114	Dental Equipment and Supplies Manufacturing
Bioscience-Related Distribution		
	423450*	Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers
	424210*	Drugs and Druggists' Sundries Merchant Wholesalers
	424910*	Farm Supplies Merchant Wholesalers
Research, Testing, & Medical Laboratories		
	541380*	Testing Laboratories
	541713*	Research and Development in Nanotechnology
	541714	Research and Development in Biotechnology (except Nanobiotechnology)
	541715	Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)
	621511	Medical Laboratories

*Includes only the portion of these industries engaged in relevant life sciences activities.