

# St. Louis Bioscience Labor Market Analysis



Prepared For:



**BIOSTL**  
DRIVING ST. LOUIS INNOVATION

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**Extension**  
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**Exceed**

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## Executive summary

Plant, life and medical sciences (hereafter referred to as the ‘biosciences’) are foundational to the St. Louis regional economy and its innovative capacity. By providing foundational knowledge about the St. Louis region’s bioscience workforce, this report supports regional efforts to help bioscience employers find the workers they need and enable new and incumbent workers to pursue bioscience careers. It draws from public and proprietary data sources, and stakeholder feedback, to identify key challenges and areas for continued and future action.

- The region’s biosciences industries engage in a wide range of activities.
  - The St. Louis region’s bioscience industries account for over 19,000 payroll jobs—with average annual earnings over \$116,000—in 800 firms.<sup>1</sup>
  - Approximately one-third of the region’s biosciences employment are in research, testing and medical labs; 30% in bioscience-related distribution; and another 37% in three manufacturing related segments—drugs and pharmaceuticals, medical devices and equipment, and agricultural feedstock and industrial biosciences.
  - Bioscience manufacturers represent one of the region’s unique advantages given the relatively high employment concentrations found in these industries.
- The St. Louis bioscience industry depends on a higher level of skilled workers than the average regional employer, with 8 out of 10 positions requiring education or job experience beyond a high school diploma. Bioscience employers are also projected to have 1,400 annual job openings over the next decade.
  - 36% of openings are for higher skilled occupations requiring at least a 4-year degree, and often are related to sales and administration, or science and technology jobs.
  - 47% of openings are for middle-skill jobs, primarily in manufacturing and sales.
- Bioscience employers need workers to perform a variety of skilled tasks. Key occupations—identified through analysis and stakeholder feedback—fall into one of three broad areas.
  - **Science and laboratory** occupations (e.g., chemists, clinical lab technicians, chemical technicians, phlebotomists)
  - **Manufacturing production** occupations (e.g., chemical equipment operators; inspectors, testers and sorters, and mixing and blending machine operators)
  - **Business support** occupations (e.g., technical sales representatives, software developers and quality analysts, computer user support specialists)
- The region’s post-secondary institutions educate new workers and train incumbent workers through a variety of degree and certificate programs.
  - The region’s larger research institutions—Washington University in St. Louis (WUSTL), Saint Louis University (SLU), University of Missouri-St. Louis (UMSL), and Southern Illinois

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<sup>1</sup> The 2021 employment estimates are based on data provided by Economic Modeling Specialists, International, as well as industry definitions used by the Biotechnology Innovation Organization (BIO).

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- University-Edwardsville (SIUE)—are the primary source of engineering, biological and biomedical sciences, and mathematics degrees.
- Community and technical colleges offer degree and certification programs in areas vital to manufacturing, such as engineering technologies, precision production, and mechanical and repair technologies.
  - Almost all of the region’s post-secondary institutions educate and train students in fields with broader demand, such as business, management and marketing and IT.
  - Some institutions attract students from outside the region, which benefits St. Louis by drawing in new potential job and business talent. These students have ties outside the area, so it is important for students to see St. Louis as an attractive place to both live and work.
- Feedback from the key public and private sector stakeholders identified regional challenges facing the St. Louis biosciences industries.
    - The greatest talent shortage pertained to scientific and production workers.
    - There is an overall need for more STEM educated and skilled workers, as well as greater diversity within the workforce. Several programs or efforts were mentioned that may offer opportunities for scaling up.
    - Stakeholders noted ongoing recruitment challenges such as firms contacting graduates after they had made decisions about where to work/live, students lacking awareness about available jobs and opportunities, a persistent lack of student demand for STEM/MFG programs, and reluctance among some students to pursue programs with significant math requirements.
  - Securing the resources needed to strengthen/expand the region’s bioscience workforce requires ongoing collaboration. Efforts should be tailored to specific job groups, as different stakeholders need to address different workforce issues.
    - **Science/Lab jobs:** Strengthen relationships between employers and K-12 STEM students and educators; Reinforce college STEM programs through expanded private-sector partnerships; and connect to college students before they decide where to live/work.
    - **Production jobs:** Work with employers, schools and youth groups to creatively promote technical and manufacturing-related training and jobs; Expand ‘Earn and Learn’ programs (e.g., apprenticeships) for incumbent workers; and Explore opportunities to provide supportive services (e.g., childcare, transportation) for disadvantaged workers.
    - **Business support jobs:** Partner with other regional industries, institutions, and organizations to support training for emerging IT and data science jobs (e.g., geospatial, cybersecurity); and connect small businesses and manufacturers to business support services such as the MO/IL Small Business Development Centers (SBDCs), Missouri Enterprise/Illinois Manufacturing Excellence Center (IMEC), workforce boards, local organizations, etc.

## Introduction

Plant, life and medical sciences (hereafter referred to as the ‘biosciences’) are a foundational piece of the St. Louis regional economy and central to its innovative capacity. The region can leverage many resources in support of these industries, including—but by no means limited to—facilities like the Danforth Plant Science Center and the neighboring Bio-Research and Development Growth (BRDG) Park; research centers like Southern Illinois University-Edwardsville’s (SIUE) National Corn-to-Ethanol Research Center (NCERC); and numerous community and technical colleges for training and preparing current and future workers. The region is also home to a wide variety of employers, including global leaders (e.g., Bayer Crop Science, Millipore Sigma, Mallinckrodt), as well as a vibrant start-up community. In aggregate, the region possesses the requisite elements for a strong biosciences cluster.<sup>2</sup>

Maintaining the biosciences’ regional competitiveness requires a strong workforce. In collaboration with its public and private sector partners, BioSTL works to help then region’s bioscience employers find the workers they need and enable new and incumbent workers to pursue bioscience careers. This report supports these efforts by building foundational knowledge about the St. Louis region’s bioscience workforce and its current and future needs.

The report relies on several different data sources. Economic Modeling Specialists International (EMSI), a nationally recognized proprietary vendor of labor market information—provided employment data and projections. Data about online job advertisements—drawn from Burning Glass Technologies’ *Labor Insight* tool—helped identify many of the in-demand skills and certifications valued by specific industries and employers.<sup>3</sup> In addition, almost 60 public and private sector stakeholders offered feedback after a presentation of the initial findings.<sup>4</sup> This feedback importantly identified many of the challenges that must be addressed to strengthen and grow the region’s biosciences workforce.

This report is organized as follows. We first define the region’s biosciences industries and consider how industry employment trends inform worker demand. We then examine broad occupational trends within the bioscience industries, by analyzing industry staffing patterns. This analysis allows us to better understand the types of jobs that bioscience employers need to fill, both now and in the future. After highlighting the broad areas of occupational demand, we then identify the specific occupations, skills and certifications sought by bioscience employers. We also examine completer data to better understand how post-secondary institutions support the region’s bioscience workforce. We conclude by identifying several workforce challenges and areas for potential action.

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<sup>2</sup> [Rethinking Cluster Initiatives: St. Louis Agricultural Technology](#). Prepared by the Brookings Institution Metropolitan Policy Project, July 2018.

<sup>3</sup> These industry-leading data providers merged in 2021 to become EMSI Burning Glass.

<sup>4</sup> On November 1, 2021 we presented the initial findings from the labor market analysis to almost 60 regional stakeholders. These stakeholders included employers, educators, economic and workforce developers and other non-profit and community leaders. Stakeholders were broken up into several different groups in order to facilitate discussion about the key challenges they see for strengthen the St. Louis Bioscience workforce, as well as sharing their input about their priorities, where there might be potential opportunities and successful local initiatives. Feedback from these sessions is incorporated throughout the report.

## The St. Louis bioscience industries include a diverse array of activities

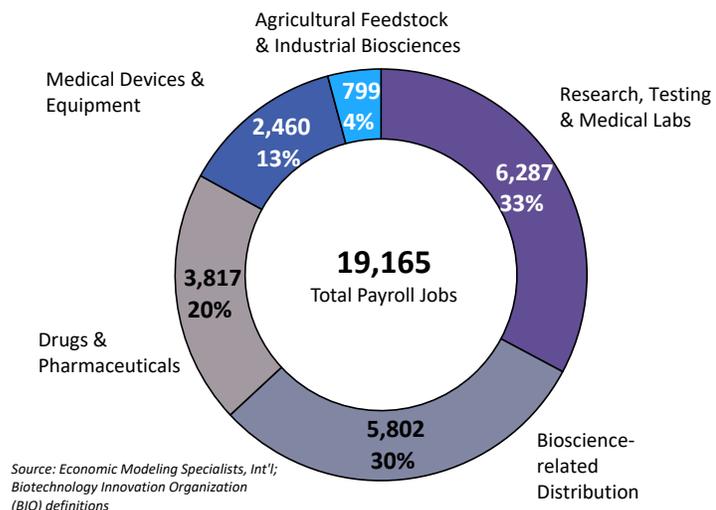
The bioscience industries include many different activities ranging from research and development, to manufacturing and distribution. Often individual firms may be involved in one or more of these bioscience-related activities. Given this diversity, no single industry definition perfectly captures the full range of activities. This report uses the Biotechnology Innovation Organization's (BIO) definition of biosciences in order to operationalize bioscience.<sup>5</sup> Since 2004, BIO has conducted a biennial survey of bioscience industry trends, and the current definition includes 25 North American Industrial Classification System (NAICS) industries across five segments of the bioscience industries.<sup>6</sup> These components include:

- Agricultural feedstock and industrial biosciences;
- Medical devices and equipment;
- Drugs and pharmaceuticals;
- Research, testing and medical laboratories; and
- Bioscience-related distribution.

Within the St. Louis, MO-IL metro area, bioscience industries account for over 19,000 payroll jobs in 800 firms.<sup>7</sup> Moreover, these industries often create good paying jobs as the

average annual earnings were over \$116,000. Figure 1 shows the St. Louis employment within each of these industry segments. Approximately one-third of all bioscience jobs are in research, testing and medical labs, which represent many of the regional firms focused on plant, life and medical R&D. Another 30% of jobs are in firms involved in distributing bioscience-related products (e.g., drugs, medical devices). These activities often involve special considerations (e.g., adhering to strict regulations, using cold storage, or automated tracking systems) to get their products to the final destination.

**Figure 1: Employment by Bioscience Industry Segment**



<sup>5</sup> [The Bioscience Economy: Propelling Life-Saving Treatments, Supporting State & Local Communities](#) prepared by TEconomy Partners, LLC. for the Biotechnology Innovation Organization, 2020.

<sup>6</sup> The BIO definition attempts to bring focus to the core bioscience activities. It does not include the employment generated by universities or hospitals where significant biosciences research takes place. Regardless, this definition works well for this analysis because an inclusion of hospitals, for instance, would lead to an overemphasis on nursing and allied health occupations which are beyond to focus of this report. A full listing of these 25 NAICS industries, as well as their employment trends, relative concentration and average earnings are available in Appendix A.

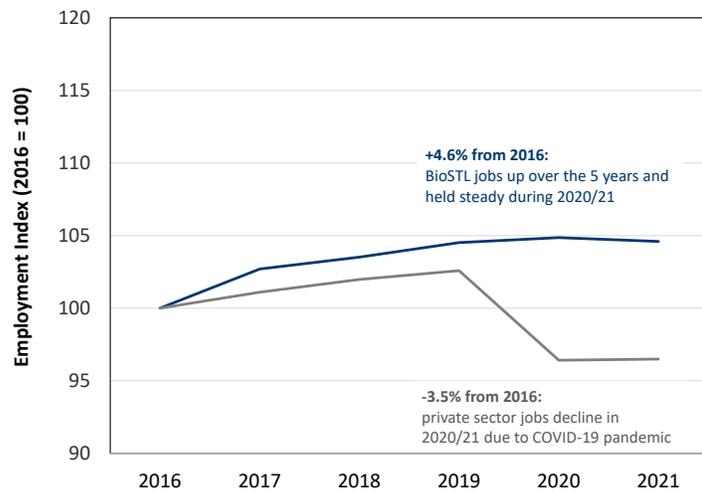
<sup>7</sup> Unless noted otherwise, the analysis uses Economic Modeling Specialists International (EMSI). The EMSI data combine U.S. Bureau of Labor Statistics employment payroll data from its Quarterly Census of Employment and Wages. EMSI then estimates data where BLS privacy standards do not allow it to disclose publicly. These estimates provide greater industry and geographic detail that would otherwise be available.

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The three other segments—drugs and pharmaceuticals, medical devices and equipment, and agricultural feedstock and industrial biosciences (e.g., fertilizer manufacturing)—account for much of the region’s bio-manufacturing activities. Within the St. Louis metro area these three components represent 37% of biosciences-related employment, with drugs and pharmaceuticals contributing the greatest share. These activities all include significant capital investments in the region, so employers need local workers to perform their jobs on-site. Unlike other activities, these activities cannot take advantage of remote work opportunities.

Figure 2 shows that over the past several years, in aggregate, biosciences-related employment in the St. Louis metro area has held steady—adding almost 850 net new jobs from 2016 to 2021—even though private sector remains down from where it was before the pandemic. The biosciences are clearly an important element of the St. Louis regional economy. Looking forward, overall employment in these select industries projects to remain relatively steady, although individual sectors may add or lose jobs. Growth in bioscience-related distribution, and modest growth in pharma, med devices, and ag feedstock and industrial biosciences are expected to drive much of this growth, but those increases will be partially offset by net losses in research, testing and medical labs.<sup>8</sup>

**Figure 2: Bioscience employment trends (2016-2021)**



Source: Economic Modeling Specialists, Int'l

Examining the relative concentration of these activities highlights where some of the St. Louis region’s competitive advantage lies, and what makes the region’s biosciences unique. Large coastal metros like Boston and the San Francisco Bay area generate much of the nation’s bioscience employment, but the relative concentration of several industries—particularly in biomanufacturing, shows that the St. Louis region has some unique strengths. Figure 3 shows the location quotients (LQs) for each bioscience industry segment and their component industries.<sup>9</sup>

Employment within the drugs and pharmaceuticals manufacturing industries are 30% more concentrated in the St. Louis metro area than they are nationwide; within that segment the medicinal

<sup>8</sup> Employment projections are informed by past industry trends which are updated periodically as new information becomes available. It is important to note that the employment numbers for 2021 are estimates and subject to revisions as BLS payroll jobs data are still being submitted by employers. As a result, new developments—such as new companies arriving or existing companies expanding—will not yet be captured in these current projections.

<sup>9</sup> Relative concentration is measured by using location quotients (LQs). LQs measure the relative percentage of a state or region’s industry employment, as compared with the national employment share. An LQ greater than 1.0 means that the region has a larger relative concentration of industry employment than the overall national economy. An LQ of 2.0 means that the share of that’s industry’s employment is twice that of the national share; an LQ of 0.5 means that the region’s share of industry employment is half as much as the national share.

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**Figure 3: Relative Concentration of Bioscience Employment (2021)**

Bioscience Industries	Job LQ*	Bioscience Industries	Job LQ*
<b>Research, Testing, &amp; Medical Labs</b>	<b>0.6</b>	<b>Medical Devices &amp; Equip. MFG</b>	<b>0.7</b>
Testing Laboratories	0.7	Electromedical Apparatus MFG	N/A
Nanotechnology R&D	2.6	Analytical Laboratory Instrument MFG	3.2
Biotechnology R&D	0.5	Irradiation Apparatus MFG	N/A
Physical, Engineering, & Life Science R&D	0.6	Surgical & Medical Instrument MFG	0.6
Medical Laboratories	0.7	Surgical Appliance & Supplies MFG	0.3
<b>Bioscience-Related Distribution</b>	<b>1.0</b>	Dental Equip. & Supplies MFG	1.9
Medical Equipment Merchant Wholesalers	1.1	<b>Ag. Feedstock &amp; Indust. Biosciences</b>	<b>1.3</b>
Drug Merchant Wholesalers	1.0	Wet Corn Milling	N/A
Farm Supplies Merchant Wholesalers	0.9	Soybean & Other Oilseed Processing	N/A
<b>Drugs &amp; Pharmaceuticals MFG</b>	<b>1.3</b>	Ethyl Alcohol MFG	1.2
Medicinal & Botanical MFG	1.9	Nitrogenous Fertilizer MFG	1.4
Pharmaceutical Preparation MFG	1.2	Phosphatic Fertilizer MFG	N/A
In-Vitro Diagnostic Substance MFG	0.6	Fertilizer (Mixing Only) MFG	1.1
Biological Product MFG	1.9	Pesticide & Other Ag. Chemical MFG	3.9

Source: Economic Modeling Specialists, Int'l; Biotechnology Innovation Organization (BIO) definitions

and botanical and biological products manufacturing industries were twice as concentrated than the nation. The agricultural feedstock and industrial biosciences segment is similarly concentrated, with the pesticide manufacturing industry almost 4 times more concentrated regionally than nationally.

In aggregate medical devices and equipment manufacturing has a relatively low location quotient (0.7), but within that industry segment the analytical laboratory instrument manufacturing industry—which employs more than 1,100 people in the region—was more than three times more concentrated regionally than nationally. Employment in research, testing and medical laboratories was also relatively underrepresented in the region, although R&D in nanotechnology was more concentrated than the other industries within this segment.

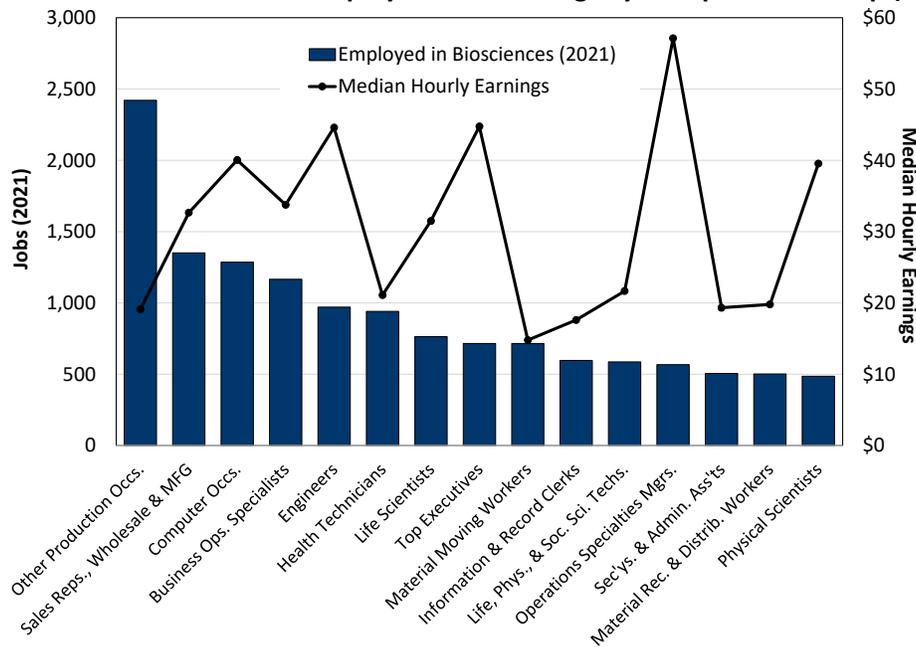
These data reflect the current industry composition of the region’s bioscience-related activities and expected employment trends, but it is important to note that the vast majority of future hiring will come from *replacement jobs*—jobs needed to fill vacancies created when a worker leaves for another job, retirement, etc. In all industries, replacement needs often account for over 90% of job openings in a given year. As a result, even though aggregate employment projections are expected to remain steady, the need for new and replacement workers will remain. Understanding the mix of industries nevertheless allows us to understand the jobs that employers must fill now, and over the next decade. To better describe these jobs, the next section shifts from what companies make (i.e., their industries) to what workers do (i.e., their occupations).

## St. Louis' bioscience employers create a variety of employment opportunities

Industry staffing patterns show the most common occupations within the bioscience industries.<sup>10</sup> The resulting occupational employment data then highlight the types of jobs that bioscience employers must fill and allow us to understand the broad workforce characteristics of the region's biosciences industries. Figure 4 shows occupational employment by broad functional area (i.e., 3-digit Standard Occupational Classification (SOC) codes), as well as their median hourly earnings.<sup>11</sup> The most common functional area is 'Other production occupations' (SOC 51-9000)<sup>12</sup>, which includes occupations such as packaging and filling machine operators; chemical equipment operators; and inspectors, testers, sorters, samplers and weighers. Combined, the occupations within this group pay median hourly earnings of around \$20 per hour—a figure consistent with the region's median hourly wage.<sup>13</sup> Overall, production occupations (SOC 51-0000) represent almost 1 in 5 jobs in the biosciences.

Many of the occupational groups within the biosciences pay median earnings well above the regional average. For instance, many workers filling managerial (e.g., Information Systems, Financial, Industrial Production Managers) and executive positions, as well as those in engineering, IT and the physical

**Figure 4: St. Louis Bioscience Employment & Earnings by Occupational Group (2021)**



Source: Economic Modeling Specialists, Int'l (2021.3)

<sup>10</sup> The US Bureau of Labor Statistics' industry-occupation staffing pattern matrix allow us to identify the types of occupations found in each industry or set of industries, by showing the distribution of occupations within a given industry. For example, if 100 people work in [pharmaceutical and medicine manufacturing \(NAICS 325400\)](#) firm, we can assume that 10 are packaging and filling machine operators and tenders, 5 are chemists, and 13 fall into some kind of management occupation. This information allows us to determine the largest occupations with the biosciences industries. Once we know the most prominent occupations and broader occupational groups, we can then examine current and future employment, wage trends, and the educational requirements for key bioscience-related occupations (as mentioned earlier, by using proprietary data developed by EMSI). Appendix B lists 115 of the most prominent occupations within the St. Louis bioscience industries.

<sup>11</sup> A complete listing of SOC codes is available from the [U.S. Bureau of Labor Statistics](#).

<sup>12</sup> This group represents approximately 70% of all production jobs within the defined biosciences industry.

<sup>13</sup> [https://www.bls.gov/oes/current/oes\\_41180.htm#00-0000](https://www.bls.gov/oes/current/oes_41180.htm#00-0000)

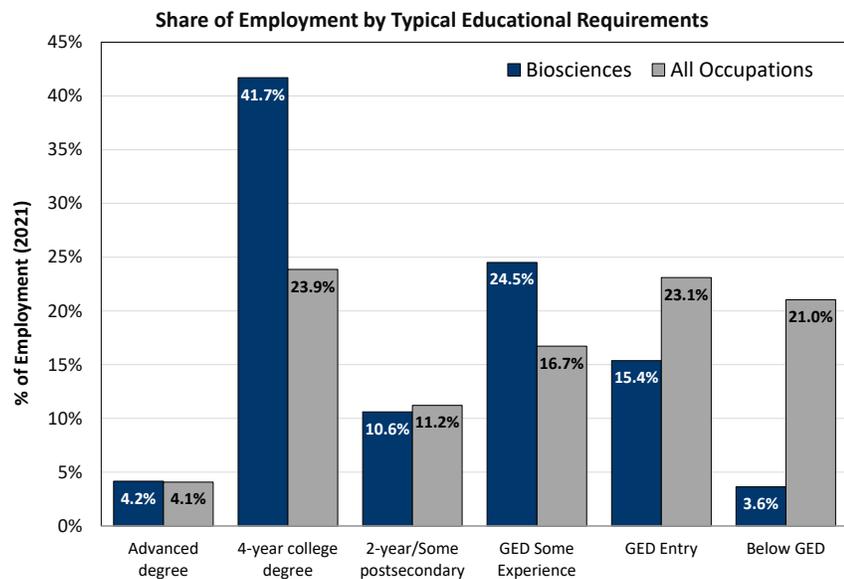
sciences (e.g., Chemists) earn at least double the regional median. Occupational groups such as business operations specialists (e.g., Project Management Specialists, Market Research Analysts), wholesale and manufacturing sales representatives, and life scientists (e.g., Medical Scientists, Microbiologists) have median annual earnings more than 50% greater than the regional average.

## The biosciences industry supports a large share of high- and middle-skill jobs

The region’s bioscience employers rely on a greater share of people with advanced education and experience, relative to the overall regional workforce. Figure 5 shows the share of jobs within the biosciences industries by their typically required education level.<sup>14</sup> High-skilled workers represent a relatively large share of

the biosciences workforce, almost 46% of all jobs typically require at least a 4-year degree. By contrast, 28% of the jobs in the St. Louis metro area typically require a 4-year degree. In the biosciences, most of these high-skilled occupations fall into two broad categories, business functions (e.g., Managers, Sales Representatives, Accountants, etc.) and scientific and technical functions (e.g., Clinical Laboratory Technicians, Software Developers, Chemists, etc.).

**Figure 5: Bioscience employment by typical educational requirement (2021)**



Source: Economic Modeling Specialists, Int'l (2021.3)

The biosciences also create a significant number of middle-skill jobs—those occupations typically requiring 2-year degree or postsecondary certification, or a high school degree with moderate (1 month to 1 year) to long-term (more than 1 year) of on-the-job training (OJT). The share of bioscience jobs requiring 2-year degree or post-secondary certification is similar to the workforce overall, but the share of workers requiring significant OJT is almost 50% greater in the biosciences. The greatest demand for these middle skills jobs comes from biomanufacturing (e.g., Packaging Machine Operators, Chemical Equipment Operators, etc.).

<sup>14</sup> The U.S. Bureau of Labor Statistics (BLS) provides [information about the education and training requirements](#) for hundreds of different occupations. The value assigned to each occupation represents the typical education level that most workers need to enter a given occupation.

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These skill distinctions are important considerations for developing strategies to grow and strengthen the region's bioscience workforce, as they help determine important parameters and key partners. People already in the regional labor market—or graduates from area 4-year institutions like Washington University in St. Louis (WUSTL), Saint Louis University (SLU) or the University of Missouri-St. Louis (UMSL)—will fill many of the jobs requiring at least a 4-year degree, but employers will nevertheless look beyond the local labor market to fill these positions. Employers will likely cast a much larger net (i.e., nationally, internationally) to recruit workers for these jobs, and especially those that require advanced degrees or very specialized skills. Moreover, the accelerated use of remote work options means that non-local workers can potentially fill some of these jobs (e.g., Information Technology).

By contrast many middle-skill jobs—particularly those involved in manufacturing—cannot be done remotely, nor are they the types of jobs that motivate workers to relocate to the region. As a result, employers rely more heavily on the local labor market to fill open positions. Therefore, partners like St. Louis Community College, St. Charles Community College, Jefferson College, or East Central College in Missouri or Lewis and Clark Community College in Illinois represent critical partners for training new and incumbent workers. Similarly other partners like local trades unions or private training providers (e.g., Ranken Technical College) represent additional sources of relevant training and education.

### Most hiring comes from replacement jobs rather than new jobs

The majority of bioscience job hiring comes from replacement openings instead of newly created positions. This is not unique to the biosciences or St. Louis; replacement needs create the vast majority of job openings—typically over 90%—for all U.S. occupations. Projected annual job openings help us understand the nature and extent of expected long-term hiring needs. Figure 6 shows the expected average annual openings over the next decade by broad functional area and skill level.<sup>15</sup>

The St. Louis biosciences industry is projected to create over 1,400 job openings annually. Similar to the existing biosciences workforce, most projected openings are for high- or middle-skill jobs. An estimated 36% of the projected openings are in occupations that typically require at least a 4-year degree. There are relatively more projected annual openings for middle-skill jobs (47% of all openings), due largely to greater turnover in those positions.

Job openings arise in a variety of functional areas. For instance, many openings among high-skilled workers fall into one of two categories—business and management (and to a lesser extent sales jobs), as well as the scientific and technical occupations. Among business and management occupations, the most common includes General Managers, Project Management Specialists, Accountants and Market Research Analysts; there is also relatively significant demand for Technical and Scientific Product Sales Representatives. Among higher-skilled scientific and technical occupations, employers will need scientists (e.g., Chemists), IT staff (e.g., Software Developers) and engineers (e.g., Industrial Engineers).

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<sup>15</sup> The broad functional areas are major occupational groups (2-digit SOC codes) or groupings of major occupational groups (e.g., Construction, Installation, Maintenance and Repair).

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**Figure 6: Projected annual openings in the St. Louis biosciences (2021 to 2031)**

	Skill Level	Higher Skill	Middle Skill	Entry-Level	Totals by BioSTL Occupation Group
All Biosciences	Typical Education or Experience	Bachelor's Degree or Higher	Assoc. Degree, Certificates, Moderate+ Training/Exp.	High School Degree & Short-Term Training	
	Annual Openings	519	673	252	1,444
	% Skill Level	36%	47%	17%	100%
Business, Sales, & Administrative Operations	Business & Mgmt.	222	2		224
	Sales & Related	77	74	13	164
	Office & Admin.		94	117	211
	Other Services	10	2	5	17
Scientific & Technical Operations	Sciences	78	33		111
	Computer & Data Science	59	16		75
	Engineering	50	17		68
	Health Care & Related	23	28		50
Production, Maint., & Material Moving Operations	Production		328	5	333
	CIMR*		54	7	61
	Transp. & Material Moving		24	105	130

Source: Economic Modeling Specialists, Int'l (2021.3)

\*Construction, Installation, Maintenance, & Repair

Production-related jobs are the single biggest source of middle-skill openings within the biosciences. Filling these positions is important to the overall competitiveness of the region’s bioscience industries, because these jobs cannot be done remotely, and the region’s bioscience manufacturers must rely heavily on the local labor market. The common middle-skill production openings that need filling reflect the nature of the region’s biomanufacturing industries—medical devices, chemicals, and pharmaceuticals. Therefore, the occupations with most projected openings include Packaging Machine Operators; Chemical Equipment Operators; Inspectors, Testers, Sorters, Samplers; and Electrical, Electronic, and Electromechanical Assemblers.

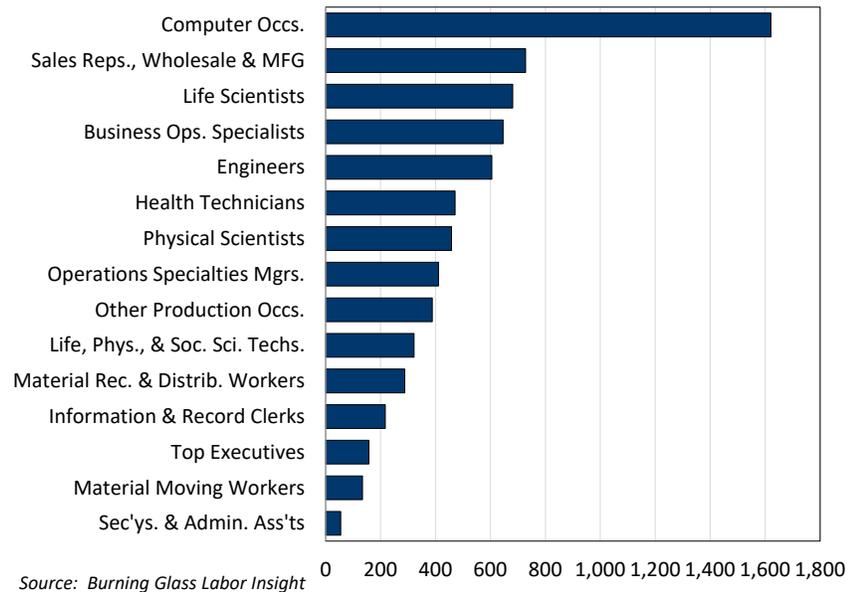
Beyond production-related occupations, there are openings for middle-skill jobs in areas such as sales and office and administrative jobs (e.g., Bookkeepers), scientific fields (e.g., Chemical Technicians) and maintenance fields. The bioscience industries must also fill entry-level positions that are largely found in office and administrative support and warehousing positions. Since bioscience-related industries create different types of opportunities they need different types of workers, and as a result meeting these diverse needs will require multiple strategies.

## Bioscience employers most commonly advertise available IT-related occupations

The employment estimates and projections discussed above are based on longer-term trends that are informed by business staffing patterns and BLS methodologies to account for job turnover and growth needs. Online job advertisements can be used to complement this information. Proprietary data vendors, such as Burning Glass, scrape job postings from online job boards (e.g., Monster, Indeed) or

corporate websites to determine the types of workers and skills that companies seek.<sup>16</sup> Figure 7 shows the number of online job postings, by occupational group (3-digit SOC), in the St. Louis metro area’s bioscience industries between January 1, 2019 and September 30, 2021. While job advertisements are not the same as job openings, the data can help gauge more current hiring intensity.

**Figure 7: St. Louis Bioscience Job Postings by Occupational Group (Jan. 2019 thru Sept. 2021)**



Among all occupational groups, the most online job advertisements were for computer occupations. Computer occupations represented about 13% of the total job postings during this period, but only account for an estimated 7% of total employment and 5% of projected average annual openings. More than other types of occupations (e.g., production), IT workers find jobs online. However, this imbalance may also reflect an intense need and competition for people with those skills, in biosciences and the workforce generally. Over the past decade, the demand for these occupations (e.g., Software Developers, Computer and Information Research Scientists) held relatively steady within the region’s bioscience industries.

Employers also commonly advertise for jobs in other high-skill occupational groups. For business and administrative occupations there was a need for technical and non-technical Sales Representatives and business operations specialists (e.g., Human Resources Specialists, Compliance Officers, Management analysts). Over the past decade the number of online job postings for these occupations has remained relatively steady in the biosciences and the region overall. Employers also advertised for scientific and technical (e.g., Biologists and Medical Scientists) and engineering (e.g., Chemical Engineers) occupations. The number of engineering-related job postings is below its 2015 levels but has stayed relatively stable since 2017.

Since 2018 the number of jobs advertisements within all the bioscience industries increased, even though overall regional demand has remained consistent. However, it should be noted that that these data do not reflect the full scope of demand. Online job advertisement trends are most inciteful when

<sup>16</sup> It is important to offer a few caveats with online job advertisements. First, one job advertisement does not equal one job opening; a job ad can lead to 5 jobs or no jobs. Often companies keep high-turnover job postings active—like truck drivers or nursing positions—which hides the actual number of available job openings. Second, these data tend to be biased toward more professional activities, so they tend to skew toward fields like IT, but very much underrepresent jobs in manufacturing, for instance. Lastly, online job postings are less likely to capture small business or lower-skilled job openings. More information on online job posting methods and uses can be found at [BurningGlass FAQ](#).

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focusing on professional jobs or jobs that require relatively greater levels of education. In many other fields, such as manufacturing, construction or agriculture, employers use online job postings less frequently to find employees. As a result, these data do not capture the demand for many of the middle-skill jobs found in the biosciences, particularly among St. Louis bio-manufacturing activities.

## Many in-demand occupations are also sought by other industries

To this point we have presented labor demand by broad occupational areas, but the specific jobs within those areas require workers with variety of skills and experience that can often serve the needs of many industries. Figure 8 shows the several key occupations that are relatively unique to biosciences, and those that are more in-demand throughout the economy.

Many of the occupations unique to biosciences tend to be more scientific or technical in nature. Among higher-skilled occupations, these include Biochemists and Biophysicists, Medical Scientists, Chemists, and Biological Technicians. Bioscience employers also employ a notable share of sales representatives who sell technical and scientific products. In-demand middle-skill jobs speak to the unique nature of bio-manufacturing and lab work, so prominent occupations include Chemical Technicians, Dental Laboratory Technicians, and Chemical Equipment Operators.

By contrast, IT-related occupations like Software Developers or Computer User Support Specialists are in-demand throughout the economy. Bioscience employers also compete with the broader healthcare industry for people to fill occupations such as Clinical Lab Technicians and Phlebotomists. Similarly, bio-manufacturers must compete with other manufacturers for production workers in occupations such as Electronic and Electromechanical Assemblers; Mixing and Blending Machine Operators; Packaging and Filling Machine Operators; and Inspectors, Testers, Sorters, Samplers and Weighers.

**Figure 8: Unique and cross-cutting occupations within the St. Louis Biosciences industries**

Skill level	Bioscience industries generate significant demand ('Unique')	Significant demand elsewhere in the economy ('Cross-cutting')
<b>High Skill (Bachelors or higher)</b>	<ul style="list-style-type: none"> <li>• Biochemists &amp; Biophysicists</li> <li>• Medical Scientists, Except Epidemiologists</li> <li>• Chemists</li> <li>• Biological Technicians</li> <li>• Microbiologists</li> <li>• Sales Reps, Wholesale &amp; MFG Technical &amp; Scientific Products</li> <li>• All other biological scientists</li> <li>• Agricultural &amp; food science technicians</li> <li>• Soil &amp; Plant Scientists</li> </ul>	<ul style="list-style-type: none"> <li>• Clinical Laboratory Technologists &amp; Technicians</li> <li>• Software Developers &amp; Software Q/A Analysts &amp; Testers</li> <li>• Network &amp; Computer Systems Admins.</li> <li>• Computer Network Support Specialists</li> <li>• Database Administrators</li> <li>• Computer Programmers</li> <li>• All Other Computer Occupations (incl. GIS technicians, document mgmt. specialists, information security engineers, etc.)</li> </ul>
<b>Middle Skill (Assoc. Degree, Certificates, Moderate/Long-term OJT)</b>	<ul style="list-style-type: none"> <li>• Chemical Technicians</li> <li>• Chemical Equipment Operators &amp; Tenders</li> <li>• Chemical Plant &amp; System Operators</li> <li>• Dental Laboratory Technicians</li> <li>• Ophthalmic Laboratory Technicians</li> <li>• Medical Appliance Technicians</li> </ul>	<ul style="list-style-type: none"> <li>• Phlebotomist</li> <li>• Sales Reps, Wholesale &amp; MFG Except Technical &amp; Scientific Products</li> <li>• Elec., &amp; Electromechanical Assemblers, Except Coil Winders, Tapers, &amp; Finishers</li> <li>• Mixing &amp; Blending Machine Setters, Operators, &amp; Tenders</li> <li>• Packaging &amp; Filling Machine Operators &amp; Tenders</li> <li>• Inspectors, Testers, Sorters, Samplers, &amp; Weighers</li> <li>• Computer User Support Specialists</li> <li>• Misc. Assemblers &amp; Fabricators</li> </ul>

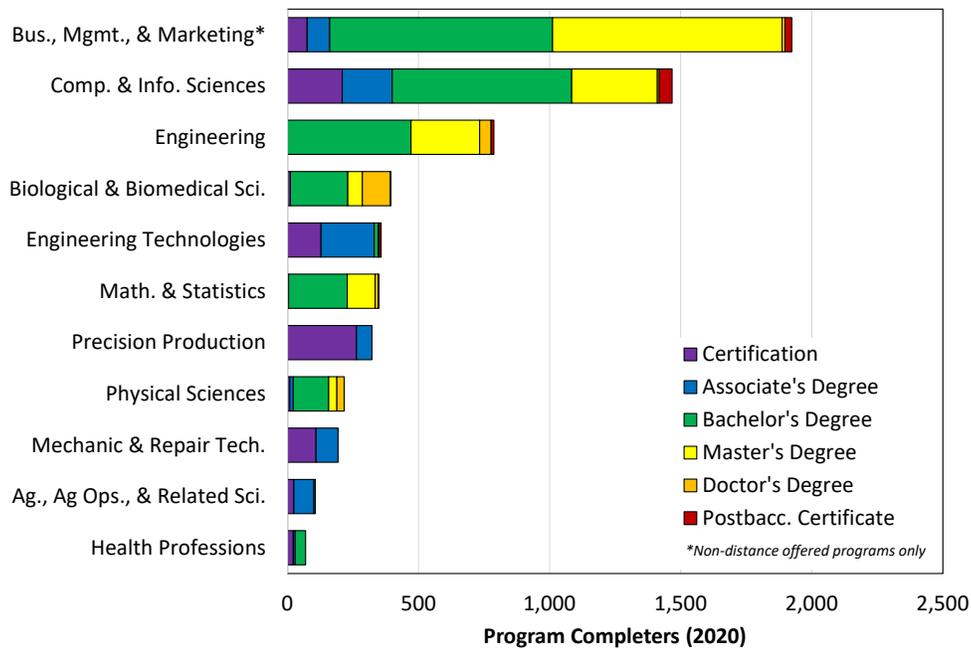
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The distinction between these two broad types of occupations (unique v. cross-cutting) is important because filling these openings requires different types of strategies. For those occupations where bioscience companies employ a significant share of a particular occupation, employers and their partners must engage students early to generate interest and awareness in these careers and then subsequently connect them to the necessary training and education. By contrast, more cross-cutting occupations (e.g., managers, accountants, administrative, etc.)—which can be found in employers throughout the region—require strategies that encourage workers to choose careers in biosciences rather than finding similar work in other industries.

## Area post-secondary institutions prepare workers for in-demand bioscience jobs

St. Louis area institutions play a critical role in preparing both future and incumbent workers for bioscience careers. We examined graduates from area post-secondary institutions to better understand these contributions. Figure 9 shows the number of people completing post-secondary certifications and degrees in 2020 for bioscience-related programs.<sup>17</sup> The two program areas that prepare people for careers in business support occupations—business, management and marketing and computer and

**Figure 9: Completers by program area and degree type from relevant biosciences programs (2020)**



Source: Economic Modeling Specialists, Int'l; National Center for Education Statistics (NCES) Integrated Post-secondary Education Data System (IPEDS)

<sup>17</sup> The data presented here include 2020 completer data for certifications, associates, bachelors, and graduate degrees. These data originate from the US Department of Education's Integrated Post-Secondary Education Data System (IPEDS), which collects and organizes program completer information submitted by public and private post-secondary institutions. The data are organized by Classification of Instructional Programs (CIP) codes. CIP codes organize completions by field of study at U.S. institutions of higher education and are available at varying levels of aggregation (e.g., 14-Engineering; 14.07-Chemical Engineering; 14.0702-Chemical and Biomolecular Engineering).

information sciences—produced the greatest number of 2020 completers. Given the ubiquitous need for these skills, almost all of the region’s post-secondary institutions contributed to these totals.<sup>18</sup>

The region’s larger research institutions—WUSTL, SLU, UMSL, SIUE—are the primary source of engineering, biological and biomedical sciences, and mathematics degrees. Although many of these institutions have graduate programs, WUSTL is the largest source of engineering and biological and biomedical graduate degrees.<sup>19</sup> The region’s community and technical colleges offer programs in more applied fields such as engineering technologies, precision production, and mechanical and repair technologies. As a result, they are vital partners in training the region’s manufacturing workforce.

It is important to note that not all degree or certificate completers find jobs in their field of study, or even stay in the region. Community and technical college students are overwhelmingly local, but this is not necessarily the case for all regional institutions. Similarly, the region’s public universities are often locally-serving, as almost 80% of UMSL students are from the St. Louis area<sup>20</sup> and 55% of SIUE students are either from the Illinois counties of the St. Louis metro area or Missouri.<sup>21</sup>

Nevertheless, Washington University and Saint Louis University educate and train many of the region’s biology, chemistry and engineering graduates, but many of their students come from outside the area—90% of Washington University students are from outside Missouri, 65% are from more than 500 miles away<sup>22</sup>; 64% of SLU students are from outside Missouri.<sup>23</sup> Attracting students from outside the region benefits St. Louis by drawing in new talent that otherwise would not be there, but a notable share of these students will not stay in the area after program completion unless local employers connect with them before they graduate. The broader point, however, is that the area’s bioscience employers face the dual challenge of encouraging people to pursue bioscience careers and persuading them to pursue those careers in the St. Louis region.

### **Bioscience employers need workers to fill occupations in three key areas**

The above information considers broader labor force characteristics and training but strengthening the region’s overall bioscience workforce also requires information about the demand for specific occupations and skills. This section highlights these more specific labor demands, by drawing on available labor market information, online job advertisements and regional stakeholder feedback.

In particular, we highlight occupations that a) require training or job experience beyond high school, b) are specialized within the biosciences and represent a unique skillset, or c) are cross-cutting positions (e.g., IT support) that complement or support the bioscience industries. These specific occupations fall

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<sup>18</sup> Given the focus on the St. Louis regional workforce, Figure 9 includes only non-distance offered programs. Several institutions (e.g., Webster University) have robust online educational programs in business, management and marketing, among other areas. As a result, many completers are not in the region or able to participate in the local labor market.

<sup>19</sup> The labor market for engineers tends to be broader and some of the region’s need for engineering graduates will be met by other institutions (e.g., Missouri S&T, University of Missouri-Columbia, University of Illinois Urbana-Champaign) that are proximate to St. Louis.

<sup>20</sup> <https://www.umsl.edu/~ir/files/pdfs/student-profile-fs2020#:~:text=Among%20students%20enrolled%20on%20the,from%2044%20states%2C%20excluding%20Missouri>.

<sup>21</sup> <https://www.siue.edu/inrs/factbook/pdf/FbCurrent.pdf>

<sup>22</sup> <https://wustl.edu/about/university-facts/>

<sup>23</sup> <https://www.slu.edu/about/key-facts/slu-profile.pdf>

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into three broad occupational areas—**science and laboratory** occupations, **manufacturing production** occupations, and **business support** occupations. For each broad occupational group, we highlight several specific jobs, their projected demand, typical educational requirements, and annual average earnings.<sup>24</sup> We also draw upon job postings data to show the in-demand skills and certifications associated with these jobs.<sup>25</sup> Additionally, each section highlights the degree and certificate completions from relevant programs at St. Louis area institutions.

### Bioscience employers create many of the region science and laboratory jobs

Science and laboratory jobs represent some of the biosciences' more prominent occupations. These jobs are critical for many of the industry's research, development and testing activities. Figure 10 lists several key science and laboratory occupations in the St. Louis region's bioscience industries. In several instances, the bioscience industries employ many of the region's workers in a given occupation. For example, the biosciences employ 70% of the region's Biochemists and Biophysicists and 53% of the region's Microbiologists. Several of these selected occupations are highlighted below:

- Chemical Technicians (SOC 19-4031):** Chemical Technicians are a prominent middle-skill, science and lab-related occupation. Within the St. Louis region, the median annual earnings for chemical technicians were almost \$47,000. Workers in these occupations assist scientists in conducting chemical or physical lab tests. The biosciences industries account for almost 2 out of every 5 chemical technicians in the region. As a result, establishing a pipeline of talent to fill these positions is important for the industry. The U.S. Bureau of Labor Statistics identifies a 2-year degree as the typical entry level education, but job postings data show that some employers will

**Figure 10: Select scientific and laboratory occupations**

SOC Code	Occupation Title	2021 StL MSA Bioscience Employment	% of All StL MSA Occup.	StL MSA Occup. LQ
31-9097	Clinical Laboratory Technicians	614	12%	1.7
19-4011	Medical Scientists, Except Epidemiologists	433	41%	1.0
19-4031	Chemists	365	43%	1.1
29-2018	Chemical Technicians	220	38%	1.0
19-4021	Phlebotomists	133	15%	0.7
19-1013	Biological Technicians	111	48%	0.3
19-1022	Microbiologists	108	53%	1.1
19-1029	Biochemists and Biophysicists	98	70%	0.4
19-2031	Biological Scientists, All Other	54	36%	0.4
19-1021	Agricultural & Food Science Technicians	40	20%	0.9
19-1042	Soil and Plant Scientists	37	23%	1.3

Source: *Economic Modeling Specialists, Int'l (2021.3)*

<sup>24</sup> Appendix C includes more detailed information about the priority occupations in each of the three areas—scientific and laboratory occupations, manufacturing production occupations, and business support occupations.

<sup>25</sup> A more detailed listing of the relevant skills and certifications drawn from online job postings is available in Appendix D.

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hire workers with just a high school degree, while others require a 4-year degree. The job postings data also show that employers seek workers with skills pertaining to Good Manufacturing Practices (GMP), record review, predictive and preventative maintenance, and equipment testing, among others.

- **Clinical Lab Technicians (SOC 29-2018):** Clinical Lab Technicians are an in-demand high-skilled science and lab occupation within the biosciences. These occupations require workers who can perform routine lab tests for diagnosing or preventing diseases. Bioscience industries project to have 25-49 openings per year over the next decade, but there will also be substantial demand for other regional employers in industries such as healthcare. Although these jobs typically require a 4-year degree, job postings data indicate that some employers hire workers with less education. In addition, job postings data also show employers seek applicants with knowledge of chemistry and skills such as Quality Assurance and Quality Control (QA/QC), predictive and preventative maintenance, specimen processing, and data entry.
- **Chemists (SOC 19-1042):** Bioscience industries employ over 40% of the region's Chemists. Workers in these occupations require at least a 4-year degree, but the job postings data show that many employers seek workers with advanced degrees. As a result, chemists are one of the region's higher pay science and laboratory occupations with average median annual earnings over \$75,000. In addition to knowledge of chemistry and biology, employers also seek applicants with skills related to Good Manufacturing Practices, high performance liquid chromatography, analytical chemistry, tech transfer, good laboratory practices, and QA/QC.
- **Phlebotomists (SOC 31-9097):** Phlebotomists draw blood for tests, donations or research. These occupations can act as a gateway to other healthcare or bioscience jobs, as they typically only require a high school degree with a postsecondary certification. Within the St. Louis region, median annual earnings were around \$32,000. Steady demand for phlebotomists is projected within both biosciences and the region more generally. Job postings data show that employers need applicants with phlebotomy certificates and driver's licenses, as well as basic skills such as customer service, data entry, coding, and other clerical duties.

### ***St. Louis post-secondary research institutions produce most of the region's scientific and laboratory program completers.***

Many of the St. Louis region's post-secondary research institutions play a key role in preparing workers for science and laboratory jobs. Washington University (WUSTL), Saint Louis University (SLU), and the University of Missouri-St. Louis (UMSL) produce many of the 4-year and graduate degree completers in engineering, biological and biomedical sciences, and the physical sciences (e.g., Chemistry).<sup>26</sup> Figure 11

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<sup>26</sup> It is important to note that not all of these graduates will work for St. Louis-based bioscience employers. These graduates will likely work in a variety of fields and in a variety of places. However, the area's bioscience employers will need workers with this kind of education, training and background.

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shows the number of 2020 completers from St. Louis-based programs relevant to scientific and laboratory occupations.

Among programs related to **biological and biomedical sciences (CIP 26)**, UMSL and WUSTL had the most 2020 undergraduate and graduate completers from their biochemistry, biophysics and molecular biology programs (CIP 26.02). SLU and Maryville University also contributed to the region share of completers, particularly for undergraduates. WUSTL and SLU were the source of graduate and undergraduate completers from programs related to bioinformatics (CIP 26.11), ecology (CIP 26.13), and neurobiology and neurosciences (CIP 26.15); UMSL also offers a neuroscience certificate. WUSTL offers the region's broadest set of programs in the biological and biomedical sciences, as it also had graduate and undergraduate completions in cellular biology (CIP 26.04), microbiological sciences and immunology (CIP 26.05), and genetics programs (CIP 26.08).

**Figure 11: Completers by program area and degree type from programs relevant to scientific and laboratory occupations (2020)**

CIP Code	Description	Undergrad. Certs.	Associate's Degree	Bachelor's Degree	Master's Degree	Doctor's Degree	Postbacc. Certificate
01.81	Veterinary Biomedical & Clinical Sciences		39				
01.83	Veterinary/Animal Health Technologies		19				
14.05	Biomedical/Medical Engineering			106	20	15	
14.07	Chemical Engineering			42	29		
26.02	Biochemistry, Biophysics & Molecular Biology			92	10	8	
26.03	Botany/Plant Biology					5	1
26.04	Cell/Cellular Biology & Anatomical Sciences				3	19	
26.05	Microbiological Sciences & Immunology			7		26	
26.08	Genetics					21	
26.10	Pharmacology & Toxicology					5	
26.11	Biomath., Bioinformatics, & Computational Biology			18	22	2	
26.12	Biotechnology			1			
26.13	Ecology, Evolution, Systematics, & Population Biology	2		23	21	4	
26.15	Neurobiology & Neurosciences	9		78		16	
26.99	Biological & Biomedical Sciences, Other					1	
40.05	Chemistry		3	135	31	28	
41.01	Biology/Biotechnology Technologies	9	10				
51.10	Clinical/Medical Laboratory Science/Research	22	7	40			
<b>TOTAL</b>		<b>42</b>	<b>78</b>	<b>542</b>	<b>136</b>	<b>150</b>	<b>1</b>

Note: Certifications, if shown, are typically credit-bearing programs. Many community colleges also offer non-credit certificate programs

Among relevant **engineering programs (CIP 14)**, WUSTL and SLU were again the leading producers of graduates. WUSTL and SLU prepared undergraduates in biomedical and medical engineering (CIP 14.05), while WUSTL was the sole source of 2020 completers for chemical engineering degrees (CIP 14.07) and graduate degrees in biomedical and medical engineering. Within the **physical sciences (CIP 40)**, chemistry degrees (CIP 41.01) are the most relevant. In 2020, SIUE and WUSTL were the most prominent producers of chemistry degrees, followed by UMSL, Lindenwood, and SLU.

Clinical and medical laboratory science and research programs (CIP 51.10) were found at both the university and community college levels. For instance, SLU was the primary source for 4-year degrees, while Southwestern Illinois College and St. Louis Community College had completers from 2-year degree programs. Southwestern Illinois College was also the region's primary source of phlebotomy certificates.

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Area community colleges also produce graduates in other programs relevant to science and laboratory occupations. For instance, St. Louis Community College was the only regional institution with students completing certificates and 2-year degrees in biotechnology technologies/technicians programs (CIP 41.01). Completers from veterinary health programs (CIP 01.81/01.83) came from the Midwest Institute and Jefferson College.

### Local workers fill most of the region’s biomanufacturing production jobs

As noted above, the relative concentration of biosciences-related manufacturing—found in areas such as medical devices, pharmaceuticals, agricultural feedstock—makes St. Louis somewhat unique amongst centers for biosciences. Many jobs within these industries, particularly production-oriented jobs, are typically middle-skilled occupations where experience, certifications, and on-the-job training can prepare workers. Higher-skilled production jobs are often in line supervision or other management positions. Figure 12 shows some of the St. Louis bioscience industry’s most prominent manufacturing production occupations. Several of these occupations either have large employment numbers, are relatively unique to the region’s bioscience industries, and/or are relatively concentrated in the St. Louis metro area. Most occupations have sizable annual job openings within the bioscience or other metro area industries, although some generate fewer job opportunities but are nevertheless critical within their firm operations. Several prominent bioscience manufacturing production occupations, include:

- Chemical Equipment Operators (51-9011):** Workers in this occupation operate the equipment used to produce industrial or consumer chemical products. The bioscience industries account for approximately 1 out of every 4 chemical equipment operators in the region. Over the next decade, these industries project to have 50 to 74 annual job openings with median annual earnings of almost \$50,000. St. Louis metro area job postings data show that employers seek workers with at least a high school degree, and with skills related to Good Manufacturing Practices, packaging, repair, cleaning, and batch records. They also wanted workers with OSHA

**Figure 12: Select manufacturing production occupations**

SOC Code	Occupation Title	2021 StL MSA Bioscience Employment	% of All StL MSA Occup.	StL MSA Occup. LQ
51-2028	Packaging Machine Operators	665	12%	1.6
51-2098	Chemical Equipment Operators	615	27%	2.6
51-8091	Inspectors, Testers, & Sorters	397	9%	0.9
51-9011	Electrical & Electronic Assemblers	244	8%	1.2
51-9023	Misc. Assemblers and Fabricators	215	3%	0.7
51-9061	Mixing & Blending Machine Operators	190	15%	1.1
51-9081	Dental Laboratory Technicians	147	51%	0.8
51-9082	Ophthalmic Laboratory Technicians	118	21%	2.4
51-9083	Chemical Plant & System Operators	95	30%	N/A
51-9111	Medical Appliance Technicians	64	41%	1.1

Source: Economic Modeling Specialists, Int'l (2021.3)

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Forklift, CDL Class A, and/or Hazardous Waste Operations and Emergency Response (Hazwoper) certifications.

- **Inspectors, Testers and Sorters (SOC 51-9082):** Inspectors, Testers and Sorters actively participate in the quality assurance and control process and check products for defects and deviations from specifications. The bioscience industries are projected to have 25-49 openings per year over the next decade. This is a relatively common occupation within the region's manufacturing sector, and typically requires a high school degree and moderate OJT (1 month to 1 year). However, online job postings data show that required education attainment for workers in biosciences is often higher, requiring workers with a 4-year or graduate degree. Job postings also show that employers seek workers with skills related to QA/QC, Good Manufacturing Practices, aseptic technique, and experience with FDA regulations.
- **Mixing and Blending Machine Operators (SOC 51-9023):** Mixing and Blending Machine Operators set up and operate machines that mix or blend chemicals, liquids, pigments or other ingredients. In addition to the bioscience industries, other manufacturing industries such as plastics and food manufacturing, need workers to fill these positions. Similar to other manufacturing production occupations, job postings data show employers seeking workers with skills related to predictive and preventative maintenance, record review, equipment testing, Good Manufacturing Practices, and/or cell culturing.
- **Packaging Machine Operators (SOC 51-9111):** Packaging Machine Operators are another common production occupations within the manufacturing sector. The region's bioscience industries project to have 50 to 74 annual openings for this occupation over the next decade. As with other manufacturing production occupations, Packaging Machine Operators typically require a high school degree and moderate OJT. According to online job postings data, employers seek workers with skills related to basic math, Good Manufacturing Practices, process improvement and aseptic technique.

### *The region's community and technical colleges prepare many workers for production occupations*

Figure 13 shows the number of 2020 completions from programs relevant to manufacturing and production at St. Louis area institutions. Universities are the primary source of **engineering (CIP 14)** graduates, while the region's community and technical colleges offer a range of **engineering technology (CIP 15)** programs. Washington University was the region's largest source of graduates completing engineering degrees in 2020, although several universities have different specialties. WUSTL and SIUE

**Figure 13: Completers by program area and degree type from programs relevant to manufacturing production occupations (2020)**

CIP Code	Description	Certification	Associate's Degree	Bachelor's Degree	Master's Degree	Doctor's Degree	Postbacc. Certificate
14.07	Chemical Engineering			42	29		
14.10	Electrical, Electronics, & Comms. Engineering			123	115	8	
14.12	Engineering Physics			3			
14.13	Engineering Science			2			
14.27	Systems Engineering			70	18	3	3
14.35	Industrial Engineering			27	15		
14.37	Ops. Research						7
14.42	Mechatronics, Robotics, & Automation Engineering			13			
14.99	Engineering, Other				27	16	
15.03	Electrical/Electronic Engineering Technicians	1	10				
15.04	Electromechanical Technologies	30	49				
15.05	Environmental Control Technologies	57	26				
15.06	Industrial Production Technologies	14	13				
15.09	Mining & Petroleum Technologies	12	17				
15.15	Engineering-Related Fields			15	4		7
47.01	Electrical/Electronics Maint. & Repair Techs.	73	53				
47.03	Heavy/Indus. Eqpt. Maint. Technologies/Technicians	32	31				
47.99	Mechanic & Repair Technologies	4					
48.05	Precision Metal Working	263	54				
48.99	Precision Production		5				
<b>TOTAL</b>		<b>486</b>	<b>258</b>	<b>253</b>	<b>179</b>	<b>27</b>	<b>17</b>

*Note: Certifications, if shown, are typically credit-bearing programs. Many community colleges also offer non-credit certificate programs*

had the most students complete both graduate and undergraduate electrical engineering programs (CIP 14.10), while UMSL and SLU both contributed the number of undergraduate completers. WUSTL accounted for all of the region’s completers in chemical engineering (CIP 14.07) and systems engineering (CIP 14.27) programs. Completers in industrial engineering (CIP 14.35) and systems engineering (CIP 14.27) programs came from SIUE, while SLU produced the post-graduate certificate completers in operations research (CIP 14.37).<sup>27</sup>

Among the community and technical colleges, Southwestern Illinois College, Ranken Technical College, and Lewis and Clark Community College are some of the leading producers for certificate and associates degree completers in areas related to **engineering technology (CIP 15)** or **precision production (CIP 48)**. For instance, in 2020 Southwestern Illinois had almost 200 people complete precision metal working certificates (CIP 48.05), as well as smaller numbers of completers in electrical engineering technicians (15.03) and heavy/industrial equipment maintenance (CIP 47.03). Lewis and Clark Community College had completers in electromechanical (CIP 15.04), environmental control (CIP 15.05), and electrical maintenance and repair (CIP 47.01) technician programs, as well as completers from its precision metal working program (CIP 48.05). Lewis and Clark Community College was also unique, in that it offers the region’s only mining and petroleum technology program (CIP 15.09), which supports the region’s oil and gas and chemical industries.

<sup>27</sup> As noted earlier, we only included completer data from institutions within the St. Louis, MO-IL MSA. Some of the region’s need for engineering graduates is likely met by institutions that are proximate, but not in the region (e.g., Missouri S&T, University of Missouri-Columbia, University of Illinois Urbana-Champaign).

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Ranken Technical College is a St. Louis-based private technical college. It contributes to the regional workforce by moving students through electromechanical (CIP 15.04), environmental control (CIP 15.05), electrical maintenance and repair (CIP 47.01), and heavy/industrial equipment maintenance (CIP 47.03) technician programs. It also offers certificate and degree programs in precision metal working (CIP 48.05). Other area community colleges also have students completing programs related to precision metal working or engineering technologies including Jefferson College, East Central College, St. Louis Community College, and St. Charles College.

### Employers throughout the economy must fill business support jobs

Beyond the more technical science and laboratory and manufacturing production jobs, the region's bioscience employers also must fill critical business support jobs in areas such as computer/data science and sales. The range of skills required for these occupations can also complement many of the other scientific and production occupations. For instance, IT skills are increasingly important as the use of bioinformatics grows. Similarly, many smaller or start-up firms need people with business and sales skills in order to grow and become viable businesses.

Figure 14 highlights several business and support occupations that either generate substantial job openings or require highly transferrable digital skills that benefit biosciences and other industries in the St. Louis area. Several of these occupations are described below:

- Technical Sales Representatives (SOC 41-4011):** The region's biosciences industries account for more than 20% of the region's Technical Sales Representatives. These sales representatives sell goods for wholesalers or manufacturers and by the nature of what they sell require technical or scientific knowledge related to biology, chemistry, electronics, or engineering. As a result, these workers tend to have higher annual earnings and typically require at least a 4-year degree. St. Louis bioscience employers project to have 75 to 99 technical sales openings per year. Based on online job postings, employers want applicants with skills such as sales, business planning,

**Figure 14: Select business support occupations**

SOC Code	Occupation Title	2021 StL MSA Bioscience Employment	% of All StL MSA Occup.	StL MSA Occup. LQ
15-1245	Technical/Science Sales Reps.	774	23%	1.3
15-1231	Non-Tech. Mfg. Sales Reps.	578	5%	1.0
41-4011	Software Developers & Quality Analysts	490	4%	1.0
15-1232	Computer User Support Spec.	195	3%	1.2
15-1244	Network & Computer Systems Admin.	89	3%	1.1
15-1251	Computer Occupations, All Other	74	2%	1.0
15-1256	Computer Network Support Spec.	52	2%	1.4
41-4012	Database Administrators	51	3%	1.4
15-1299	Computer Programmers	44	3%	1.1

Source: Economic Modeling Specialists, Int'l (2021.3)

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budgeting, customer service, and experience using Customer Relationship Management (CRM) software (e.g., Salesforce).

- **Software Developers and Quality Analysts (SOC 15-1256):** Many IT-related jobs are critical to operating businesses, and consequently employers throughout the economy seek workers with these skills. Over the next decade, bioscience employers project to need 25 to 49 software developers and quality analysts annually. These jobs typically demand at least a 4-year degree and require workers who can develop and use software to identify potential software problems and then develop appropriate solutions. Within the St. Louis region, job postings show that bioscience employers want applicants with skills and experience in software development and engineering, technical writing, and product management. Online job postings further show demand for workers with industry recognized credentials such as CISSP (Certified Information Systems Security Professional), SANS/GIAC Certification (Global Information Assurance Certification), CISA (Certified Information Systems Auditor), and/or CISM (Certified Information Security Manager). In some instances, employers also sought applicants with Lean Six Sigma training and/or a security clearance.
- **Computer User Support Specialists (SOC 15-1232):** Often considered middle-skill IT jobs, these occupations require some college or certifications but not necessarily a 4-year degree. However, job postings data show that most bioscience employers advertising for this position sought workers with at least a 4-year degree. They also wanted applicants with skills and experience in areas such as IT support, Good Manufacturing Practices, lifecycle management, and project management. As with other IT professions, industry-recognized certifications are also essential and bioscience employers advertised for Computer User Support Specialists who had certifications such as Information Technology Infrastructure Library (ITIL) Certification, Microsoft Certified Solutions Expert/Associate, Microsoft Certified Professional, Access Management, Systems Security Certified Practitioner (SSCP), CompTIA+ Security, and/or Cisco Certified Network Associate. These workers are sought throughout the economy, with 10-24 openings per year expected over the next decade within the biosciences.

### ***Most post-secondary institutions offer programs that prepare workers for business support occupations***

Most of the region's post-secondary institutions offer programs that prepare people for business and business support occupations. Figure 15 shows that there were almost 2,000 completers from relevant St. Louis area **computer science (CIP 11)** and **mathematics (CIP 27)** programs in 2020. Universities—such as WUSTL, SLU, UMSL, SIUE, Lindenwood and others—are responsible for many of the degree completers in more advanced fields like computer and information sciences (CIP 11.01), computer science (CIP 11.07), and computer engineering (CIP 14.09), as well as completers in mathematics (CIP 27.01) and statistics (CIP 27.05) programs. Community colleges like St. Louis Community College, St. Charles Community College, Southwestern Illinois College, Lewis and Clark Community College and others produce associates and certificate completers in programs related to computer programming

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**Figure 15: Completers by program area and degree type from programs relevant to computer science and mathematics occupations (2020)**

CIP Code	Description	Certification	Associate's Degree	Bachelor's Degree	Master's Degree	Doctor's Degree	Postbacc. Certificate
11.01	Computer & Information Sciences	10	35	178	30		27
11.02	Computer Programming	52	73	2	41		
11.04	Information Science/Studies			7			
11.05	Computer Systems Analysis			17			
11.07	Computer Science	3		386	141	7	
11.08	Computer Software & Media Apps.	22	12	48	2		
11.09	Computer Systems Networking & Telecom.	90	46				
11.10	Computer/Information Technology Admin.	32	25	46	113		22
14.09	Computer Engineering			43	9	2	
15.12	Computer Engineering Technicians	14	88				
27.01	Mathematics			207	21	7	
27.03	Applied Mathematics			3	61	4	
27.05	Statistics			4	15	2	1
27.99	Mathematics & Statistics, Other	4		10	9		
<b>TOTAL</b>		<b>227</b>	<b>279</b>	<b>951</b>	<b>442</b>	<b>22</b>	<b>50</b>

Note: Certifications, if shown, are typically credit-bearing programs. Many community colleges also offer non-credit certificate programs

(CIP 11.02), computer systems networking (CIP 11.09), and computer and information technology administration (CIP 11.10). Ranken Technical College produced certificate and associates degree completers from its computer engineering technician program (CIP 15.12).

Figure 16 shows the number of 2020 completers from the region's relevant non-distanced offered<sup>28</sup> **business management and sales (CIP 52)** programs. New and incumbent workers complete relevant programs at many of the region's prominent 4-year institutions like WUSTL, Webster University, SLU,

**Figure 16: Completers\* by program area and degree type from programs relevant to management and business occupations (2020)**

CIP Code	Description	Certification	Associate's Degree	Bachelor's Degree	Master's Degree	Doctor's Degree	Postbacc. Certificate
01.01	Agricultural Business & Mgmt.			5			
01.06	Applied Horticulture & Horticultural Business Services	24	19				
52.01	Business/Commerce, General	5	49				11
52.02	Business Administration, Mgmt. & Ops.	14	18	131	449	8	
52.04	Business Ops. Support Services	14	13				
52.06	Business/Managerial Economics	11		146			
52.07	Entrepreneurial & Small Business Ops.	7	5	31			
52.08	Finance & Financial Mgmt. Services	10		214	186		
52.11	International Business			53	22		
52.12	Mgmt. Information Systems & Services			30			
52.13	Mgmt. Sciences & Quant. Methods			62	197		12
52.14	Marketing	8	1	178	19	3	3
52.18	General Sales, Merchandising & Related Marketing Ops.	6		5	3		
<b>TOTAL</b>		<b>99</b>	<b>105</b>	<b>855</b>	<b>876</b>	<b>11</b>	<b>26</b>

Note: Certifications, if shown, are typically credit-bearing programs. Many community colleges also offer non-credit certificate programs

\*Includes Non-distance programs only.

<sup>28</sup> Among business management and sales programs this is an important distinction. Many area institutions such as Webster University, Lindenwood University, Maryville University, UMSL, SIUE, and others are active in online education, particularly for programs like online MBAs. Since many of their completers may live outside the region, we elected to only show the non-distance offered completers as this provides a more accurate depiction of the number of annual completers available to St. Louis area employers.

Lindenwood University, and Harris-Stowe State University, among others. WUSTL and SLU account for the majority of completers in fields like finance (CIP 52.08), and SLU is the primary source for international business (CIP 52.11) graduates. Area community colleges like St. Louis Community College, Jefferson College, and East Central College provide general business (CIP 52.01) education, St. Louis Community College, Southwestern Illinois College and Lewis and Clark Community College also provide certificates and associates degrees in more specialized fields like horticultural business services (CIP 01.06).

### Moving forward

The biosciences industries represent an important part of the St. Louis region's innovation economy. These industries account for more than 19,000 payroll employees, and with average annual earnings of more than \$116,000, many of these are high paying jobs. These occupations not only create opportunities for people for 4-year and advanced degrees, but they also generate significant numbers of middle-skilled opportunities for people with relevant certificates and experience. These latter opportunities are particularly important to the region's bio-manufacturing industries, many of which give the region a unique competitive advantage. Overall, St. Louis bioscience employers must find workers with skills in three broad areas—science/lab occupations (e.g., clinical lab skills), production occupations (e.g., quality assurance), and business support occupations (e.g., management, IT including cross-cutting science/data skills like bio-informatics).

Public and private sector feedback helped identify what some of the ongoing challenges facing the region's bioscience workforce. Some of these challenges affect all segments of the bioscience workforce; notably employers cited the need for more Science, Technology, Engineering and Mathematics (STEM)-skilled workers as well as a more diverse workforce at all levels.

- Encouraging students to select bioscience careers is considered one of the industry's most significant challenges for establishing a talent pipeline. Student reluctance—or fear—to pursue degrees that require advanced math skills limits the potential supply of available STEM graduates. This challenge was particularly acute for highly sought, but math-intensive, fields like chemistry. Industry leaders view student demand for STEM programs as a greater issue than the availability of these programs.
- Area stakeholders also noted the relative lack of diversity within the St. Louis biosciences workforce. Targeting outreach and engagement efforts towards underrepresented groups of students and workers (e.g., women, communities of color) can expand the potential regional talent pool from which these employers may draw. For instance, more than 70% of the region's manufacturing workforce are men, but these imbalances will not change on their own. Rather employers and stakeholders must find ways to actively engage with women to get them to choose to enter, and then find opportunities in, manufacturing careers. Proactive solutions are required to address similar imbalances in other areas of the region's biosciences industries.

The need for more STEM-skilled workers and greater diversity affects most elements of the bioscience workforce, but the manner in which these—and other challenges—impact the different types of

bioscience jobs varies. As a result, addressing these challenges requires different types of actions depending on the nature of the affected jobs.

### Scientific and laboratory jobs

The competition for qualified *scientific and laboratory* talent extends beyond the St. Louis region. Ensuring the region has sufficient numbers of workers to fill open positions is a two-fold challenge—area students must elect to pursue these educational paths, and then the region must find ways to retain more of these students upon graduation. The region’s industry and educational leaders view the availability of relevant STEM programs as less an issue, than generating sufficient student demand for those programs.

Moreover, many students completing bioscience-related degrees at St. Louis area institutions are not from the region, so there is no guarantee that those students will remain past graduation. Part of the challenge—as noted by the stakeholder feedback—is that too many employers attempt to connect with college students after they make their decision about where they will live and work post-graduation. The share of regional STEM graduates that ultimately find work in the region after graduation merits further investigation.<sup>29</sup> In the meantime, however, the region may consider several steps to address these challenges.

- Efforts should continue supporting the region’s ongoing STEM education and promotion programs (e.g., [St. Louis Regional STEM Learning Ecosystem \(STEMSTL\)](#)). These efforts bring together a diverse collection of regional stakeholders to provide programming and resources that encourages STEM education through after-school programs or facilitates more work-based learning opportunities.
- Further extending STEM education efforts to disadvantaged neighborhoods and underrepresented groups creates more opportunities for area students, which in turn can broaden the potential talent pool available to area employers. Regional stakeholders should continue building partnerships with schools like the [STEAM Academy at McCluer South-Berkeley](#) in the Ferguson-Florissant School District. These efforts expose students in underrepresented communities to bioscience careers. They also lead to stronger relationships between employers and K-12 educators, which are critical for the long-term sustainability of these efforts.
- Continuously expanding the employer coalition that supports regional STEM initiatives and training and education programs, makes these efforts more sustainable and responsive to changing needs. For example, several area public colleges have put forth [proposals](#) to increase training in the fields of information technology and engineering with the help of state funding. Employer support increases the likely success of these proposals. These additional resources are critical for increasing the region’s capacity to train technically skilled workers.

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<sup>29</sup> Some of this information is available through the U.S. Census Bureau’s Longitudinal Employer-Household Dynamics (LEHD) [Post-Secondary Educational Outcomes \(PSEO\)](#) data. Currently, within the St. Louis area these data are only available for public institutions in Missouri. These data show that the majority graduates from the region’s community colleges and institutions like UMSL remain in the area after graduate. However, as shown earlier much of the region’s programs that prepare and train scientific and laboratory workers do so at private institutions at WUSTL and SLU so those data are currently available. Similarly, Illinois’ data has not yet been published so we do not have information for institutions like SIUE, or Illinois-based community colleges.

- Better connecting area employers with college students—before they decide where they want to live and work—is crucial for capturing a greater percentage of the region’s STEM graduates. Employers can build more, and stronger, relationships with college students by expanding internship and co-op opportunities. Promoting work opportunities is necessary, but not always sufficient for convincing area graduates to stay in the St. Louis. Other regions facing similar challenges responded by developing creative ways to connect area students to the community (e.g., [Pittsburgh Passport](#)). These programs encourage students to see the region as a place where they want to both live and work.

### Manufacturing production jobs

Finding workers with sufficient STEM skills also challenges employers seeking to fill *manufacturing production* jobs. These are often considered middle-skill occupations where employers draw upon the local labor market to fill many of these positions. The persistent challenge facing employers—both in St. Louis and nationally—is that these occupations often have an image problem, whereby students, parents and educators lack a true understanding of the opportunities they present.<sup>30</sup> This is particularly true for biomanufacturing that offers a different work environment than other types of manufacturing.

Addressing these challenges will require private sector and educational leaders—particularly in Career and Technical Education (CTE)—to continue working together to create more career exploration opportunities, starting as early as middle school. CTE programs not only introduce students to manufacturing, maintenance or construction careers, but they also give students some of the foundational knowledge they need to enter these careers. Moreover, they can create opportunities for students to undertake actual work tasks through internships or work-based learning projects.

Incumbent workers wanting to shift careers present another source of potential workers but transitioning into jobs requiring new skills is not easy. Many incumbent workers cannot afford the time, or the cost, associated with leaving their job and pursuing the requisite education and training. This is particularly true for disadvantaged workers further challenged by limited childcare or unreliable transportation. The region may explore several options for addressing this myriad of challenges:

- The region must continue its efforts to promote CTE, increase career awareness, and enhance work-based learning opportunities. The region might explore how other regions creatively promote manufacturing careers (e.g., [student film competitions in Northeast Pennsylvania](#)) in partnership with area employers, schools and youth groups. Locally, Southern Illinois University-Edwardsville worked with partners to make an escape room as a fun way for students to apply biotech skills. Beyond employers and schools, youth groups (e.g., Boy Scouts, Girl Scouts, 4-H, Boys and Girls Clubs) can also help reach young people and therefore represent potential partners.
- Educators, and particularly teachers, play important roles in shaping perceptions of manufacturing careers. Teacher externships offer educators real-world, hands-on experience that they can share with their students and incorporate into their teaching. They allow teachers

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<sup>30</sup> <https://truman.missouri.edu/sites/default/files/publication/white-paper-perceptions-of-career-and-technical-education-in-missouri-w.pdf>

to show students the applications of what they are learning. It also enables teachers to become better counselors for students looking to select careers. The St. Louis region may consider increasing support for teacher externships. Over the past decade, the State of Iowa has been a leader in supporting [STEM Teacher Externships](#). In Iowa, these externships are full-time, six-week temporary summer positions in local businesses and teachers can also earn a stipend of up to \$5,000 and college credit for participating.<sup>31</sup>

- The region should expand ‘Earn and Learn’ programs for incumbent workers. As noted above, many incumbent workers must continue to work while they train and prepare for new careers or more demanding jobs. In Missouri, the state Department of Higher Education and Workforce Development has made a strong commitment to promoting and supporting [apprenticeships](#), and regional efforts should expand use of these programs in support of the biosciences.
- In order to better include workers from disadvantaged or underrepresented communities, regional stakeholders and bioscience employers should explore ways to provide services such as childcare or transportation. Without these ‘wrap around’ services, many workers cannot take advantage of available job or training opportunities, which in turn can limit the number of potential workers from which employers can draw. St. Louis region workforce investment boards and job centers can often be a starting point for finding resources to assist with, or organizations engaged in, worker support services.

### Business support jobs

Filling *business support* jobs presents a different set of challenges than the scientific or manufacturing jobs described above. These are often cross-cutting jobs sought by employers throughout the region, so bioscience employers compete for these workers with other sectors. This is particularly true for IT jobs, which according to the online job postings data, are among the region’s most commonly advertised positions. Increasingly, bioscience employers need workers with IT and data science skills, not just to support their business operations, but to allow them to move into growing fields such as bioinformatics. Larger firms expressed less concern about filling sales, management, and/or administrative positions, but smaller businesses—and particularly startups—often need to develop their business skills in order to create a viable and sustainable enterprise.

- Bioscience employers are not the only area employers needing workers with increasingly in-demand skills like data science. As a result, the region’s bioscience employers and key stakeholders should expand their employer coalition to include other industries with similarly growing demand for IT and data science skills (e.g., geospatial, cybersecurity). Expanding the number of participating employers can lead to more resources to support education and training programs. Moreover, education and training providers can more confidently scale their programs if area employers clearly communicate their current and future needs and encourage their existing workers to pursue additional education and certifications.

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<sup>31</sup> The State of Missouri supports [Certified Teacher Externships](#) where participating teachers can earn graduate credits, but they are not specifically focused on STEM fields and they do not appear to include a stipend.

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- The region should make concerted efforts to increase awareness among smaller businesses and manufacturers to available support services through, for instance the [Illinois](#) or [Missouri Small Business Development Centers](#), [Missouri Enterprise](#) or the [Illinois Manufacturing Excellence Center \(IMEC\)](#), local Workforce Development Boards, or other local organizations. Raising awareness about these service providers can ensure that more small business and manufacturers receive access the business counseling and support services necessary for them to grow. These service providers not only provide direct business assistance, but they can also refer firms to other credible resources and programs.

Moving forward, there are many regional opportunities to strengthen the bioscience workforce. There are other available resources through, for instance, state programs (e.g., [MoExcels Workforce Initiative](#)) and federal funding opportunities from agencies such as the U.S. Economic Development Administration or U.S. Employment and Training Administration. These resources allow local education and training providers to develop programs and/or build new facilities, that can increase the region’s capacity to prepare workers for these in-demand jobs. However, successfully securing these funding resources—and ensuring successful and sustainable programs—requires continued regional collaboration between educational institutions, employers, and other regional stakeholders.

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### Authors

Dr. Mark C. White, Associate Extension Professor, University of Missouri  
Alan Spell, Assistant Extension Professor, University of Missouri

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## Appendices

### Appendix A: St. Louis MSA Bioscience Industries

The [Biotechnology Innovation Organization](#) defines the biosciences as a aggregation of 25 NAICS (North American Industry Classification System) industries. Within those industries, BIO further identifies five bioscience segments. The table below presents St. Louis MSA bioscience industry data from EMSI Burning Glass (EMSI). EMSI data is informed by U.S. Bureau of Labor Statistics (BLS) information and also includes 2021 and 2031 job estimates.

Bioscience Industry Group	NAICS Code	Industry Description	2016 Jobs	2021 Jobs	2031 Jobs	2016 - 2021 Change	2016 - 2021 % Change	2021 Location Quotient	2020 Average Earnings Per Job
Agricultural Feedstock & Industrial Biosciences	311221	Wet Corn Milling	0	0	0	0	0%	0.0	\$0
	311224	Soybean and Other Oilseed Processing	17	<10	<10	Insf. Data	Insf. Data	0.0	Insf. Data
	325193	Ethyl Alcohol Manufacturing	209	110	94	-99	-48%	1.2	\$111,785
	325311	Nitrogenous Fertilizer Manufacturing	48	110	149	62	130%	1.4	\$103,288
	325312	Phosphatic Fertilizer Manufacturing	0	0	0	0	0%	0.0	\$0
	325314	Fertilizer (Mixing Only) Manufacturing	73	94	93	21	29%	1.1	\$67,475
	325320	Pesticide and Other Agricultural Chemical Manufacturing	242	483	607	242	100%	3.9	\$82,523
Drugs & Pharmaceuticals Manufacturing	325411	Medicinal and Botanical Manufacturing	900	630	370	-270	-30%	1.9	\$139,471
	325412	Pharmaceutical Preparation Manufacturing	2,204	2,375	2,240	171	8%	1.2	\$117,601
	325413	In-Vitro Diagnostic Substance Manufacturing	158	148	188	-10	-6%	0.6	\$105,078
	325414	Biological Product (except Diagnostic) Manufacturing	473	664	830	191	40%	1.9	\$125,393
Medical Devices & Equipment Manufacturing	334510	Electromedical and Electrotherapeutic Apparatus Mfg.	45	<10	<10	Insf. Data	Insf. Data	0.0	Insf. Data
	334516	Analytical Laboratory Instrument Manufacturing	745	1,154	1,583	409	55%	3.2	\$122,347
	334517	Irradiation Apparatus Manufacturing	0	<10	<10	Insf. Data	Insf. Data	0.0	Insf. Data
	339112	Surgical and Medical Instrument Manufacturing	766	750	463	-16	-2%	0.6	\$87,017
	339113	Surgical Appliance and Supplies Manufacturing	407	293	278	-114	-28%	0.3	\$87,504
	339114	Dental Equipment and Supplies Manufacturing	144	260	401	116	81%	1.9	\$96,429
Bioscience-Related Distribution	423450	Medical Equipment and Supplies Wholesalers	1,832	2,654	2,671	822	45%	1.1	\$135,777
	424210	Drugs and Druggists' Sundries Merchant Wholesalers	1,977	2,232	2,392	255	13%	1.0	\$108,598
	424910	Farm Supplies Merchant Wholesalers	727	916	963	189	26%	0.9	\$83,570
Research, Testing, & Medical Labs	541380	Testing Laboratories	1,225	1,056	803	-169	-14%	0.7	\$74,071
	541713	Research and Development in Nanotechnology	751	535	337	-216	-29%	2.6	\$164,842
	541714	Research and Development in Biotechnology	2,129	985	520	-1,143	-54%	0.5	\$115,538
	541715	Research & Dev. in Physical, Engineering, & Life Sciences	1,717	2,460	1,918	743	43%	0.6	\$157,782
	621511	Medical Laboratories	1,535	1,251	1,039	-284	-18%	0.7	\$74,736
<b>Total</b>	<b>Bioscience Industry</b>		<b>18,323</b>	<b>19,165</b>	<b>17,944</b>	<b>842</b>	<b>5%</b>	<b>0.9</b>	<b>\$116,695</b>

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## Appendix B: St. Louis Top Bioscience Occupations

The 115 occupations in this table represent the St. Louis MSA's top middle-to-higher skilled bioscience occupations by employment level. These occupations are based on EMSI Burning Glass staffing pattern analysis. Together these occupations represent more than 80% of total bioscience employment.

The last column indicates if the occupation is considered middle or higher skilled for typical job entry. "Middle skill" occupations often require moderate-to-long term training after high school, work experience, certifications, and/or an associate's degree. "Higher skill" occupations can require a bachelor's degree or higher for job entry. Typical entry requirements, however, are only a guide as combinations of different training, experience, and degrees can offer other pathways into a career.

The occupations in this table are sorted by Standard Occupational Classification (SOC) group and then by 2021 bioscience employment level. The table also includes total occupational employment for the St. Louis MSA.

SOC group	SOC Code	Occupation Description	2021 StL MSA Bioscience Jobs	2021 Total StL MSA Jobs	Percent of Total StL MSA Jobs	Median Earnings	Typical Skill Level
Business & Management	11-1021	General and Operations Managers	650	27,334	2.4%	\$90,339	Higher Skill
	13-1198	Project Management Specialists and Business Operations Specialists, All Other	344	12,072	2.9%	\$78,208	Higher Skill
	13-2011	Accountants and Auditors	218	12,944	1.7%	\$71,422	Higher Skill
	13-1161	Market Research Analysts and Marketing Specialists	163	5,780	2.8%	\$59,906	Higher Skill
	13-1028	Buyers and Purchasing Agents	141	3,995	3.5%	\$66,631	Higher Skill
	11-3051	Industrial Production Managers	140	1,673	8.4%	\$105,459	Higher Skill
	11-9121	Natural Sciences Managers	140	272	51.4%	\$98,590	Higher Skill
	11-3021	Computer and Information Systems Managers	135	3,991	3.4%	\$139,272	Higher Skill
	13-1071	Human Resources Specialists	128	6,562	2.0%	\$60,901	Higher Skill
	11-9041	Architectural and Engineering Managers	118	1,535	7.7%	\$147,612	Higher Skill
	11-2022	Sales Managers	118	2,841	4.2%	\$136,853	Higher Skill
	13-1111	Management Analysts	111	6,460	1.7%	\$84,032	Higher Skill
	13-1041	Compliance Officers	109	2,042	5.3%	\$77,205	Higher Skill
	11-3031	Financial Managers	107	5,280	2.0%	\$134,395	Higher Skill
	11-9198	Personal Service Managers, All Other	84	2,576	3.3%	\$119,566	Higher Skill
	11-9111	Medical and Health Services Managers	80	4,048	2.0%	\$100,722	Higher Skill
	11-3011	Administrative Services and Facilities Managers	80	2,704	3.0%	\$92,834	Higher Skill
	13-1151	Training and Development Specialists	72	2,602	2.8%	\$64,341	Higher Skill
	13-1081	Logisticians	69	1,757	4.0%	\$76,931	Higher Skill
	11-2021	Marketing Managers	66	1,634	4.1%	\$133,585	Higher Skill
	11-1011	Chief Executives	66	2,223	3.0%	\$174,889	Higher Skill
	13-2098	Financial and Investment Analysts, All Other	57	4,662	1.2%	\$82,460	Higher Skill
	11-3121	Human Resources Managers	38	1,246	3.1%	\$112,315	Higher Skill
	11-3071	Transportation, Storage, and Distribution Managers	29	1,059	2.8%	\$97,716	Middle Skill
11-2031	Public Relations and Fundraising Managers	28	618	4.5%	\$94,275	Higher Skill	
11-3061	Purchasing Managers	27	534	5.0%	\$111,991	Higher Skill	

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SOC group	SOC Code	Occupation Description	2021 StL MSA Bioscience Jobs	2021 Total StL MSA Jobs	Percent of Total StL MSA Jobs	Median Earnings	Typical Skill Level
Computer & Data Science	15-1256	Software Developers and Software Quality Analysts	490	13,191	3.7%	\$97,907	Higher Skill
	15-1232	Computer User Support Specialists	195	6,859	2.8%	\$50,960	Middle Skill
	15-1211	Computer Systems Analysts	147	5,971	2.5%	\$89,263	Higher Skill
	15-1244	Network and Computer Systems Administrators	89	3,224	2.8%	\$89,296	Higher Skill
	15-1299	Computer Occupations, All Other	74	3,148	2.3%	\$86,540	Higher Skill
	15-1241	Computer Network Architects	54	1,755	3.1%	\$103,012	Higher Skill
	15-1231	Computer Network Support Specialists	52	2,222	2.3%	\$54,297	Middle Skill
	15-1245	Database Administrators and Architects	51	1,672	3.0%	\$84,300	Higher Skill
	15-1251	Computer Programmers	44	1,604	2.8%	\$84,652	Higher Skill
	15-2041	Statisticians	40	225	17.8%	\$88,496	Higher Skill
	15-1212	Information Security Analysts	38	1,260	3.0%	\$94,182	Higher Skill
	15-2098	Data Scientists and Math Occupations, All Other	33	559	5.9%	\$96,020	Higher Skill
	15-2031	Operations Research Analysts	27	859	3.1%	\$84,267	Higher Skill
	15-1257	Web Developers and Digital Interface Designers	27	1,543	1.7%	\$66,817	Middle Skill
15-1221	Computer and Information Research Scientists	27	210	12.7%	\$111,749	Higher Skill	
Engineering & Related	17-2112	Industrial Engineers	272	3,363	8.1%	\$92,288	Higher Skill
	17-2071	Electrical Engineers	147	2,599	5.7%	\$100,911	Higher Skill
	17-2141	Mechanical Engineers	111	1,581	7.0%	\$86,812	Higher Skill
	17-2199	Engineers, All Other	86	862	9.9%	\$79,410	Higher Skill
	17-3026	Industrial Engineering Technologists and Technicians	83	580	14.4%	\$64,829	Middle Skill
	17-2072	Electronics Engineers, Except Computer	75	1,115	6.7%	\$101,704	Higher Skill
	17-2011	Aerospace Engineers	69	1,085	6.4%	\$111,525	Higher Skill
	17-3098	Engineering Technologists and Technicians	61	417	14.7%	\$64,032	Middle Skill
	17-2061	Computer Hardware Engineers	43	389	11.0%	\$110,430	Higher Skill
	17-2041	Chemical Engineers	40	206	19.3%	\$107,126	Higher Skill
	17-3023	Electrical and Electronic Engineering Technicians	39	509	7.7%	\$73,387	Middle Skill
	17-2131	Materials Engineers	37	520	7.1%	\$85,511	Higher Skill
17-2051	Civil Engineers	26	2,947	0.9%	\$84,248	Higher Skill	
Life, Physical, & Social Sciences	19-1042	Medical Scientists, Except Epidemiologists	433	1,067	40.6%	\$61,100	Higher Skill
	19-2031	Chemists	365	838	43.5%	\$75,279	Higher Skill
	19-4031	Chemical Technicians	220	585	37.6%	\$46,720	Middle Skill
	19-4099	Life, Physical, and Social Science Techs., All Other	118	650	18.1%	\$41,096	Middle Skill
	19-4021	Biological Technicians	111	230	48.4%	\$44,727	Higher Skill
	19-1022	Microbiologists	108	204	53.1%	\$63,656	Higher Skill
	19-1021	Biochemists and Biophysicists	98	139	70.3%	\$84,372	Higher Skill
	19-1029	Biological Scientists, All Other	54	152	35.8%	\$77,067	Higher Skill
	19-2012	Physicists	47	187	24.9%	\$106,699	Higher Skill
	19-4011	Agricultural and Food Science Technicians	40	204	19.7%	\$48,877	Middle Skill
	19-4042	Environmental Science and Protection Technicians	39	264	14.8%	\$40,802	Middle Skill
19-1013	Soil and Plant Scientists	37	161	23.2%	\$63,266	Higher Skill	
Other Services	27-3031	Public Relations Specialists	50	2,264	2.2%	\$54,620	Higher Skill
	23-1011	Lawyers	40	5,873	0.7%	\$94,082	Higher Skill
	27-3042	Technical Writers	38	430	8.8%	\$69,379	Higher Skill
	27-1024	Graphic Designers	32	1,731	1.9%	\$51,405	Higher Skill
Health Care & Related	29-2018	Clinical Laboratory Technologists and Technicians	614	5,087	12.1%	\$47,599	Higher Skill
	31-9097	Phlebotomists	133	857	15.5%	\$32,077	Middle Skill
	29-2052	Pharmacy Technicians	125	4,707	2.7%	\$35,593	Middle Skill
	29-1051	Pharmacists	65	3,231	2.0%	\$131,596	Higher Skill
	29-1141	Registered Nurses	52	35,320	0.1%	\$65,250	Higher Skill
	29-2034	Radiologic Technologists and Technicians	49	1,782	2.7%	\$55,781	Middle Skill
	29-2035	Magnetic Resonance Imaging Technologists	48	605	7.9%	\$65,848	Middle Skill
	29-2032	Diagnostic Medical Sonographers	34	815	4.2%	\$73,862	Middle Skill
29-2098	Medical Records and Health Technicians, All Other	32	3,348	1.0%	\$46,855	Middle Skill	

# St. Louis Bioscience Labor Market Analysis

SOC group	SOC Code	Occupation Description	2021 StL MSA Bioscience Jobs	2021 Total StL MSA Jobs	Percent of Total StL MSA Jobs	Median Earnings	Typical Skill Level
Sales & Related	41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	774	3,371	22.9%	\$81,486	Higher Skill
	41-4012	Sales Representatives, Wholesale and Manufacturing	578	10,948	5.3%	\$64,031	Middle Skill
	41-3091	Sales Representatives of Services	90	6,933	1.3%	\$59,205	Middle Skill
	41-1012	First-Line Supervisors of Non-Retail Sales Workers	81	2,107	3.8%	\$78,057	Middle Skill
	41-9031	Sales Engineers	59	666	8.8%	\$77,926	Higher Skill
Office & Admin. Support	43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	273	18,575	1.5%	\$38,153	Middle Skill
	43-3031	Bookkeeping, Accounting, and Auditing Clerks	195	12,828	1.5%	\$41,015	Middle Skill
	43-6011	Executive Administrative Assistants	182	6,245	2.9%	\$53,823	Middle Skill
	43-1011	First-Line Supervisors of Office and Administrative Support Workers	169	11,432	1.5%	\$61,161	Middle Skill
	43-5061	Production, Planning, and Expediting Clerks	115	3,302	3.5%	\$50,853	Middle Skill
	43-3021	Billing and Posting Clerks	96	5,158	1.9%	\$37,878	Middle Skill
	43-6013	Medical Secretaries and Administrative Assistants	50	7,371	0.7%	\$36,663	Middle Skill
	43-4151	Order Clerks	41	1,098	3.8%	\$35,771	Middle Skill
Construction, Installation, Maint., & Repair	49-9071	Maintenance and Repair Workers, General	180	13,295	1.4%	\$43,312	Middle Skill
	49-2011	Computer and Office Machine Repairers	124	1,055	11.7%	\$40,995	Middle Skill
	49-9041	Industrial Machinery Mechanics	96	2,279	4.2%	\$56,818	Middle Skill
	49-9062	Medical Equipment Repairers	92	556	16.6%	\$53,286	Middle Skill
	49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	48	3,451	1.4%	\$69,401	Middle Skill
Production	51-9111	Packaging and Filling Machine Operators and Tenders	665	5,448	12.2%	\$37,161	Middle Skill
	51-9011	Chemical Equipment Operators and Tenders	615	2,260	27.2%	\$49,893	Middle Skill
	51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	397	4,531	8.8%	\$44,335	Middle Skill
	51-1011	First-Line Supervisors of Production and Operating Workers	278	5,246	5.3%	\$64,596	Middle Skill
	51-2028	Electrical, Electronic, and Electromechanical Assemblers	244	3,162	7.7%	\$35,508	Middle Skill
	51-2098	Miscellaneous Assemblers and Fabricators	215	7,829	2.7%	\$36,719	Middle Skill
	51-9023	Mixing and Blending Machine Setters, Operators	190	1,298	14.7%	\$39,936	Middle Skill
	51-9081	Dental Laboratory Technicians	147	287	51.1%	\$43,021	Middle Skill
	51-9083	Ophthalmic Laboratory Technicians	118	568	20.8%	\$31,891	Middle Skill
	51-8091	Chemical Plant and System Operators	95	313	30.4%	\$78,490	Middle Skill
	51-9082	Medical Appliance Technicians	64	154	41.2%	\$47,204	Middle Skill
	51-4041	Machinists	57	3,430	1.7%	\$51,582	Middle Skill
	51-9041	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders	56	577	9.7%	\$37,697	Middle Skill
	51-9199	Production Workers, All Other	50	1,399	3.6%	\$33,680	Middle Skill
	51-9161	Computer Numerically Controlled Tool Operators	34	2,184	1.6%	\$39,942	Middle Skill
51-4072	Molding, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	33	1,506	2.2%	\$37,780	Middle Skill	
Transp. & Material Moving	53-3032	Heavy and Tractor-Trailer Truck Drivers	170	17,264	1.0%	\$50,947	Middle Skill
	53-1047	First-Line Supervisors of Transportation and Material Moving Workers	53	3,706	1.4%	\$58,981	Middle Skill

## Appendix C: Selected Key Occupations in the St. Louis Bioscience Sector

The tables below identify 30 middle-to-higher skilled occupations that have one or more key characteristics—a bioscience industry specialization, a high number of annual job openings, and/or critical cross-cutting or complementary skills informed by analysis and stakeholder feedback. This is not an exhaustive list as other occupations may be critical to certain businesses or have similar skills.

Projected annual job opening estimates come from analysis of EMSI Burning Glass projections and the Missouri Economic Research and Information Center’s long-term occupational projections. The typical education identified in these tables are only a guide, as different combinations of training, experience, and degrees can offer pathways into any given career.

### Key Occupations: Science and Laboratory

These occupations bring specialized scientific skills that underpin the bioscience sector. The jobs identified in Figures C1 and C2 have higher bioscience concentration—like the 70% of Biochemists employed in this industry, or combine a concentration with higher job openings, such as Clinical Lab Technicians. Most occupations require a bachelor’s degree, but several jobs have middle-skill entry requirements.

Figure C1 lists several notable “Middle skill” occupations involved in science and laboratory activities. These middle skill occupations typically require moderate-to-long term training, work experience, certifications, and/or a 2-year degree. Figure C2 highlights “Higher skill” science and laboratory occupations and often require a bachelor’s degree or higher for job entry.

**Figure C1: Middle-skill science and laboratory occupations**

Annual Job Openings*		Occupation Title	2021 Median Earnings	StL MSA 2021 Bioscience Jobs	% of StL MSA Jobs in BioScience	StL MSA 2021 Total Jobs
BioSci. Job Openings	StL MSA Total Job Openings					
<b>10-24</b>	<b>100-149</b>	<b>Phlebotomists</b> Related Job Titles: Lab Liaison Technician, Patient Service Technician, Phlebotomy Technician, Registered Phlebotomist Typical Education: Postsecondary nondegree award Occup. Code: 31-9097	<b>\$32,077</b>	<b>133</b>	<b>15%</b>	<b>857</b>
<b>&lt;10</b>	<b>10-24</b>	<b>Agricultural &amp; Food Science Technicians</b> Related Job Titles: Lab Technician, Food Science Technician, Lab Assistant, Quality Assurance Analyst, Quality Control Tech. Typical Education: Associate's degree Occup. Code: 19-4011	<b>\$48,877</b>	<b>40</b>	<b>20%</b>	<b>204</b>
<b>10-24</b>	<b>50-74</b>	<b>Chemical Technicians</b> Related Job Titles: Analytical Lab Technician, Chemical Analyst, Chemical Technician, Laboratory Analyst or Technician Typical Education: Associate's degree Occup. Code: 19-4031	<b>\$46,720</b>	<b>220</b>	<b>38%</b>	<b>585</b>

# St. Louis Bioscience Labor Market Analysis

**Figure C2: Higher-skill science and laboratory occupations**

Annual Job Openings*		Occupation Title	2021 Median Earnings	StL MSA 2021 Bioscience Jobs	% of StL MSA Jobs in BioScience	StL MSA 2021 Total Jobs
BioSci. Job Openings	StL MSA Total Job Openings					
25-49	250-299	<b>Clinical Laboratory Technicians</b> Related Job Titles: Clinical Lab Technologist or Technician, Medical Lab Technologist or Technician, Laboratory Assistant Typical Education: Bachelor's degree Occup. Code: 29-2018	\$47,599	614	12%	5,087
10-24	25-49	<b>Biological Technicians</b> Related Job Titles: Biological Science Lab Technician, Biological Technician, Lab Technician, Research Assistant or Technician Typical Education: Bachelor's degree Occup. Code: 19-4021	\$44,727	111	48%	230
<10	10-24	<b>Soil and Plant Scientists</b> Related Job Titles: Agronomist, Crop Nutrition Scientist, Horticulture Specialist, Plant Physiologist, Plant Research Geneticist Typical Education: Bachelor's degree Occup. Code: 19-1013	\$63,266	37	23%	161
<10	10-24	<b>Microbiologists</b> Related Job Titles: Bacteriologist, Clinical Laboratory Scientist, Clinical Microbiologist, Microbiological Analyst Typical Education: Bachelor's degree Occup. Code: 19-1022	\$63,656	108	53%	204
<10	10-24	<b>Biological Scientists, All Other</b> Related Job Titles: Bioinformatics Scientists, Molecular and Cellular Biologists, Geneticists Typical Education: Bachelor's degree Occup. Code: 19-1029	\$77,067	54	36%	152
25-49	75-99	<b>Chemists</b> Related Job Titles: Analytical Chemist, Chemical Lab Scientist, Quality Control Chemist, Research Chemist Typical Education: Bachelor's degree Occup. Code: 19-2031	\$75,279	365	43%	838
<10	<10	<b>Biochemists and Biophysicists</b> Related Job Titles: Analytical Research Chemist, Biochemist, Biophysics Researcher Typical Education: Doctoral or professional degree Occup. Code: 19-1021	\$84,372	98	70%	139
25-49	75-99	<b>Medical Scientists, Excl. Epidemiologists</b> Related Job Titles: Clinical Lab Scientist, Clinical Pharmacologist, Clinical Research Scientist, Medical Researcher Typical Education: Doctoral or professional degree Occup. Code: 19-1042	\$61,100	433	41%	1,067

\*Annual openings from analysis of EMSI and state labor market office occupational projections.

\*\*The typical entry level education is based on the National Center for O\*NET Development. For these higher-skilled jobs, O\*NET indicates that a Bachelor's Degree or higher is typically required for job entry. However, Associate's Degrees, often coupled with industry experience, are suitable for entry into many technical positions.

# St. Louis Bioscience Labor Market Analysis

## Key Occupations: Production

Skilled production occupations are critical for the region’s biomanufacturing industries, and these jobs have higher annual openings and/or industry specialization. The key production occupations identified in Figure C3 are all middle skilled occupations that require moderate-to-long term on-the-job training and/or certifications. These jobs may also lead to bioscience career paths in management and sales, where industry experience can prove beneficial.

**Figure C3: Middle-skill production occupations**

Annual Job Openings*		Occupation Title	2021 Median Earnings	StL MSA 2021 Bioscience Jobs	% of StL MSA Jobs in BioScience	StL MSA 2021 Total Jobs
BioSci. Job Openings	StL MSA Total Job Openings					
25-49	350-399	<b>Electrical &amp; Electronic Assemblers</b> Related Job Titles: Electromechanical Assembler, Electronic Technician, Mechanical Assembler Typical Education: High school diploma or equivalent Occup. Code: 51-2028	\$35,508	244	8%	3,162
10-24	600-699	<b>Misc. Assemblers and Fabricators</b> Related Job Titles: Fabricator, Assembly Line Worker, Mechanical Assembler Typical Education: High school diploma or equivalent Occup. Code: 51-2098	\$36,719	215	3%	7,829
<10	10-24	<b>Chemical Plant &amp; System Operators</b> Related Job Titles: Chemical Operator, Loader Technician, Process Control Operator, Process Technician Typical Education: High school diploma or equivalent Occup. Code: 51-8091	\$78,490	95	30%	313
50-74	200-249	<b>Chemical Equipment Operators</b> Related Job Titles: Chemical Operator, Process Operator, Spray Dry Operator Typical Education: High school diploma or equivalent Occup. Code: 51-9011	\$49,893	615	27%	2,260
10-24	100-149	<b>Mixing &amp; Blending Machine Operators</b> Related Job Titles: Blender, Blending Technician, Coater Operator, Mixer Typical Education: High school diploma or equivalent Occup. Code: 51-9023	\$39,936	190	15%	1,298
25-49	400-449	<b>Inspectors, Testers, &amp; Sorters</b> Related Job Titles: Quality Assurance Auditor, Inspector, Quality Control Technician, Quality Control Analyst Typical Education: High school diploma or equivalent Occup. Code: 51-9082	\$44,335	397	9%	4,531
10-24	25-49	<b>Dental Laboratory Technicians</b> Related Job Titles: Dental Lab Technician, Dental Technician, Orthodontic Laboratory Technician Typical Education: High school diploma or equivalent Occup. Code: 51-9081	\$43,021	147	51%	287
<10	10-24	<b>Medical Appliance Technicians</b> Related Job Titles: Lab Technician, Orthopedic Technician, Orthotic or Prosthetic Technician Typical Education: High school diploma or equivalent Occup. Code: 51-9082	\$47,204	64	41%	154
10-24	75-99	<b>Ophthalmic Laboratory Technicians</b> Related Job Titles: Edger Technician, Finishing Lab Technician, Optical Lab Technician, Surfacing Technician Typical Education: High school diploma or equivalent Occup. Code: 51-9083	\$31,891	118	21%	568
50-74	500-599	<b>Packaging Machine Operators</b> Related Job Titles: Filler Operator, Closing Machine Operator, Packaging Operator Typical Education: High school diploma or equivalent Occup. Code: 51-9111	\$37,161	665	12%	5,448

\*Annual openings from analysis of EMSI and state labor market office occupational projections.

# St. Louis Bioscience Labor Market Analysis

## Key Occupations: Business Support

Figure C4 shows the middle skill occupations found in business support activities, and which typically require moderate-to-long term training, work experience, certifications, and/or an associate's degree. These occupations often relate to IT support or non-technical sales. Figure C5 highlights the higher skill business support occupations that have relatively greater numbers of bioscience job openings. This set of occupations includes Software Developers and several other computer-related occupations. Technical sales representatives are another higher skill occupation with relatively higher numbers of projected openings and which also represents a potential career path for experienced applicants.

**Figure C4: Middle-skill business support occupations**

Annual Job Openings*		Occupation Title	2021 Median Earnings	StL MSA 2021 Bioscience Jobs	% of StL MSA Jobs in BioScience	StL MSA 2021 Total Jobs
BioSci. Job Openings	StL MSA Total Job Openings					
<10	150-199	<b>Computer Network Support Specialists</b> Related Job Titles: Network Specialist, Network Support Specialist, Network Technical Analyst Typical Education: Associate's degree Occup. Code: 15-1231	\$54,297	52	2%	2,222
10-24	500-599	<b>Computer User Support Specialists</b> Related Job Titles: Computer Support Specialist, Desktop Support Tech., Help Desk Analyst Typical Education: Some college, no degree Occup. Code: 15-1232	\$50,960	195	3%	6,859
50-74	1,000-1,499	<b>Non-Tech. Mfg. Sales Representatives</b> Related Job Titles: Account Representative, Customer Account Technician, Inside Salesperson Typical Education: High school diploma or equivalent Occup. Code: 41-4012	\$64,031	578	5%	10,948

**Figure C5: Higher-skill business support occupations**

Annual Job Openings*		Occupation Title	2021 Median Earnings	StL MSA 2021 Bioscience Jobs	% of StL MSA Jobs in BioScience	StL MSA 2021 Total Jobs
BioSci. Job Openings	StL MSA Total Job Openings					
<10	200-249	<b>Network &amp; Computer Systems Admin.</b> Related Job Titles: Systems Administrator, Information Systems Manager, Information Technology Specialist Typical Education: Bachelor's degree Occup. Code: 15-1244	\$89,296	89	3%	3,224
<10	75-99	<b>Database Administrators</b> Related Job Titles: Database Manager, Database Coordinator, Information Systems Manager, Information Architect Typical Education: Bachelor's degree Occup. Code: 15-1245	\$84,300	51	3%	1,672
<10	100-149	<b>Computer Programmers</b> Related Job Titles: Analyst Programmer, Application Programmer, Computer Programmer, Web Applications Programmer Typical Education: Bachelor's degree Occup. Code: 15-1251	\$84,652	44	3%	1,604
25-49	900-999	<b>Software Developers &amp; Quality Analysts</b> Related Job Titles: Application Developer, Software Architect, Software Engineer, Systems Engineer, Quality Assurance Typical Education: Bachelor's degree Occup. Code: 15-1256	\$97,907	490	4%	13,191
<10	200-249	<b>Computer Occupations, All Other</b> Related Job Titles: Web Administrators, GIS Specialists, Information Security Engineers, Digital Forensics Analysts Typical Education: Bachelor's degree Occup. Code: 15-1299	\$86,540	74	2%	3,148
75-99	350-399	<b>Technical/Science Sales Representatives</b> Related Job Titles: Field Sales, Area Sales, Marketing Representative, Sales Consultant Typical Education: Bachelor's degree Occup. Code: 41-4011	\$81,486	774	23%	3,371

\*Annual openings from analysis of EMSI and state labor market office occupational projections.

\*\*The typical entry level education is based on the National Center for O\*NET Development. For these higher-skilled jobs, O\*NET indicates that a Bachelor's Degree or higher is typically required for job entry. However, Associate's Degrees, often coupled with industry experience, are suitable for entry into many technical positions.

## Appendix D: St. Louis Bioscience Occupation Critical Skills and Certifications

The tables below show the top specialized skills and certifications identified in online job advertisements for the three occupation groups. Data from EMSI Burning Glass and considers online job postings found between January 1, 2019, to September 30, 2021, in the St. Louis, MO-IL MSA.

### Science and Lab Occupations

Figure D1 identifies the region's top specialized skills and certifications for science and lab occupations. Large online job advertisers included Quest Diagnostics, Bayer, Pfizer, and Thermo Fisher Scientific.

**Figure D1: In-demand science and laboratory skills and certifications**

Skill Cluster Family	% of Skill Postings	Skill Cluster Family	% of Skill Postings
<b>Science and Research - Top Ten Skills</b>	<b>33%</b>	<b>Business - Top Ten Skills</b>	<b>8%</b>
Chemistry		Quality Assurance and Control	
Biology		Technology Transfer	
Biochemistry		Process Improvement	
Chromatography and HPLC		Project Management	
Good Laboratory Practices (GLP)		Root Cause Analysis	
Laboratory Testing		Following SOPs	
Experiments		Conflict Management	
Biologics		TrackWise	
Proteins		Key Performance Indicators (KPIs)	
Cell Culturing		Business Systems Analysis	
<b>Health Care - Top Ten Skills</b>	<b>18%</b>	<b>Manufacturing - Top Ten Skills</b>	<b>6%</b>
Phlebotomy		Good Manufacturing Practices (GMP)	
Specimen Collection		Manufacturing Processes	
Patient Contact		New Product Development	
Medical Coding		Design of experiments (DOE)	
Vaccines		ISO 9001 Standards	
Cancer knowledge		Six Sigma and Lean	
Clinical Trials		Non-Conformance Assessment	
Clinical Development		Cost-Effective Manufacturing Processes	
Medical Science		Materials Science	
Aseptic Technique		Product Inspection and Testing	
Certification	% of Certificate Postings	Certification	% of Certificate Postings
Phlebotomy Certification	74%	Certified Outpatient Coding (COC)	2%
Certified Cytotechnologist	5%	Amer. Society for Quality (ASQ)	2%
Certified Quality Auditor (CQA)	3%	Auditor Certification	2%
Certified Registered Nurse Practitioner	3%	(ASCP)	1%
Hazardous Materials Certification	2%	Certified Medical Assistant	1%

# St. Louis Bioscience Labor Market Analysis

## Production Occupations

Figure D2 shows the top specialized skills and certifications identified for manufacturing production occupations in the St. Louis MSA. Large online job advertisers included Pfizer, MilliporeSigma, Thermo Fisher Scientific, Bayer, Becton Dickinson (BD), and Merck.

**Figure D2: In-demand manufacturing production skills and certifications**

Skill Cluster Family	% of Skill Postings	Skill Cluster Family	% of Skill Postings
<b>Business - Top Ten Skills</b>	<b>19%</b>	<b>Science and Research - Top Ten Skills</b>	<b>17%</b>
Quality Assurance and Control		Chemistry and Biochemistry	
Process Improvement		Batch Records	
Operations and Production Management		Biology	
Staff Management		Chemical Engineering	
Project Management		Chromatography	
Root Cause Analysis		Centrifugation Techniques	
Following SOPs		Biologics	
Conflict Management		Laboratory Testing	
Performance Management		Cell Culturing	
Business Planning		Biopharmaceutical Manufacturing	
<b>Manufacturing - Top Ten Skills</b>	<b>17%</b>	<b>Maint. and Repair - Top Ten Skills</b>	<b>6%</b>
Good Manufacturing Practices (GMP)		Equipment Repair and Maintenance	
Six Sigma and Lean		Hand Tools	
Quality Management		Cleaning	
Inventory Maintenance		Predictive/Preventative Maintenance	
Machinery and Machine Operation		Calibration	
Manufacturing Processes		Sandblasting	
Computer Numerical Control (CNC)		Equipment Operation	
ISO Standards		Micrometers	
Non-Conformance Assessment		Equipment Moving	
Welding		Test Equipment	
Certification	% of Certificates	Certification	% of Certificates
Six Sigma Certification	30%	Certified Quality Auditor (CQA)	6%
Wastewater Treatment Operator	12%	CDL Class A	6%
Certified Production and Inventory	9%	American Society For Quality (ASQ)	6%
Certified Supply Chain Professional	9%	Stationary Engineer License	3%
OSHA Forklift Certification	6%	Licensed Professional Engineer	3%

# St. Louis Bioscience Labor Market Analysis

## Business Support Occupations

Figure D3 highlights the top specialized skills and certifications identified for computer science and sales occupations in the St. Louis MSA. Large online job advertisers included Bayer, MilliporeSigma, Pfizer, Thermo Fisher Scientific, Eurofins Scientific, and Bunge.

**Figure D3: In-demand business support skills and certifications**

Computer Science Skill Cluster Family	% of Skill Postings
<b>Information Technology - Top Ten Skills</b>	<b>36%</b>
Python	
SQL	
Software Development	
SAP	
Java	
Software Engineering	
Technical Support	
Linux	
Enterprise Resource Planning (ERP)	
Data Management	
<b>Analysis - Top Ten Skills</b>	<b>12%</b>
Data Science	
Statistical Analysis	
Data Analysis	
Machine Learning	
Data Collection and Governance	
SAS	
Tableau	
Predictive Models	
Mathematical Programming	
Data Visualization	

Sales Rep. Skill Cluster Family	% of Skill Postings
<b>Sales and Marketing - Top Ten Skills</b>	<b>47%</b>
Product Sales	
Account Management	
Sales Goals	
Product Knowledge	
Pharmaceutical Sales	
Sales Strategy	
Salesforce	
Territory Management	
Negotiation Skills	
Marketing Development	
<b>Business/Client Support - Top Ten Skills</b>	<b>16%</b>
Business and Strategic Planning	
Customer Service/Needs Assessment	
Budgeting	
Customer Contact	
Biotechnology Industry Knowledge	
Customer Accounts	
Pricing Strategy and Negotiation	
Project Management	
Key Performance Indicators (KPIs)	
Thought Leadership	

Computer Science Certification	% of Certificates
Project Management Certification	11%
Certified Info. Security Mgr. (CISM)/Prof. (CISSP)	10%
IT Infrastructure Library (ITIL) Certification	9%
Project Management Professional (PMP)	7%
CompTIA Security+	4%

Sales Rep. Certification	% of Certificates
Product-specific sales/service certs	N/A
Six Sigma Certification	43%
Project Management Certification	25%
Financial Risk Manager (FRM)	10%
Project Management Professional (PMP)	5%