



Life Sciences

LABOR MARKET ANALYSIS
SAN DIEGO COUNTY

October 2014



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Job Center of Californiasm Network*





Foreword: Vision for San Diego

I am pleased to share with you the Life Sciences: Labor Market Analysis report. The report is one in a series of five published this year. We identified five regional high-priority sectors for an in-depth assessment of employer needs: Advanced Manufacturing, Life Sciences, Information and Communication Technologies, Clean Energy and Health Care.

San Diego has consistently ranked as one of the top 10 regions in the country for Life Sciences innovation. Nearly 1,400 Life Sciences companies employ approximately 45,000 people. The sector grew 45 percent over the past 10 years and is projected to expand 9.4 percent over the next 12 months. Its expected rapid employment growth and opportunities for on-the-job training, combined with reported current and future skills shortage, placed Life Sciences on our list of San Diego's top five priority sectors.

Our findings are a result of a collaboration with the San Diego and Imperial Counties Community Colleges Association (SDICCCA). These reports represent the first step in cooperative, sector-based strategies for workforce development in our region. Together, the San Diego Workforce Partnership (SDWP) and SDICCCA conducted online surveys, in-person interviews and focus groups of regional employers from the Life Sciences sector. We delved deep, asking questions that would give us insight into the jobs that can be filled with an associate degree or short-term training. Our findings and recommendations paint a picture of where we are and where we should be headed in our workforce planning.

With nearly 1.6 million people in the regional workforce, it is important for us to continuously review the state of our industries and identify job potential for our burgeoning workforce. We need to inform the unemployed, the underemployed and the yet-to-be-employed of which careers will provide an upward trajectory and meet the needs of our regional employers. SDWP is committed to funding research and job training programs that will ensure every business in our region has access to a skilled workforce and every job seeker has access to meaningful employment.

Together we will build our region's skilled and prosperous workforce.



A handwritten signature in black ink, appearing to read 'Peter Callstrom'.

Peter Callstrom, President and CEO
San Diego Workforce Partnership



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EXECUTIVE SUMMARY

Life Sciences/biotechnology is a sector that exists at the crossroads of innovative scientific research and the dynamic market economy. It is comprised of professional, scientific and technical industries that involve the scientific study of living organisms. The sector is focused on finding solutions for the world’s great challenges in healthcare, agriculture and sustainability.

In San Diego County, the Life Sciences sector employs 45,000 workers (3 percent of the county’s total workforce) in high-wage, high-skill jobs at over 1,400 establishments, and has been identified as a Life Sciences hub in the United States. Employment in this sector grew by 53 percent from 2005 to 2014, and is expected to grow an additional 9 percent over the next 12 months.

This report identifies the industries and occupations in the Life Sciences sector that have workforce development needs, documents employer demands and opportunities available for workers , and recommends specific actions for investments in workforce development to prepare the future workforce. For the purpose of this study, six subsectors and nine job titles were identified for in-depth analysis:

Subsectors	Job Titles ¹
<ul style="list-style-type: none"> • Agricultural Feedstock & Chemicals • Drugs & Pharmaceuticals • Medical Devices & Equipment • Bioscience-Related Distribution • M-Health or Wireless Health • Research, Testing & Medical Laboratories 	<ul style="list-style-type: none"> • Research associate or assistants • Quality control associate, assistant, or coordinators • Medical lab technician or clinical lab scientists • Materials handler or supply-chain technicians • Regulatory affairs specialist or analysts • Manufacturing or production technician or assemblers • Lab assistant, technician, or specimen accessioners or processors • Sales representatives or business development specialists

This report gives an analysis and overview of the Life Sciences sector in San Diego County and the nine occupations studied, including employment demand, education requirements, hiring practices and employer expectations.

Overall, Life Sciences firms anticipate growth in their workforce, but struggle to find job applicants with the technical skills needed to perform the job. The report reveals that most Life Sciences employers prefer job candidates who have formal education to candidates who possess work experience.

Education and training providers and the workforce development system need to work together to provide more technical training for future Life Sciences workers starting in the K-12 system with a focus on Science, Technology, Engineering and Mathematics (STEM) education. With the high levels of innovation in this sector, educators and trainers need to have a continual conversation regarding employers’ expectations of the future workforce.

¹ Animal technician was originally one of the job titles to be analyzed in this study, but was found to have not enough employment significance and was thus omitted.

INTRODUCTION

Life Sciences, also referred to as Biotechnology (or Biotech), focuses on finding solutions for the world’s great challenges in health care, agriculture and sustainability. The Life Sciences sector is a significant employer in San Diego County (more than 45,000 jobs in 2013), which has been identified as one of the nation’s top three regions for biotechnology business and research.²

Since 2001, San Diego has consistently been ranked as one of the top 10 regions for this sector in the country.³ A 2004 study by the Milken Institute rated the San Diego Metropolitan Statistical Area (MSA)⁴ as the number one region in its Biotech composite index, leading in current impact, research and development inputs, as well as ranking third in risk capital.⁵ More typically, San Diego is found just below leading Life Sciences regional hubs—Boston, Massachusetts and California’s Bay Area or, more specifically, Silicon Valley.

A 2014 study of Life Sciences regional clusters by Jones Lang LaSalle (JLL) identified the top 10 U.S. cities for biotech business and research.⁶ JLL stated, “Access to talent and research is keeping cities like Boston, San Francisco and San Diego at the top of the U.S. Life Sciences cluster list.” Table 1 compares JLL’s top five U.S. regions for Life Sciences with the 2014 results of the IHS’s Business Cost Index.⁷ The Business Cost Index determines the most expensive metro areas for conducting business. Four of the top five Life Sciences regions also made the top 10 most expensive metros on the Business Cost Index.

Venture Capital

Over \$19 billion in biotechnology-related venture capital investments were made in California between 2009 and 2013, accounting for over 38 percent of venture capital dollars invested in biosciences in the U.S. during that period.

Table 1: Top Life Sciences Regions by Business Cost Index

Life Sciences Regional Hub	JLL 2014 Regional Ranking	IHS 2014 Business Cost Index
Boston	#1	#10
San Francisco	#2	#5 & #6
San Diego	#3	#7
Raleigh-Durham, North Carolina	#4	Not in top 10
Northern New Jersey/New York City	#5	#3

Regions with a high concentration of Life Sciences firms are typically built around great research institutions, entrepreneurial companies and scientists who are willing to leave universities and develop companies in the private sector. San Diego County is no exception, with research institutions such as Salk Institute, Scripps Research Institute and the University of California, San Diego (UCSD) all founded in Torrey Pines Mesa between 1955 and 1965.⁸ Another critical ingredient in the development of the county’s Life Sciences sector was the formation of Hybritech in 1978, a company that was founded by two UCSD

² us.jll.com/united-states/en-us/news/2939/top-us-life-sciences-clusters-revealed-did-your-city-make-the-list.

³ milkeninstitute.org/publications/publications.taf?function=detail&ID=38801196&cat=resrep.

⁴ Metropolitan Statistical Areas are geographic entities delineated by the Office of Management and Budget (OMB) for use by Federal statistical agencies in collecting, tabulating, and publishing Federal statistics. San Diego’s MSA is San Diego-Carlsbad, CA MSA.

⁵ southcarolinialifescience.com/econ_dev_reports/Milken_Institute_Biotech_Report.pdf.

⁶ us.jll.com/united-states/en-us/news/2939/top-us-life-sciences-clusters-revealed-did-your-city-make-the-list.

⁷ press.ihs.com/press-release/economics-country-risk/new-york-city-area-washington-san-francisco-among-most-expensiv; Geographic areas are not an exact match but represent the closest geographic overlay.

⁸ brookings.edu/es/urban/publications/biotechsandiego.pdf.

researchers. While Hybritech was acquired for \$400 million in 1986, its alumni have connections to about 150 Life Sciences companies in San Diego County.⁹

Entrepreneurship has also “played a significant role in building San Diego into the biotech hub it is today,”¹⁰ supported by organizations like CONNECT that have assisted entrepreneurs beginning to commercialize biotech frontiers such as genomics, wireless and digital health, gene therapy and regenerative medicine and molecular antibodies.

This study was conducted to further understand the San Diego Life Sciences sector and its employment opportunities. It is a product of the regional collaboration between the San Diego Workforce Partnership (SDWP), the San Diego & Imperial Counties Community Colleges Association (SDICCCA) and the Regional Center of Excellence for Labor Market Research (COE). Life Sciences was chosen for in-depth research as one of the five priority sectors that SDWP and regional community colleges share. This report was commissioned by SDWP, with BW Research Partnership collecting and analyzing regional labor market data. Data was derived from surveys of 137 Life Sciences firms that responded to online and phone questionnaires, an employer focus group, and several executive interviews with industry employers and regional stakeholders. For more information on the research methodology, please see Appendix D.

Providing an overview of Life Sciences, this report identifies occupational needs within the sector and highlights growth trends, wages, difficulty hiring, and education and training institutions that prepare the workforce for employment in Life Sciences.

INDUSTRY SECTOR OVERVIEW

The Life Sciences sector is a complex and fast-evolving group of industries, spanning many industries and industry subsectors. It includes companies engaged in advanced manufacturing, research and development and technological services. The sector is best understood as a group of diverse industries with a common link—the application of biological scientific knowledge. In 2013, San Diego’s Life Sciences sector was large and diverse with approximately 45,000 employees in six subsectors:¹¹

- Agriculture Feedstock & Chemicals (25 jobs)
- Drugs & Pharmaceuticals (5,882 jobs)
- Medical Devices & Equipment (6,828 jobs)
- Research, Testing & Medical Laboratories (21,377 jobs¹²)
- Bioscience-Related Distribution (less than 4,739 jobs)
- M-Health or Wireless Health (5,091 jobs)

The Life Sciences sector in San Diego County has 1,450 establishments, 45,000 workers and approximately \$16 billion in annual sales revenue.¹³

⁹ voiceofsandiego.org/2008/08/04/how-san-diego-biotech-started-and-where-its-going/.

¹⁰ utsandiego.com/news/2014/Jun/21/building-san-diego-biotech-rebels-misfits/?#article-copy.

¹¹ The subsectors and their definitions are based on Battelle’s life science segments bio.org/sites/default/files/Battelle-BIO-2014-Industry.pdf, with the addition of M-Health and Wireless Health. For a full list of North American Industry Classification System (NAICS) codes used in this report, see Appendix C.

¹² Includes only a portion of industry jobs that are related to Life sciences activities.

¹³ 2013 is the most recent year with data for establishments and workers. 2012 is the most recent year with available date for sales revenue.

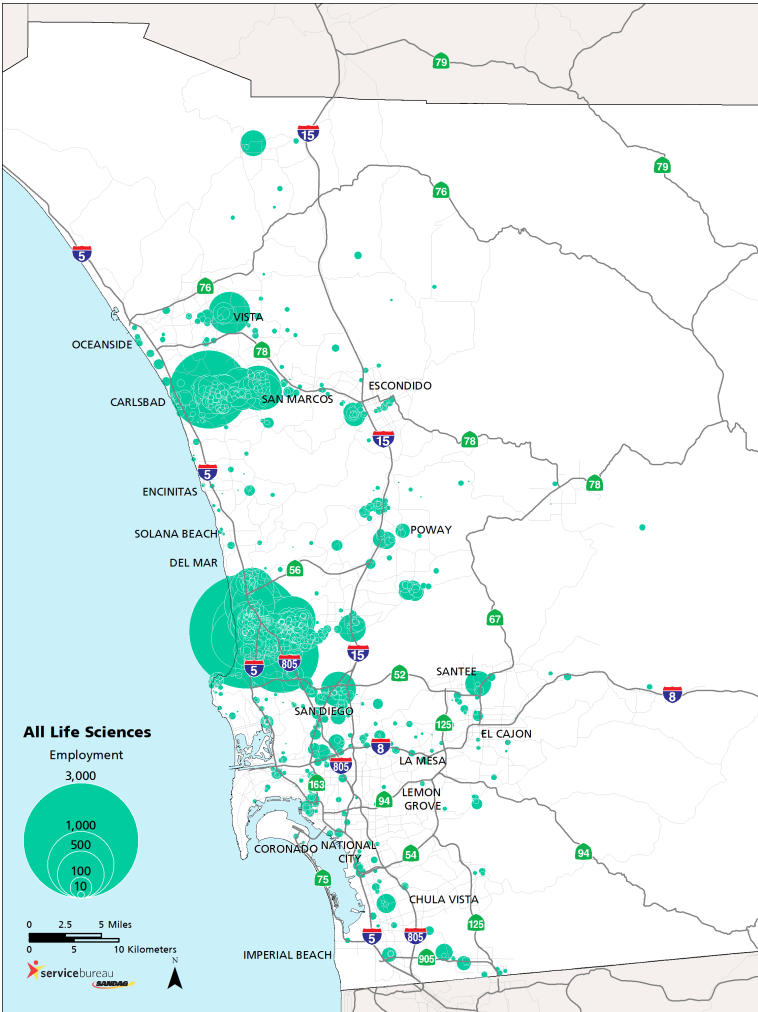
Employment in San Diego County

With approximately 45,000 workers in San Diego County averaging over \$125,000 in annual earnings, the Life Sciences sector has demonstrated that it is a strong and steady job generator, growing employment over the past decade at a pace well above the national average. It also fared much better than the overall economy during the recent U.S. recession and subsequent recovery period, which can partially be attributed to the diverse set of markets that the sector serves.

Life Sciences Employment in California
California has the largest biotechnology employment base in the U.S. with more than 235,000 jobs spanning over 8,000 individual business establishments.

The occupations selected for this study are found across many industries including Professional, Scientific and Technical Services, Ambulatory Health Care Services, Chemical Manufacturing, Computer and Electronic Product Manufacturing, Miscellaneous Manufacturing, Educational Services, and Administrative and Support Services. Geographically speaking, the Life Sciences sector covers all of San Diego County, but is concentrated in Sorrento Valley and Carlsbad. Figure 1 demonstrates where Life Sciences employment is found in the region.

Figure 1: Life Sciences Employment in San Diego County



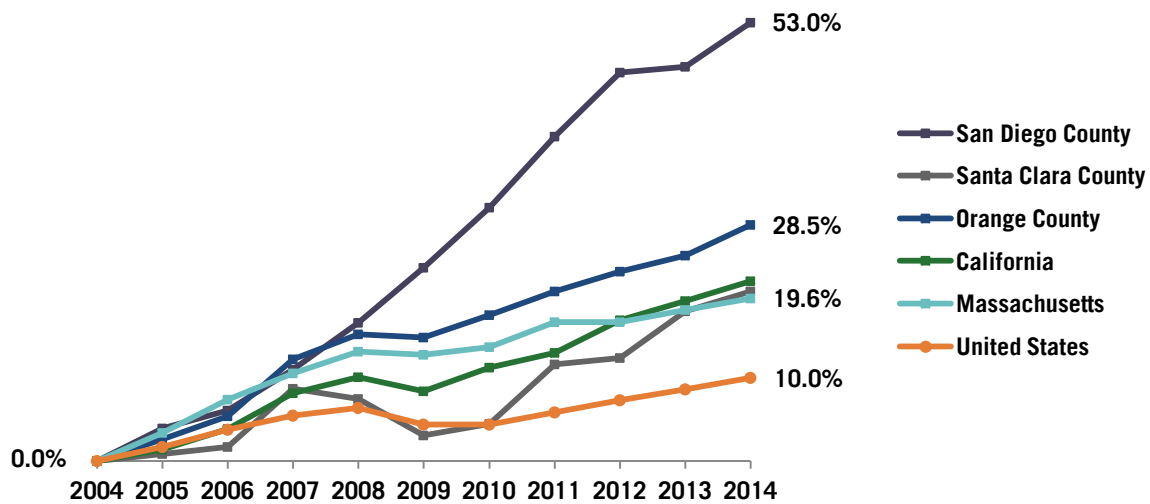
According to the San Diego Association of Governments (SANDAG), employment in the Life Sciences subsectors is primarily concentrated in the North County or Metro areas. Ninety-eight percent of pharmaceutical employment is found in North County (49 percent) and Metro (49 percent) with biomedical device employment largely split between the Sorrento Valley and Carlsbad areas, and the majority of research and development jobs (89 percent) centered in Sorrento Valley (Table 2).¹⁴ Additional maps by subsector can be found in Appendix E.

Table 2: Employment Distribution by Geographic Area, 2013

Region	Life Sciences Overall	Life Sciences Subsectors			
		Medical Devices	Drugs & Pharmaceuticals	Research, Testing, and Medical Laboratories	Other ¹⁵
East	2%	2%	0%	1%	2%
Metro	74%	51%	49%	89%	74%
North	23%	44%	49%	8%	22%
South	2%	3%	1%	1%	2%

San Diego County’s Life Sciences sector has grown 53 percent in the last 10 years – faster than comparable counties (Orange and Santa Clara) in California, leading national biotechnology hubs such as Boston, and the nation as a whole. Figure 2 illustrates the growth of San Diego County’s Life Sciences sector compared to other leading biotechnology hubs.¹⁶ The only region with a comparable growth pattern over the last 10 years is Orange County, with an employment growth of over 28 percent for the same time period.

Figure 2: Change in Employment in Life Sciences, 2004 to 2014



While national employment in the Life Sciences sector declined slightly from 2008 to 2010 during the Great Recession, San Diego County’s Life Sciences sector experienced considerable growth. The significant

¹⁴ Geographic areas represent the four San Diego Workforce Partnership regions. Employment distribution does not include firms with P.O. boxes, or firms with missing or zero employment.

¹⁵ Other includes Agriculture Feedstock & Chemicals, Bioscience-Related Distribution, and M-Health and Wireless Health.

¹⁶ Economic Modeling Specialists International (EMSI). Quarterly Census of Employment and Wages. May 2014.

growth spike for Life Sciences between 2009 and 2010 was due to the expansion of research and development in the county. Research and development¹⁷ added approximately 8,700 jobs (a 39 percent growth) during this time period, contributing to the sector’s ability to remain recession-proof in San Diego.

Between 2005 and 2014, 16 industries in the Life Sciences sector experienced growth, two declined, and 13 of the 26 industries¹⁸ had over 30 percent employment growth. The Life Sciences industries in San Diego with the highest overall growth are:

1. Irradiation Apparatus Manufacturing (617 jobs, 1,870% growth)
2. Analytical Laboratory Instrument Manufacturing (504 jobs, 229% growth)
3. Medical Laboratories (2,577 jobs, 179% growth)
4. Testing Laboratories (4,595 jobs, 130% growth)
5. Medicinal and Botanical Manufacturing (273 jobs, 85% growth)

Fifty percent of Life Sciences firms in San Diego anticipate adding more employees over the next 12 months, totaling 9.4 percent in growth (Figure 3).¹⁹ Only 2 percent of firms surveyed expect to have fewer permanent employees in 12 months, while approximately two out of every five firms predict maintaining current permanent employment levels.

Figure 3: Firms’ Overall Expected 12-Month Growth



Life Sciences firms engaged in multiple subsectors (those that perform more than one type of work) were the most optimistic about their growth expectations with 67 percent expecting to have more employees 12 months from now (Figure 4).²⁰ Businesses involved in multiple Life Sciences subsectors are likely more optimistic as they represent a larger swath of the industry, particularly one that has experienced prominent and steady growth over the last decade.²¹ The other two subsectors above the industry average for increased hiring expectations were agricultural and industrial biotechnology (64 percent) and pharmaceuticals (55 percent).

Research, testing and medical laboratories (40 percent), medical devices (43 percent) and other²² industry subsectors (43 percent) were below the industry average (50 percent) for hiring expectations.

Figure 4: Hiring Expectations of Life Sciences Companies in the Next 12 Months by Subsector (n=137)

¹⁷ Research and Development in Biotechnology (541711) and a portion of Research and Development in the Physical, Engineering, and Life Science (541712).

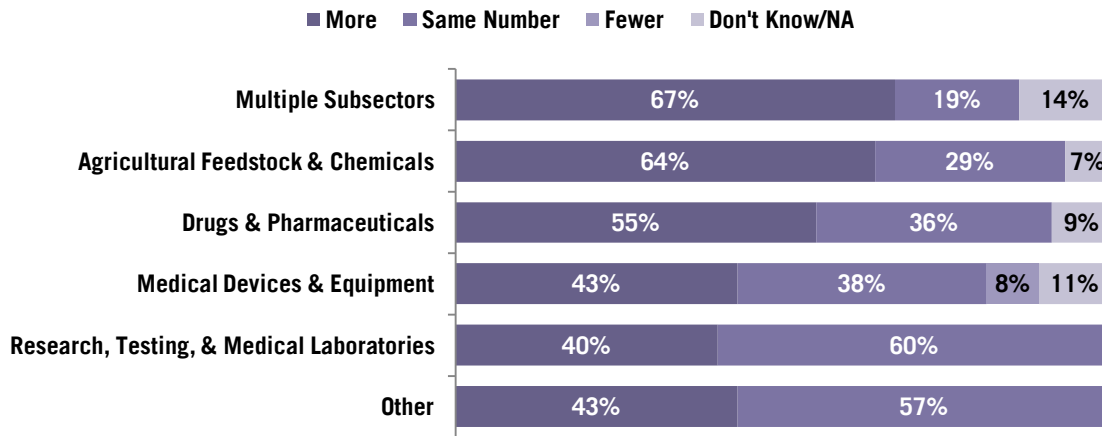
¹⁸ Defined at the 6-digit NAICS level.

¹⁹ Life Sciences employment in San Diego County was estimated using self-identified employment responses from a survey of firms, listed location employment from secondary data sources (InfoUSA, Dun & Bradstreet) and extrapolated employment from the incidence of Life Science firms within NAICS defined industries. Employment totals were compared between the known and unknown universe of Life Science firms and the larger number was used for each industry segment. For more information, see Appendix D.

²⁰ n = 137. "n" indicates the number of survey respondents.

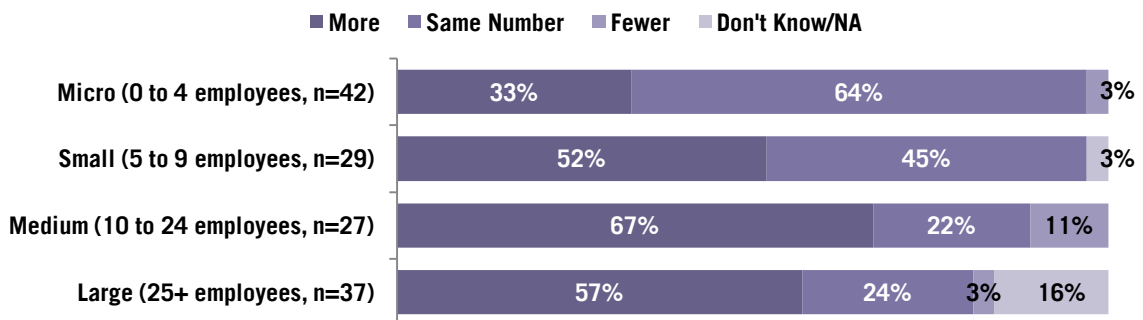
²¹ See the following section "Historic Growth" for more information.

²² Other includes Bioscience-Related Distribution, M-Health and Wireless Health, and firms that identified with a subsector outside the six defined for this report.



Medium and large Life Sciences firms with 10 or more employees were more likely to expect having additional employees 12 months from now compared to small- and micro-employers with fewer than 10 employees (Figure 5). This is unique, compared to other sectors where small firms are more likely to have higher employment growth expectations than their larger counterparts. In the next 12 months, job candidates should seek employment in the medium- to large-sized Life Sciences firms.

Figure 5: Hiring Expectations of Life Sciences Firms in the Next 12 Months by Firm Size



OCCUPATIONAL OVERVIEW

For this study, 10 Life Sciences occupations were identified as the focus of the research. These occupations were selected for their growth and employment opportunities in the region. Additionally, these occupations represent entry-level to middle-skills jobs that require a four-year degree or less as the highest level of formal education.

The analysis of relevant online job advertisements in the region and interviews with biotech employers revealed that employers advertise open positions using job titles that differ significantly from the Standard Occupational Classification (SOC) titles used by the U.S. Department of Labor, Bureau of Labor Statistics

(BLS).²³ For this reason, the research team decided to study 10 general job titles used by employers rather than traditional SOC-based occupations. The following is the list of titles included in this research:²⁴

- Lab assistant, technician, or specimen accessioner or processors
- Manufacturing or production technician or assemblers
- Materials handler or supply-chain technicians
- Medical lab technician or clinical lab scientists
- Quality assurance analyst, auditor or specialists
- Quality control associate, assistant or coordinators
- Regulatory affairs specialist or analysts
- Research associate or assistants (preclinical, research and development or clinical)
- Sales representative or business development specialists

The data in Table 3 shows projected employment growth (change) by occupation within Life Sciences sector between 2013 and 2018. The data was extracted from EMSI staffing patterns using corresponding SOC codes and the Battelle’s Life Sciences sector definition of NAICS codes.²⁵ The table also shows the projected number of average annual job openings due to both growth and replacement needs, as well as the number of online job advertisements for these occupations pulled from Burning Glass.

Table 3: Occupational Demand

Occupation	2013 Jobs	2018 Jobs	% Change (2013-2018)	Average Annual Job Openings ²⁶	Number of Job Postings ²⁷ Jan-Dec 2013
Materials handler or supply-chain technicians	1,790	2,292	28%	72	35
Quality assurance analyst, auditor or specialists	220	256	16%	9	240
Quality control associate, assistant or coordinators	428	603	41%	32	225
Medical lab technician or clinical lab scientists	381	439	15%	22	104
Manufacturing or production technician or assemblers	361	413	14%	11	91
Regulatory affairs specialist or analysts	428	603	41%	32	225
Lab assistant, technician, specimen accessioner or processors	908	1,060	17%	42	136
Sales representative or business development specialists	2,665	2,932	10%	112	815
Research associate or assistants	7,181	8,599	20%	332	1,999
TOTAL					

²³ Standard Occupational Classification (SOC) codes are used to collect and disseminate employment data for occupations. For a complete list of the occupations studied and corresponding SOC codes, see Appendix C.

²⁴ Animal technician was originally one of the occupations studied, but was found to have no significant employment in San Diego. The survey response rate for this occupation was too low to develop a concrete analysis and was thus omitted.

²⁵ bio.org/sites/default/files/Battelle-BIO-2014-Industry.pdf.

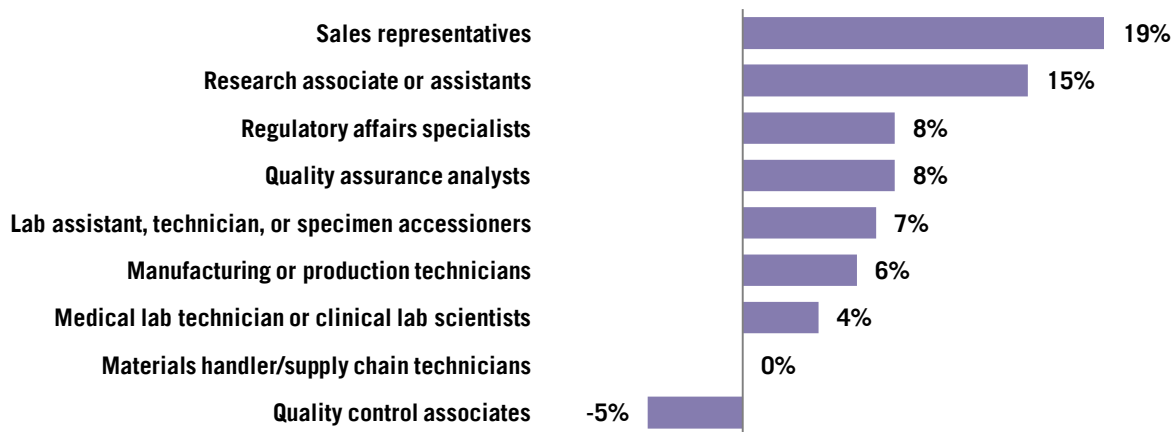
²⁶ EMSI. Quarterly Census of Employment and Wages (QCEW), non-QCEW and self employment data. May 2014.

²⁷ Burning Glass. Insight program data.

The data shows that current employment for these nine jobs in the Life Sciences sector is just over 7,000. Between 2014 and 2018, 1,418 jobs will be added for a total of 8,600 jobs in these occupations – a 20 percent growth rate in the sector. There will be over 1,600 new and replacement job openings over the next five years, with 332 openings annually.

According to the survey of Life Sciences firms in San Diego County, employers anticipate hiring more workers for all but one occupation over the next 12 months, though demand varies by employer. Half of all employers that employed research associates or research assistants (preclinical, R&D or clinical) expect to hire more workers for these positions over the next year. More than one-third (37 percent) of survey respondents expect to have more medical lab technicians or clinical lab scientists at their business location by the same point in time in 2015 (Figure 6). Sales representatives are expected to grow the most over the next 12 months (19 percent), followed closely by research associates or assistants (15 percent). Materials handlers and supply chain technicians are not expected to grow, while quality control associates are expected to decline by 5 percent.

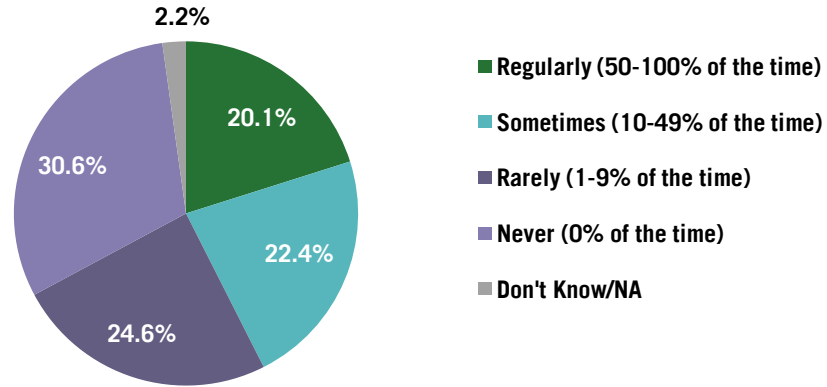
Figure 6: Average Anticipated 12-Month Growth by Occupation



Temporary and contract hiring is utilized by several Life Sciences employers in San Diego County. Life Sciences employers that would like to maintain flexibility with their payroll prefer temporary or contract workers since such workers can contribute on a project-to-project basis and are easier on the budget. Employers can also evaluate employees on a trial basis to determine whether they are a good fit for the organization before deciding to take them on as a permanent hire.

Approximately two out of five of San Diego County’s Life Sciences businesses regularly (20 percent) or sometimes (22 percent) hire workers on a temporary or contract basis, while almost 25 percent of Life Sciences employers rarely do so (Figure 7).

Figure 7: Frequency in Hiring Non-Permanent Workers



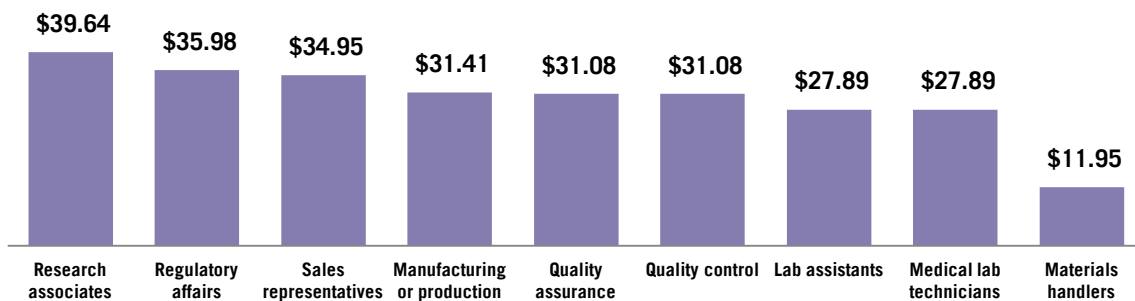
Firms use staffing agencies most often to fill positions for research assistants, manufacturing technicians, quality assurance and quality control.²⁸ The collection of responses from Life Sciences employers in San Diego County highlights the inconsistency in temporary and contract hiring across the industry.

Life Sciences employers were asked about hiring practices for entry-level employees in terms of direct hire, temporary or contract, or temp-to-hire. Temp-to-hire practices are less often used for entry-level employees than temporary/contract employment in the Life Sciences sector. Overall, one in 10 Life Sciences employers hire entry-level workers regularly on a temp-to-hire basis 22 percent of employers sometimes hire on a temp-to-hire basis, while over two-thirds of employers rarely or never do so.

Wages

The Life Sciences sector employs workers who earn wages far above the average for San Diego County, with an annual median salary of approximately \$125,000. Figure 8 shows the median wages for each occupation studied.²⁹ All occupations have wages over \$27.00 per hour except materials handlers. For more detailed information on wages, see the occupational profiles in Appendix A.

Figure 8: Median Hourly Wages by Occupation



Difficulties in Hiring

²⁸ From the COE/California Community College Staffing Agency Survey 2014.

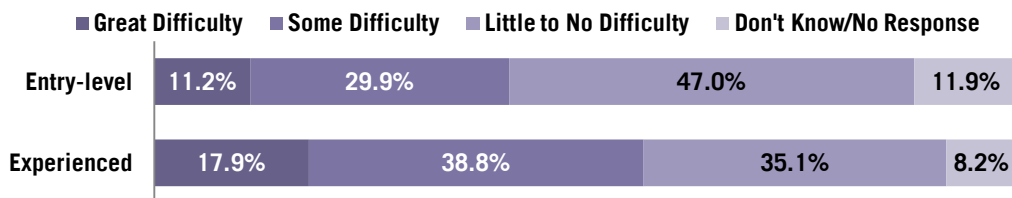
²⁹ Average wages were based on sector occupational wages and most appropriate SOC code. Data source: EMSI. QCEW, non-QCEW and self-employment data. May 2014.

Life Sciences firms were tasked with ranking their difficulty in finding both entry-level and experienced applicants at their San Diego County locations. Over half of Life Sciences businesses indicate at least some difficulty finding qualified applicants (either for entry-level or experienced workers) who meet their organization’s standards.

Employers in Life Sciences are more likely than other employers to emphasize the challenge and difficulty associated with finding and retaining experienced employees compared to entry-level employees. This is typical for most growing sectors with a higher percentage of high-skill and high-wage occupations. Interestingly, Life Sciences employers place greater emphasis on technical skills for experienced applicants rather than non-technical skills or industry experience.

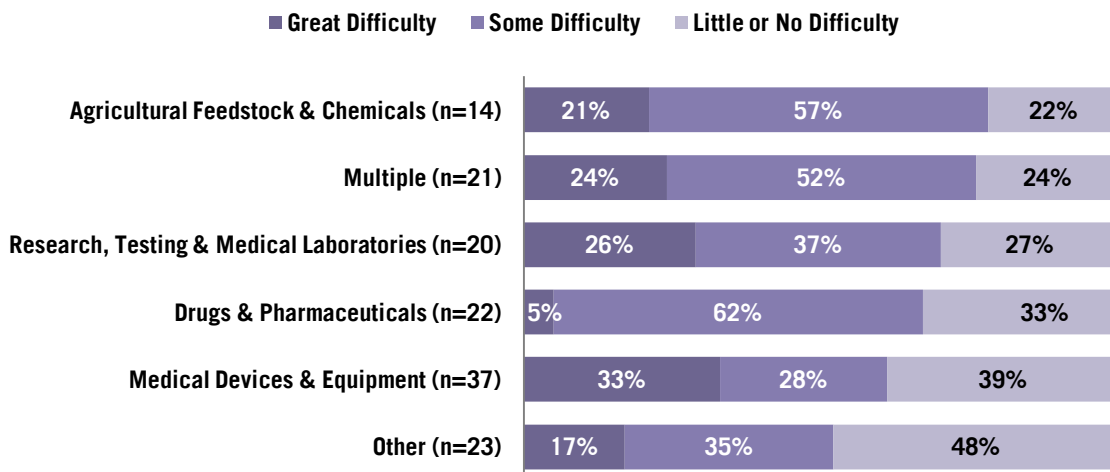
Figure 9 demonstrates the difficulty San Diego Life Sciences employers have in finding both entry-level and experienced applicants. Employers reported having more difficulty in finding qualified experienced workers (57 percent) than qualified entry-level workers (41 percent).

Figure 9: Employer-Reported Difficulty in Hiring Qualified Candidates, Entry-level and Experienced



Each subsector had at least half of business respondents indicate they are having some or great difficulty in finding qualified applicants (Figure 10).³⁰

Figure 10: Employer Reported Difficulty in Hiring Qualified Candidates by Subsector

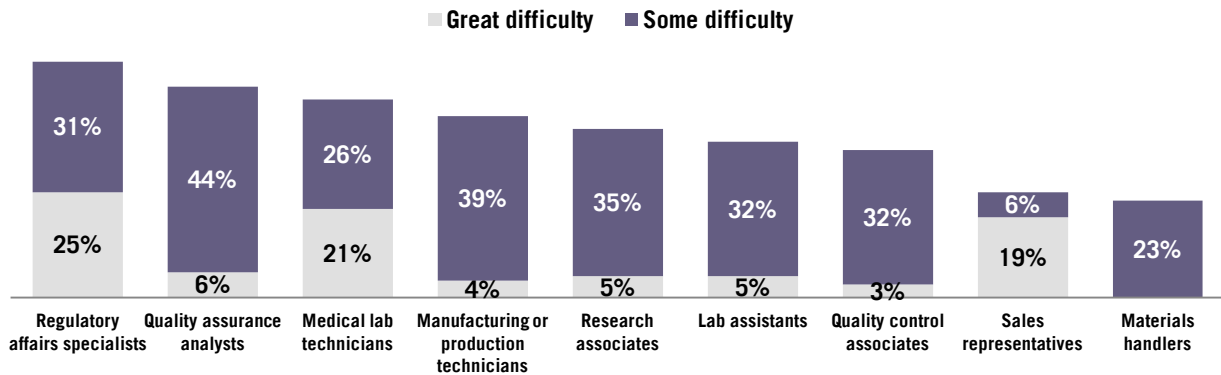


Employers are having difficulty finding qualified applicants for higher skilled, higher paying positions. The two occupations employers had the greatest difficulty finding qualified applicants for were regulatory

³⁰ Includes responses recoded to combine entry-level and non-entry-level difficulty – if the respondent indicated “Great difficulty” for either entry-level or non-entry-level, the response was coded as “Great difficulty for the combined chart – if the respondent indicated “Some difficulty” for either entry-level or non- entry-level as the highest difficulty reported, the response was coded as “Some difficulty” for the combined chart.

affairs specialists or analysts and sales representatives, the two highest paid positions. Additionally, employers had the least difficulty in finding qualified applicants for materials handlers and lab assistants, which are both the lowest-paying jobs (Figure 11).

Figure 11: Employer Reported Difficulty in Hiring Qualified Candidates by Occupation



Life Sciences employers who indicated at least some difficulty finding qualified, experienced job applicants were asked to identify the skills or areas of expertise that were most difficult to find within this cohort. The results were categorized as follows:

- Technical skills: 65%
 - Regulatory knowledge & expertise
 - Engineering background & skills
 - Drug development: clinical trials
 - Lab skills: protein purification, cell culture
 - Data management: bioinformatics, information technology
- Non-technical skills: 17%
 - Attitude and ability to stay motivated
- Industry and applied experience
 - Sales
 - Lab work

Employer responses and jobs postings data³¹ indicated that Good Manufacturing Practices (GMP), quality control, fundamentals of scientific knowledge and workplace skills and abilities are important skills for job seekers to possess (Table 4).³²

³¹ Job postings data were gathered through the program, Burning Glass, Labor/Insight. The job postings were posted between January and December 2013.

³² Source: Burning Glass Labor Insight. Jan. 1, 2013–Dec. 31, 2013. Analysis by Center of Excellence.

Table 4: Top Required Skills from Employer Job Postings in California

Technical or Specialized Skills	Fundamental or Baseline Skills
Chemistry*	Quality Assurance and Control ^{**}
Inspection	Communication Skills
Good Manufacturing Practices (GMP)	Research
Biology*	Organizational Skills
Experiments	Writing
Laboratory Equipment	Microsoft Excel
Validation	Detail-Oriented
Good Laboratory Practices (GLP)	Computer Skills
Biochemistry	Troubleshooting
Calibration	Problem Solving
Mathematics	Microsoft Office
High Performance Liquid Chromatography	Multi-tasking
Manufacturing Processes	English
Record Keeping	Management
Molecular Biology	Microsoft Word
Laboratory Testing	Planning
Phlebotomy	Leadership
Cell Culturing	File Management
Laboratory Procedures	Time Management
Sample Preparation	Microsoft PowerPoint

*While these determinations were based on job postings data, Life Sciences employers who participated in a focus group in San Diego suggested that these are general subject areas. What employers look for in middle-skills biotechnology workers is familiarity with applied chemistry and biology as it relates to routine laboratory work.

** Similarly, participants of the Life Sciences employer focus group suggested that quality assurance and control should be listed as a technical skill area rather than a baseline one.

Educational Requirements

In Life Sciences, employers have high expectations for education and training requirements, even for entry-level workers. Analyzing the minimum education requirements of online job postings reveals that 34 percent of employers posted jobs requiring a bachelor's degree as the minimum. Table 5 shows the breakdown of employer education expectations.³³

Table 5: Overall Educational Requirements

Education Level	Percentage of Job Postings (Jan. 1–Dec. 30, 2013)
High School Diploma	28%
Postsecondary or Associate Degree	9%
Bachelor's Degree	34%
Graduate of Professional Degree	2%
Unspecified	27%

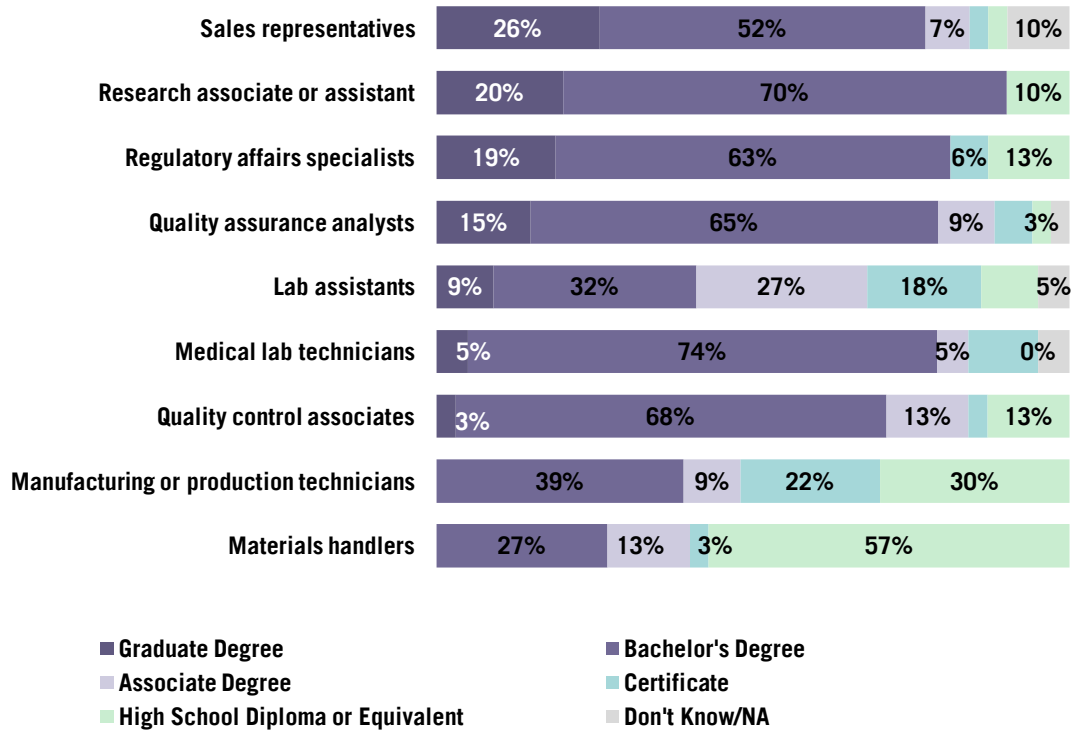
According to the employer survey, 26 percent of firms that employ sales representatives or business development specialists expect these workers to possess a master's degree or other graduate degree (Figure 12).³⁴ Sales representatives and business development specialists are often the point of contact

³³ Source: Burning Glass Labor Insight. Jan. 1, 2013–Dec. 31, 2013.

³⁴ Source: Employer Survey, n=137. "n" indicates the number of respondents.

between the Life Sciences firm and customers (physicians, pharmacists, health care providers, etc.); therefore, it is likely that they are expected to possess advanced industry knowledge and interpersonal communication skills (to maintain interactive relationships) that may be obtained through an advanced degree program or several years of industry experience.

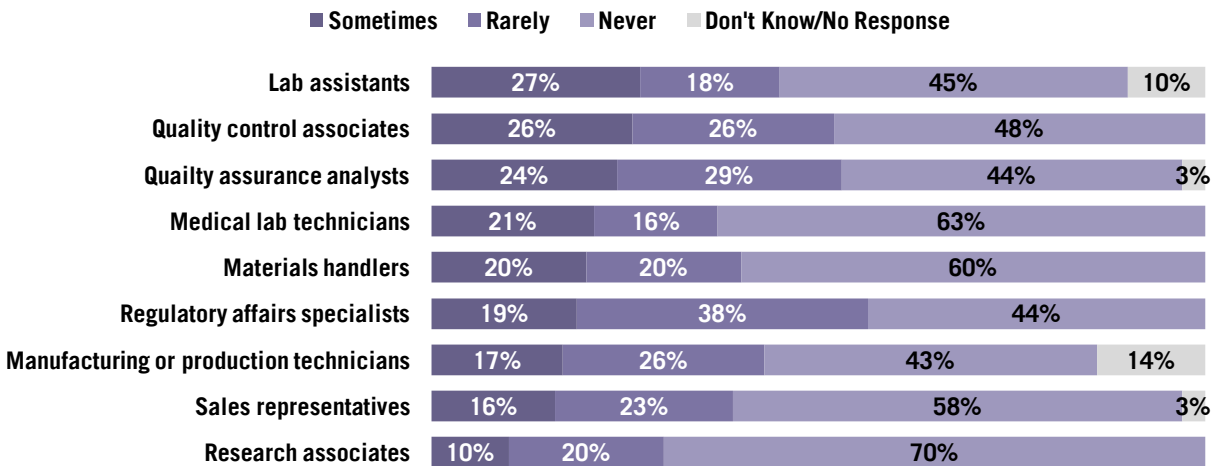
Figure 12: Educational Requirements by Occupation



Employers indicated lower educational requirements for lab assistants, technicians or specimen accessioners or processors (55 percent require an associate degree or less), manufacturing or production technicians or assemblers (61 percent require an associate degree or less), and materials handlers or supply-chain technicians (73 percent require an associate degree or less). Fifty-seven Life Sciences employers in San Diego County are satisfied with the completion of high school or equivalency for materials handlers or supply-chain technicians.

The nine occupations in this study largely represent the entry-level positions with lower educational requirements in the Life Sciences sector. Even with the emphasis on entry-level positions, over 70 percent of employers expect a bachelor's or graduate degree for six of the nine positions evaluated. One-third to over half of employers indicate that they sometimes or rarely hire individuals with less than the typical education requirements.

To understand if education levels affect hiring decisions, Life Sciences firms were asked how often they hire applicants who possess less than the typical education requirements for the position (Figure 13). At least 30 percent of employers surveyed said that they have or will hire a worker with less than the typical education requirement at their firm for each of the nine occupations.

Figure 13: Frequency of Hiring Applicant with Less than Requirement (n=137)

Education Versus Work Experience

To discern employer needs and expectations for each occupation, employers who completed the survey were asked to state their preference between two applicants for each occupation: one with a strong educational background but lack of work experience, and one with hands-on work experience but lower education.

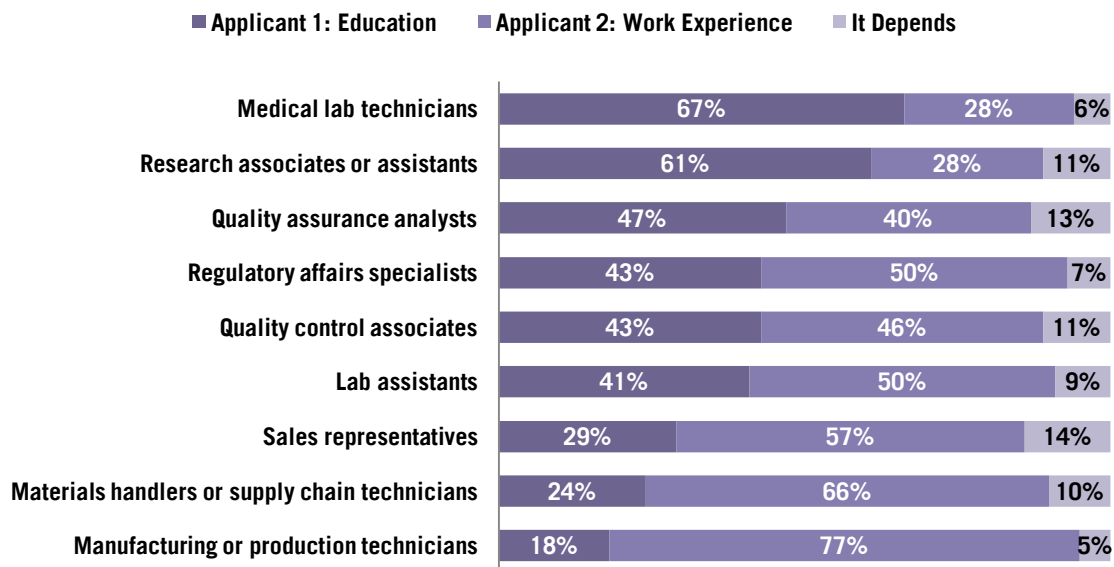
Applicant 1 has recently completed or has almost completed his four-year college degree and is planning on going to graduate school in a related Life Sciences discipline.

Applicant 2 has more hands-on applied industry experience specific to the occupation but does not possess, and is not in the process of getting a four-year degree.

As Figure 14 shows, preference for the job candidate with an undergraduate degree and potential graduate degree outweighed the promise of specific skills for firms that employ medical lab technicians or clinical lab scientists (67 percent), research associates or assistants (61 percent) and quality assurance analysts, auditors or specialists (47 percent). Workers interested in these occupations will benefit from a focus on educational training.

Work experience outweighed educational attainment in hiring manufacturing or production technicians or assemblers (77 percent), materials handlers or supply-chain technicians (66 percent), sales representatives or business development specialists (57 percent), lab assistants, technicians or specimen accessioners or processors (50 percent), and regulatory affairs specialists or analysts (50 percent). Such occupations where specific skills are preferred over educational attainment should be the focus of on-the-job training programs such as internships, apprenticeships, or other hands-on programs.

Figure 14: Employer Preference for Hiring: Education versus Work Experience



Regional Supply

In San Diego, approximately 20 programs across eight institutions train workers for the nine occupations studied in this report, graduating over 400 students in fields related to these jobs. Regional institutions that train in Life Sciences include MiraCosta College, Miramar College, San Diego City College, Southwestern College, University of California San Diego (UCSD), San Diego State University, University of San Diego and National University, graduating students with credentials ranging from certificates and associate degrees up to bachelor’s and master’s degrees.³⁵

The regional supply of an educated and trained entry-level workforce was determined by examining the regional community college, public and private university programs related to Life Sciences. The supply data included information from the California Community Colleges Chancellor’s Office Data Mart³⁶ for community colleges and the Integrated Postsecondary Education Data System (IPEDS) completions data for four-year universities and proprietary institutions in the San Diego region.

Education data was collected by using O*NET’s occupational crosswalk in order to determine technical skills for each occupation and to obtain the Taxonomy of Programs (TOP) codes (for community colleges) and Classification of Instructional Programs (CIP) codes (for all other institutions) that are associated with the Standard Occupational Classification (SOC) codes. A gap analysis is particularly difficult for the Life Sciences occupations selected for this report, as they are not easily classified using available SOC codes. The following analysis matches occupations, educational programs and program completions using their approximate matches. Data Mart and IPEDS were used to retrieve the number of educational programs that were offered over the last three years for each educational institution. For lab assistant occupations, information from faculty interviews with community colleges was utilized.

³⁵ For the full breakdown of programs, institutions and completions, see Appendix B.

³⁶ datamart.cccco.edu.

Table 6 is a summary of the occupational TOP codes, number of programs that are offered for each occupation and the number of institutions that offer the programs.³⁷ This table includes programs in the region's community colleges and public and private universities. The two occupations with the greatest number of programs, institutions and program completions were medical lab technician or clinical lab scientist, and lab assistant, technician or specimen accessioner or processor.

Table 6: Regional Programs & Institutions in San Diego

Occupation	CIP Code	# Programs	# Institutions	Program Completions Total (2012-2013)
Materials handlers or supply-chain technicians	52.0203	3	2	37
Quality assurance analysts, auditors, or specialists	41.9999	1	1	1
Quality control associates, assistants, or coordinators	15.0702			
Medical lab technicians or clinical lab scientists	51.1004	3	2	42
Manufacturing or production technicians or assemblers	15.0304	2	1	7
Regulatory affairs specialists or analysts	51.2010	1	1	13
Lab assistants, technicians, specimen accessioners or processors	26.0502 15.0401	9	6	145
Sales representatives or business development specialists	52.1804	1	1	24
Research associates or assistants (preclinical, R&D, or clinical)	51.2004	0	0	0
	Total	20	8	269

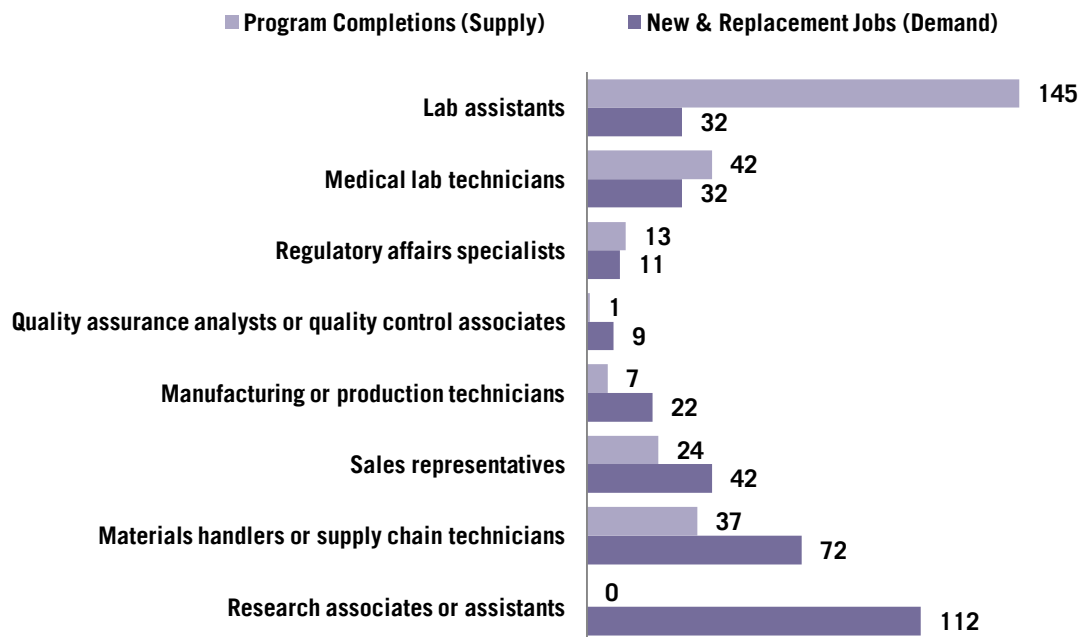
Gap Analysis

Overall, there is an undersupply of trained entry-level workers for the nine Life Sciences occupations studied. Demand for these occupations (which require up to a bachelor's degree for entry-level work) is approximately 332 openings per year. Supply provided by the community colleges, four-year public and private universities and proprietary schools is approximately 269 workers each year. Thus, based on best available data, the education system is undersupplying the region's labor-market for Life Sciences workers by 63 workers annually.

As illustrated in Figure 15, three of the nine occupations have a worker oversupply since there are more program completions than there are new and replacement jobs. Lab assistants show an oversupply of 113 workers. However, there is a large undersupply of research associates each year where none are being trained at San Diego institutions despite there being 112 annual openings for these positions.

³⁷ Data source: Data Mart, IPEDS.

Figure 15: Gap Analysis



The job titles used for the job postings analysis and the actual titles that employers use to post jobs for entry-level Life Sciences workers showed that there is a lot of overlap between these occupational categories. Employers use a variety of job titles that often overlap in terms of skills and education needed for a job. Therefore, what appears to be an oversupply in lab assistants (+113) and an undersupply in research assistants (-112) could actually mean a balanced market since skills and education required for these entry-level positions are likely to be similar.

RECOMMENDATIONS

Based on the key findings of this study, the following recommendations have been developed to guide the workforce development system in preparing qualified workers for the Life Sciences sector:

- 1) Regional workforce investments in short-term training should primarily emphasize the development of technical skills or specific areas of expertise for individuals who already have a strong academic and/or industry foundation in the Life Sciences. This short-term technical training could include working in a laboratory, training with specific laboratory tools and research software, or include regulatory process and quality assurance exposure and education.
- 2) Considering employer-reported difficulties in hiring and retaining experienced workers, both employers and education and training institutions should invest resources in professional development training for incumbent workers. Specific areas of focus for Life Sciences would include technical skills, especially regulatory knowledge or expertise and/or data management, bioinformatics and information technology.

- 3) Regional Life Sciences education and training programs should emphasize key areas of skills and expertise including quality control, bio-informatics, bio-engineering, data mining and analysis, and biochemistry, as well as the foundational skills associated with a Science, Technology, Engineering and Mathematics (STEM) education. While these strategies have a longer return on investment, they could provide a critical advantage to San Diego in the continued growth of this competitive sector.
- 4) Education and training institutions need to collaborate with employers and industry associations (such as BIOCOM) to more effectively serve the Life Sciences businesses in the region. Effective strategies for developing a stronger Life Sciences workforce require collaboration between education and training providers (starting in K-12) and sector employers to understand their evolving workforce needs. These collaborative relationships should include education and training planning based on industry input and research.

K-12: Collaborative educational models integrate exposure to Life Sciences in current science and math courses in high school while also offering contextual learning opportunities.

Community Colleges: The Southern California Biotechnology Center (SCBC) at Miramar College is a successful example of how community colleges can play an effective role in supporting the region's Life Sciences businesses. Life Sciences employers indicated that many of their entry-level technicians and applied researchers did not receive enough laboratory experience when completing their four-year degrees. SCBC provides the lab experience that entry-level applicants lack and fills a valuable niche to Life Sciences businesses looking to hire individuals who can work effectively in a laboratory environment.

Public and Private Universities: Employers indicated the need for new training and educational specialties focused on Life Sciences, which could include:

- Regulatory affairs and the science and policy behind this process
- Bio-informatics and data analysis focused on applications for Life Sciences
- Genomics and the molecular biology associated with understanding gene sequencing and DNA
- Biomedical engineering and the application of engineering principles and design concepts to medicine and biology

CONCLUSIONS

The Life Sciences sector is growing in San Diego County with evolving employment opportunities for the region's workforce. In an ever-changing, innovative sector, employers are constantly seeking the best and brightest workers to ensure their firm's success. San Diego County's Life Sciences sector should be a priority for the region due to its strong historical and recession-proof employment growth, high-growth expectations, and large proportion of employers that have difficulty finding qualified applicants. Most occupations of importance to Life Sciences employers are not likely to be filled with short-term (three to six month) training unless those individuals already have a prior foundation in the sector. Life Sciences employers are more likely to emphasize the need for occupations requiring at least a bachelor's degree and often a graduate degree in a STEM-related field with at least some industry experience.

Life Sciences is not a sector for all job seekers but it does provide quality employment opportunities for those with the willingness and ability to learn, adapt and respond quickly in a challenging environment. While the sector has considerable barriers to entry for its career pathways, individuals who are able to succeed in this industry are typically rewarded with high-paying, challenging positions that provide considerable advancement opportunities. According to employers, job applicants must possess the following characteristics in order to be successful:

Passion and the ability to learn: Jobseekers need to have both interest and intellectual curiosity in science and technology.

A scientific background and ability to communicate technical information: Positions such as sales representatives and business development specialists typically require higher levels of formal education, as well as strong communication skills since employers expect their sales force to be able to communicate effectively to a wide audience, and understand the technical nuances of the different products and services they sell.

Willingness to work in an evolving and fast-paced environment: Private sector firms often build upon the research findings of their academic counterparts. However, private sector Life Sciences firms often work in a more fast-paced environment than academia and related research organizations, and expect their employees to learn and work at a similar pace.

Life Sciences employers and stakeholders emphasized the need for related skills or current experience, as well as a workforce that can learn and adapt quickly to a changing environment. With these priorities, Life Sciences business are generally less willing to hire workers they perceive as taking longer to develop or be brought up to speed.

The Life Science sector is competitive and dynamic, and employers typically pay a premium for the fastest, smartest and most innovative products and services. Human capital (or talent) is one of the sector's most valued commodities and Life Sciences firms will travel to where the talent is located rather than wait to develop the talent within a given geography. Therefore, San Diego needs to focus on keeping the talent pipeline strong to give Life Sciences companies the workforce required for them to stay in the region.

APPENDIX A: OCCUPATIONAL PROFILES







Sources: U.S. Bureau of Labor Statistics, Economic Modeling Specialists, International and O*NET OnLine.

Engineering Technicians, Except Drafters, All Other

Standard Occupational Code: 17-3029

Other Job Title(s): Manufacturing Technician, Production Technician, Manufacturing Assembler, Production Assembler, Engineering Technician, Manufacturing Specialist

Description: Set up, test and adjust manufacturing machinery or equipment, using any combination of electrical, electronic, mechanical, hydraulic, pneumatic or computer technologies.

Fast Facts			
Current Employment (2013)		1,619	
Projected Employment (2018)		1,707	
Growth Rate (2013-2018)		5%	
Average Annual Openings (2013-2018)		52	
Hourly Pay Range		\$22.72 Entry-level	\$31.41 Median
Typical Educational Attainment		Associate degree	

Top Skills and Competencies

Technical	Non-Technical
Repair	Communication
Installation	Troubleshooting
Calibration	Detail-oriented
Cleaning	Quality Assurance and Control
Manufacturing Processes	Writing

Occupational Tasks







- Adhere to all applicable regulations, policies and procedures for health, safety and environmental compliance.
- Inspect finished products for quality and adherence to customer specifications.
- Set up and operate production equipment in accordance with current good manufacturing practices and standard operating procedures.
- Calibrate or adjust equipment to ensure quality production, using tools such as calipers, micrometers, height gauges, protractors or ring gauges.
- Set up and verify the functionality of safety equipment.
- Monitor and adjust production processes or equipment for quality and productivity.
- Troubleshoot problems with equipment, devices or products.
- Test products or subassemblies for functionality or quality.
- Plan and lay out work to meet production and schedule requirements.

Inspectors, Testers, Sorters, Samplers and Weighers

Standard Occupational Code: 51-9061

Other Job Title(s): Quality Control Associate, Quality Control Assistant, Quality Control Coordinator, Quality Assurance Analyst, Quality Assurance Auditor, Quality Assurance Specialist, Quality Inspector, Mechanical Inspector

Description: Inspect, test, sort, sample or weigh nonagricultural raw materials or processed, machined, fabricated, or assembled parts or products for defects, wear and deviations from specifications. May use precision measuring instruments and complex test equipment.

Fast Facts			
Current Employment (2013)		4,548	
Projected Employment (2018)		4,987	
Growth Rate (2013-2018)		10%	
Average Annual Openings (2013-2018)		194	
Hourly Pay Range		\$14.49 Entry-level	\$18.44 Median
Typical Educational Attainment		High School diploma or equivalent	

Top Skills and Competencies

Technical	Non-Technical
Inspection	Quality Assurance and Control
Micrometers	Communication
Calipers	Writing
Mathematics	Microsoft Excel
Repair	Organization

Occupational Tasks







- Inspect, test or measure materials, products, installations or work for conformance to specifications.
- Measure dimensions of products to verify conformance to specifications, using measuring instruments such as rulers, calipers, gauges or micrometers.
- Read blueprints, data, manuals or other materials to determine specifications, inspection and testing procedures, adjustment methods, certification processes, formulas or measuring instruments required.
- Record inspection or test data, such as weights, temperatures, grades or moisture content and quantities inspected or graded.
- Mark items with details such as grade or acceptance-rejection status.
- Notify supervisors or other personnel of production problems.
- Discard or reject products, materials or equipment not meeting specifications.
- Collect or select samples for testing or for use as models.
- Write test or inspection reports describing results, recommendations or needed repairs.
- Compare colors, shapes, textures or grades of products or materials with color charts, templates or samples to verify conformance to standards.

Medical and Clinical Laboratory Technologists

Standard Occupational Code: 29-2011

Other Job Title(s): Clinical Laboratory Scientists, Medical Lab Technician, Clinical Lab Scientist, Clinical Research Associate, Medical Technologist, Histology Technician, Histotechnician, Cytotechnologist, Laboratory Technologist

Description: Perform complex medical laboratory tests for diagnosis, treatment and prevention of disease. May train or supervise staff.

Fast Facts			
Current Employment (2013)		1,110	
Projected Employment (2018)		1,302	
Growth Rate (2013-2018)		17%	
Average Annual Openings (2013-2018)		70	
Hourly Pay Range		\$27.74 Entry-level	\$35.47 Median
Typical Educational Attainment		Bachelor's degree	
		\$43.18 Experienced	

Top Skills and Competencies

Technical	Non-Technical
Clinical Research	Organization
GCP	Writing
Clinical Study/Trials	Communication
Chemistry	Research
Medical Terminology	Quality Assurance and Control

Occupational Tasks







- Conduct chemical analysis of body fluids, including blood, urine or spinal fluid to determine presence of normal or abnormal components.
- Analyze laboratory findings to check the accuracy of the results.
- Operate, calibrate or maintain equipment used in quantitative or qualitative analysis, such as spectrophotometers, calorimeters, flame photometers or computer-controlled analyzers.
- Collect and study blood samples to determine the number of cells, their morphology or their blood group, blood type or compatibility for transfusion purposes, using microscopic techniques.
- Enter data from analysis of medical tests or clinical results into computer for storage.
- Establish or monitor quality assurance programs or activities to ensure the accuracy of laboratory results.
- Analyze samples of biological material for chemical content or reaction.
- Set up, clean, and maintain laboratory equipment.
- Provide technical information about test results to physicians, family members or researchers.
- Cultivate, isolate or assist in identifying microbial organisms or perform various tests on these microorganisms.

Medical and Clinical Laboratory Technicians

Standard Occupational Code: 29-2012

Other Job Title(s): Medical Laboratory Technician, Lab Assistant, Lab Technician, Specimen Accessioner, Specimen Processor, Photo Laboratory Technician, Clinical Technician

Description: Perform complex medical laboratory tests for diagnosis, treatment and prevention of disease. May work under the supervision of a medical technologist.

Fast Facts			
Current Employment (2013)		1,507	
Projected Employment (2018)		1,830	
Growth Rate (2013-2018)		21%	
Average Annual Openings (2013-2018)		109	
Hourly Pay Range		\$16.57 Entry-level	\$20.32 Median \$25.03 Experienced
Typical Educational Attainment		Associate degree	

Top Skills and Competencies

Technical	Non-Technical
Chemistry	Organization
Biology	Research
Laboratory Equipment	Communication
Phlebotomy	Writing
Experiments	Detail-oriented

Occupational Tasks







- Conduct chemical analyses of body fluids, such as blood or urine, using microscope or automatic analyzer to detect abnormalities or diseases and enter findings into computer.
- Conduct blood tests for transfusion purposes and perform blood counts.
- Examine cells stained with dye to locate abnormalities.
- Set up, maintain, calibrate, clean and test sterility of medical laboratory equipment.
- Analyze the results of tests or experiments to ensure conformity to specifications, using special mechanical or electrical devices.
- Analyze and record test data to issue reports that use charts, graphs or narratives.
- Consult with a pathologist to determine a final diagnosis when abnormal cells are found.
- Prepare standard volumetric solutions or reagents to be combined with samples, following standardized formulas or experimental procedures.
- Inoculate fertilized eggs, broths or other bacteriological media with organisms.
- Collect blood or tissue samples from patients, observing principles of asepsis to obtain blood sample.

Compliance Officers

Standard Occupational Code: 13-1041

Other Job Title(s): Regulatory Affairs Specialist, Regulatory Affairs Analyst, Compliance Analyst, Compliance Officer, Regulatory Affairs Coordinator, Regulatory Affairs Associate, Research Compliance and Contracts Coordinator

Description: Examine, evaluate, and investigate eligibility for or conformity with laws and regulations governing contract compliance of licenses and permits, and perform other compliance and enforcement inspection and analysis activities not classified elsewhere.

Fast Facts			
Current Employment (2013)		3,920	
Projected Employment (2018)		4,103	
Growth Rate (2013-2018)		5%	
Average Annual Openings (2013-2018)		111	
Hourly Pay Range		\$24.77 Entry-level	\$35.98 Median
Typical Educational Attainment		Bachelor's degree	

Top Skills and Competencies

Technical	Non-Technical
Regulatory Affairs	Communication
Legal Compliance	Organization
Medical Device	Writing
Labeling	Microsoft Excel
Product Development	Research

Occupational Tasks







- Coordinate, prepare, or review regulatory submissions for domestic or international projects.
- Provide technical review of data or reports that will be incorporated into regulatory submissions to assure scientific rigor, accuracy and clarity of presentation.
- Review product promotional materials, labeling, batch records, specification sheets or test methods for compliance with applicable regulations and policies.
- Maintain current knowledge base of existing and emerging regulations, standards or guidance documents.
- Interpret regulatory rules or rule changes and ensure that they are communicated through corporate policies and procedures.
- Determine the types of regulatory submissions or internal documentation that are required in situations such as proposed device changes or labeling changes.
- Advise project teams on subjects such as premarket regulatory requirements, export and labeling requirements, or clinical study compliance issues.
- Prepare or maintain technical files as necessary to obtain and sustain product approval.
- Coordinate efforts associated with the preparation of regulatory documents or submissions.

Medical Scientists, Except Epidemiologists

Standard Occupational Code: 19-1042

Other Job Title(s): Research Associate, Research Assistant, Clinical Laboratory Scientist, Laboratory Technologist, Scientist

Description: Conduct research dealing with the understanding of human diseases and the improvement of human health. Engage in clinical investigation, research and development or other related activities. Includes physicians, dentists, public health specialists, pharmacologists and medical pathologists who primarily conduct research.

Fast Facts			
Current Employment (2013)		5,089	
Projected Employment (2018)		5,586	
Growth Rate (2013-2018)		10%	
Average Annual Openings (2013-2018)		214	
Hourly Pay Range		\$28.98 Entry-level	\$39.64 Median \$50.58 Experienced
Typical Educational Attainment		Doctoral or professional degree	

Top Skills and Competencies

Technical	Non-Technical
Experiments	Research
Chemistry	Communication
Biology	Organization
Biochemistry	Writing
Molecular Biology	Microsoft Excel

Occupational Tasks







- Plan and direct studies to investigate human or animal disease, preventive methods and treatments for disease.
- Conduct research to develop methodologies, instrumentation and procedures for medical application, analyzing data and presenting findings to the scientific audience and general public.
- Study animal and human health and physiological processes.
- Follow strict safety procedures when handling toxic materials to avoid contamination.
- Write and publish articles in scientific journals.
- Evaluate effects of drugs, gases, pesticides, parasites and microorganisms at various levels.
- Use equipment such as atomic absorption spectrometers, electron microscopes, flow cytometers and chromatography systems.
- Prepare and analyze organ, tissue, and cell samples to identify toxicity, bacteria or microorganisms or to study cell structure.
- Standardize drug dosages, methods of immunization, and procedures for manufacture of drugs and medicinal compounds.
- Investigate cause, progress, life cycle or mode of transmission of diseases or parasites.

Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products

Standard Occupational Code: 41-4011

Other Job Title(s): Business Development Specialist, Sales Representative, Account Manager, Sales Specialist, Sales Executive, Inside Sales Representative, Outside Sales Representative

Description: Sell goods for wholesalers or manufacturers where technical or scientific knowledge is required in such areas as biology, engineering, chemistry and electronics, normally obtained from at least 2 years of post-secondary education.

Fast Facts			
Current Employment (2013)		4,079	
Projected Employment (2018)		4,531	
Growth Rate (2013-2018)		11%	
Average Annual Openings (2013-2018)		183	
Hourly Pay Range		\$24.93 Entry-level	\$34.95 Median \$47.42 Experienced
Typical Educational Attainment		Bachelor's degree	

Top Skills and Competencies

Technical	Non-Technical
Sales	Communication
Outside Sales	Organization
Sales Management	Microsoft Office
Business Development	Time Management
Account Management	Customer Service

Occupational Tasks







- Contact new and existing customers to discuss their needs, and to explain how these needs could be met by specific products and services.
- Answer customers' questions about products, prices, availability or credit terms.
- Quote prices, credit terms or other bid specifications.
- Emphasize product features based on analyses of customers' needs and on technical knowledge of product capabilities and limitations.
- Negotiate prices or terms of sales or service agreements.
- Maintain customer records, using automated systems.
- Identify prospective customers by using business directories, following leads from existing clients, participating in organizations and clubs and attending trade shows and conferences.
- Prepare sales contracts for orders obtained and submit orders for processing.
- Select the correct products or assist customers in making product selections, based on customers' needs, product specifications and applicable regulations.
- Collaborate with colleagues to exchange information, such as selling strategies or marketing information.

Industrial Production Managers

Standard Occupational Code: 11-3051

Other Job Title(s): Quality Assurance Analyst, Quality Assurance Auditor, Quality Assurance Specialist, Production Manager, Manufacturing Manager, Quality Manager

Description: Plan, direct, or coordinate the work activities and resources necessary for manufacturing products in accordance with cost, quality and quantity specifications.

Fast Facts			
Current Employment (2013)		1,380	
Projected Employment (2018)		1,371	
Growth Rate (2013-2018)		-1%	
Average Annual Openings (2013-2018)		26	
Hourly Pay Range		\$35.04 Entry-level	\$43.73 Median
Typical Educational Attainment		Bachelor's degree	

Top Skills and Competencies

Technical	Non-Technical
Good Manufacturing Practices (GMP)	Quality Assurance and Control
Inspection	Leadership
Six Sigma	Organization
Medical Device	Communication
Validation	Management

Occupational Tasks







- Review processing schedules or production orders to make decisions concerning inventory requirements, staffing requirements, work procedures or duty assignments, considering budgetary limitations and time constraints.
- Direct or coordinate production, processing, distribution or marketing activities of industrial organizations.
- Develop or implement production tracking or quality control systems, analyzing production, quality control, maintenance or other operational reports, to detect production problems.
- Review operations and confer with technical or administrative staff to resolve production or processing problems.
- Hire, train, evaluate or discharge staff or resolve personnel grievances.
- Prepare and maintain production reports or personnel records.
- Set and monitor product standards, examining samples of raw products or directing testing during processing, to ensure finished products are of prescribed quality.
- Develop budgets or approve expenditures for supplies, materials or human resources, ensuring that materials, labor or equipment are used efficiently to meet production targets.
- Initiate or coordinate inventory or cost control programs.

Laborers and Freight Stock Materials Movers, Hand

Standard Occupational Code: 53-7062

Other Job Title(s): Materials Handler, Supply Chain Technician, Warehouse Worker, General Laborer

Description: Materials Handler, Supply Chain Technician, Warehouse Worker, General Laborer

Fast Facts			
Current Employment (2013)		17,079	
Projected Employment (2018)		18,109	
Growth Rate (2013-2018)		6%	
Average Annual Openings (2013-2018)		757	
Hourly Pay Range		\$10.05 Entry-level	\$11.95 Median
Typical Educational Attainment		Less than high school diploma	

Top Skills and Competencies

Technical	Non-Technical
Physical Demand	Communication
Forklift Operation	Customer Service
Inspection	Positive Disposition
Mathematics	Lotus Notes
Inventory Management	Organization

Occupational Tasks







- Move freight, stock, or other materials to and from storage or production areas, loading docks, delivery vehicles, ships, or containers, by hand or using trucks, tractors or other equipment.
- Sort cargo before loading and unloading.
- Attach identifying tags to containers or mark them with identifying information.
- Read work orders or receive oral instructions to determine work assignments or material or equipment needs.
- Stack cargo in locations such as transit sheds or in holds of ships as directed, using pallets or cargo boards.
- Record numbers of units handled or moved, using daily production sheets or work tickets.
- Install protective devices, such as bracing, padding or strapping, to prevent shifting or damage to items being transported.
- Direct spouts and position receptacles, such as bins, carts or containers so they can be loaded.
- Attach slings, hooks, or other devices to lift cargo and guide loads.
- Maintain equipment storage areas to ensure that inventory is protected.

Production, Planning, and Expediting Clerks

Standard Occupational Code: 43-5061

Other Job Title(s): Materials Handler, Supply Chain Technician, Scheduler, Operations Specialist, Production Assistant, Production Coordinator

Description: Coordinate and expedite the flow of work and materials within or between departments of an establishment according to production schedule. Duties include reviewing and distributing production, work and shipment schedules; conferring with department supervisors to determine progress of work and completion dates; and compiling reports on progress of work, inventory levels, costs and production problems.

Fast Facts			
Current Employment (2013)		3,610	
Projected Employment (2018)		3,724	
Growth Rate (2013-2018)		3%	
Average Annual Openings (2013-2018)		115	
Hourly Pay Range		\$17.94 Entry-level	\$23.23 Median
Typical Educational Attainment		High School diploma or equivalent	

Top Skills and Competencies

Technical	Non-Technical
Scheduling	Communication
Inventory Management	Microsoft Office
Purchasing	Organization
Mathematics	Planning
Enterprise Resource Planning (ERP)	Detail-oriented

Occupational Tasks

- Distribute production schedules or work orders to departments.
- Review documents, such as production schedules, work orders or staffing tables, to determine personnel or materials requirements or material priorities.
- Requisition and maintain inventories of materials or supplies necessary to meet production demands.
- Arrange for delivery, assembly, or distribution of supplies or parts to expedite flow of materials and meet production schedules.
- Confer with department supervisors or other personnel to assess progress and discuss needed changes.
- Revise production schedules when required due to design changes, labor or material shortages, backlogs, or other interruptions, collaborating with management, marketing, sales, production or engineering.
- Confer with establishment personnel, vendors, or customers to coordinate production or shipping activities and to resolve complaints or eliminate delays.

APPENDIX B: SUPPLY DATA AND DEMAND CROSSWALKS

Supply Data

San Diego County Occupation-related Training Programs & Completions³⁸

Training Provider/ Institution	Program Description	Type of Program	Annual Supply (2012-2013)
Lab Assistant CIP: 15.0401, 26.0502			
MiraCosta College	Biotechnology and Biomedical Technology	Certificate Associate	26*
Miramar College	Biotechnology and Biomedical Technology	Associate	25*
San Diego City College	Applied Biotechnology	Associate	23*
Southwestern College	Biotechnology and Biomedical Technology	Certificate Associate	20*
UC San Diego	Biological Sciences	Bachelor	29
San Diego State University	Biography	Bachelor Master	19 3
Sub Total			145
Manufacturing or Production Technician CIP: 15.0304			
San Diego City College	Engineering Technologies and Engineering	Certificate Associate	7
Sub Total			7
Materials Handler CIP: 52.0203			
Southwestern College	Logistics and Materials Transportation	Certificate	5
University of San Diego	Industrial & Systems Engineering	Post 4-year	10
	Logistics & Materials Management	Certificate Master	22
Sub Total			37
Medical Lab Technician CIP: 51.1004			
Miramar College	Medical Laboratory Technology	Certificate Associate	31
Southwestern College	Medical Laboratory Technology	Associate	11
Sub Total			42
Quality Assurance & Quality Control CIP: 41.9999, 15.0702			
San Diego State University	Quality Control and Safety Technologies/ Technicians	Master	1
Sub Total			1
Regulatory Affairs Specialist CIP: 51.2010			
National University	Legal Professions and Studies	Bachelor	13
Sub Total			13

³⁸ Source: Data Mart, IPEDS, Faculty Interviews.

Sales Representative CIP: 52.1804			
San Diego State University	Business, Management, Marketing, and Related Support	Master	24
Sub Total			24
Total Completions			269

*The California Community Colleges' Life Sciences/Biotechnology Initiative and Centers of Excellence conducted research in 2014 that determined that the Data Mart data reported for these programs by colleges was incomplete and not reflective of actual supply. The research team conducted interviews with faculty members of the four community colleges in San Diego County and determined the numbers shown in this table as actual annual supply of job ready laboratory workforce.

Job Title – SOC Crosswalk

Employers advertise open positions using job titles that differ significantly from the standard occupational classification (SOC) titles used by the U.S. Department of Labor, Bureau of Labor Statistics (BLS).

Crosswalk of Job Titles & SOCs

Job Title	SOC Title	SOC Code
Materials handler or supply-chain technician	Laborers and Freight Stock Materials Movers, Hand	53-7062
Quality assurance analyst, auditor, or specialist	Inspectors, Testers, Sorters, Samplers, and Weighers	51-9061
Quality control associate, assistant, or coordinator	Industrial Production Managers	11-3051
Medical lab technician or clinical lab scientist	Medical and Clinical Laboratory Technologists	29-2011
Lab assistant, technician, specimen accessioner or processor	Medical and Clinical Laboratory Technicians	29-2012
Manufacturing or production technician or assembler	Engineering Technicians, Except Drafters, All Other	17-3029
Regulatory affairs specialist or analyst	Compliance Officers	13-1041
Sales representative or business development specialist	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	41-4011
Research associate or assistant (preclinical, R&D, or clinical)	Medical Scientists, Except Epidemiologists	19-1042

APPENDIX C: DEFINITIONS

North American Industry Classification System (NAICS) Codes for Life Sciences

NAICS Code	NAICS Description
Agricultural Feedstock & Chemicals	
311221	Wet Corn Milling
311222	Soybean Processing
311223	Other Oilseed Processing
325193	Ethyl Alcohol Manufacturing
325221	Cellulosic Organic Fiber Manufacturing
325311	Nitrogenous Fertilizer Manufacturing
325312	Fertilizer (Mixing Only) Manufacturing
325320	Pesticide and Other Agricultural Chemical Manufacturing
Drugs & Pharmaceuticals	
325411	Medicinal and Botanical Manufacturing
325412	Pharmaceutical Preparation Manufacturing
325413	In-Vitro Diagnostic Substance Manufacturing
325414	Biological Product (except Diagnostic) Manufacturing
Medical Devices & Equipment	
334510	Electrometrical and Electrotherapeutic Apparatus Manufacturing
334516	Analytical Laboratory Instrument Manufacturing
334517	Irradiation Apparatus Manufacturing
339112	Surgical and Medical Instrument Manufacturing
339113	Surgical Appliance and Supplies Manufacturing
339114	Dental Equipment and Supplies Manufacturing
Research, Testing, & Medical Laboratories	
541380	Testing Laboratories
541711	Research and Development in Biotechnology
621511	Medical Laboratories
Bioscience-Related Distribution	
423450	Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers
424210	Drugs and Druggists' Sundries Merchant Wholesalers
424910	Farm Supplies and Merchant Wholesalers
M-Health or Wireless Health	
511210	Software Publishers
518210	Data Processing, Hosting, and Related Services

Standard Occupational Classification (SOC) Codes for Life Sciences

Job Title	SOC Description	SOC Code
Materials handler or supply-chain technician	Laborers and Freight Stock Materials Movers, Hand	53-7062
Quality assurance analyst, auditor, or specialist	Inspectors, Testers, Sorters, Samplers, and Weighers	51-9061 11-3051
Quality control associate, assistant, or coordinator	Industrial Production Managers	
Medical lab technician or clinical lab scientist	Medical and Clinical Laboratory Technologists	29-2011 29-2012
Lab assistant, technician, specimen accessioner or processor	Medical and Clinical Laboratory Technicians	
Manufacturing or production technician or assembler	Engineering Technicians, Except Drafters, All Other	17-3029
Regulatory affairs specialist or analyst	Compliance Officers	13-1041
Sales representative or business development specialist	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	41-4011
Research associate or assistant (preclinical, R&D, or clinical)	Medical Scientists, Except Epidemiologists	19-1042

APPENDIX D: METHODOLOGY

Data compiled for this report were drawn from both primary and secondary data sources. The following table provides a brief overview of the methodology utilized for the survey research component of the project. BW Research also completed several qualitative executive interviews with industry employers and regional stakeholders.

Overview of Survey Methodology

Method	Telephone & web survey of Life Science businesses in San Diego County
Number of Survey Participants	137 Life Sciences businesses in San Diego County
Survey Field Dates	May 19 – June 17, 2014
Survey Universe	2,215 businesses in San Diego County
Survey Margin of Error	The margin of error for questions answered by all 137 Life Sciences businesses was +/- 8.11 at the 95% level of confidence.

Survey Design

Through an iterative process, BW Research worked closely with the San Diego Workforce Partnership (SDWP) to develop a survey instrument that met the research objectives of the study. In developing the survey instrument, BW Research utilized techniques to overcome known biases in survey research and minimize potential sources of measurement error within the survey.

Sampling Method: A database of 2,215 San Diego firms in a Life Sciences related industry. Initially, there were 388 known firms and 1,827 unknown firms.

Data Collection: Prior to beginning data collection, BW Research conducted interviewer training and also pre-tested the survey instruments to ensure that the respondents easily understood all words and questions. The data collection period was May 19th through June 17th, 2014.

Margin of Error: The overall margin of error for the surveys at the 95 percent confidence level is +/- 8.11 percent for all questions answered by all 137 firms.

Life Sciences Employment Estimation

Life Sciences employment in San Diego County was derived from a multiple method approach that is broken into the three phases listed below.

Phase 1: Develop, classify, and analyze a database of known Life Sciences firms in San Diego County, provided by Biocom and SDWP. Duplicates were removed based on identifying factors such as phone number, company name and address. Next, SANDAG populated firm employment from either self-identified survey responses, or by matching firm employment to 2013 numbers provided by Dun & Bradstreet and InfoUSA. This was completed by SANDAG. The overall total for employment and individual establishments were then divided into four industry groups based on 2-digit NAICS, which consisted of:

- Distribution – NAICS 42

- Healthcare Labs – NAICS 62
- Information and Professional, Scientific, & Technical Services – NAICS 51 & 54
- Manufacturing – NAICS 31-33

Phase 2: Compile and clean the disposition file of all unknown firms that were called for the survey component of the study and organize the list into the four sectors listed previously. Next, San Diego employment and establishment information for the corresponding 2-digit NAICS industries were downloaded from Economic Modeling Specialists, International (EMSI). An incidence rate was established for the unknown universe within each of the four industry categories by determining the percentage of firms that identified with Life Sciences out of all establishments contacted. Finally, this factor (or rate) was applied to overall NAICS employment within each industry division to derive an estimate of Life Sciences employment. The same process also applied to establishment totals.

Phase 3: The final phase compared the employment and establishment totals for the four industry groups between the known and unknown universe of firms. Within each industry group and between universes, the highest totals for employment and establishments were used to apply to the final Life Sciences total. This was done for two reasons:

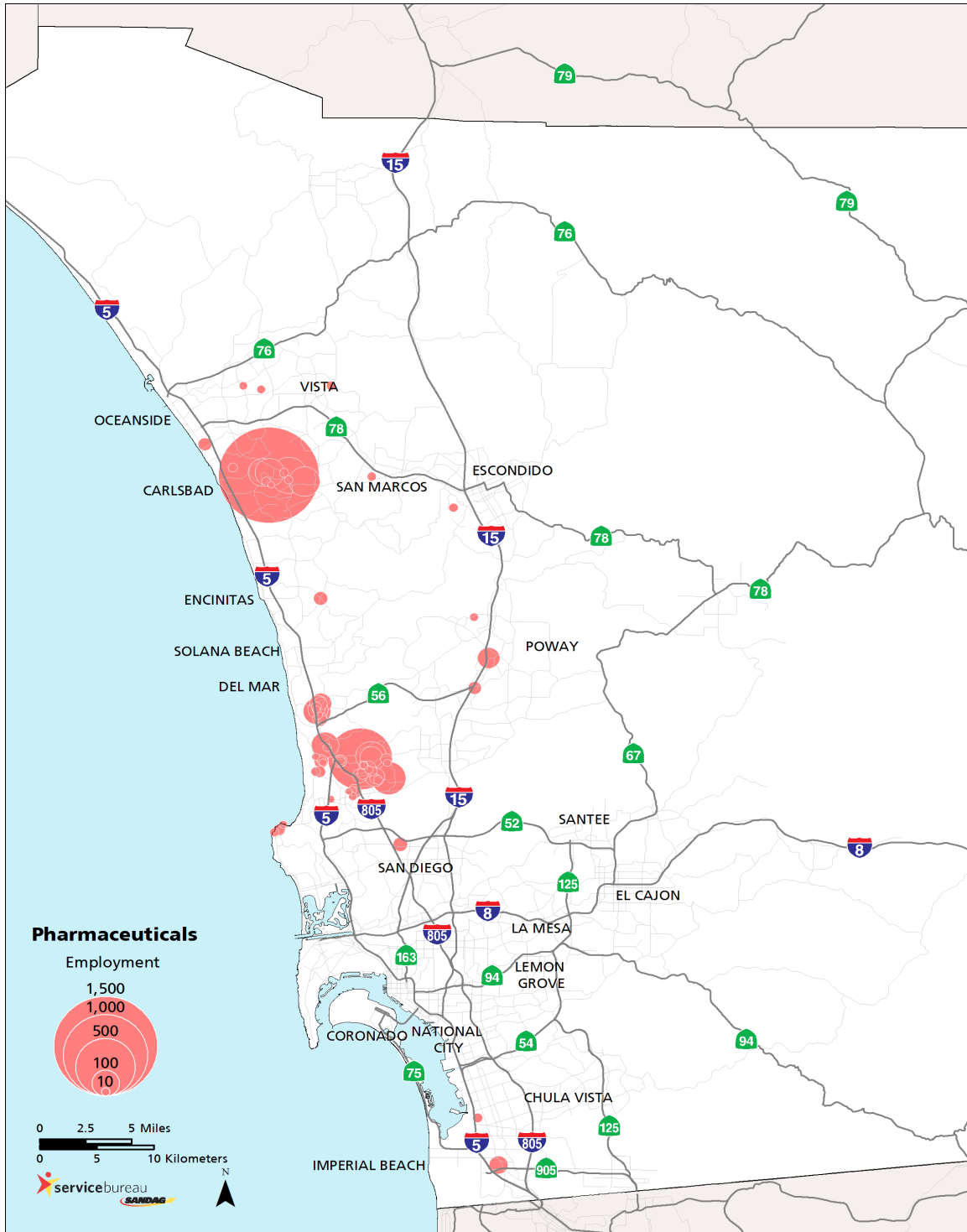
1. If the known universe total was higher, it was concluded that the database of known firms was more robust than the totals that were provided from an industry incidence factor. This was the case for Life Sciences distribution, manufacturing, and healthcare labs.
2. If the unknown universe was prominently higher, it was concluded that the known list of firms was not so robust and the incidence analysis provided a more accurate picture of employment. This was the case for Information and Professional, Scientific, & Technical Services. This is unsurprising as this grouping of NAICS industries has experienced the greatest growth over the last decade within Life Sciences and would; therefore, make it difficult to maintain an updated list of known firms.

Average Annual Job Openings (Demand)

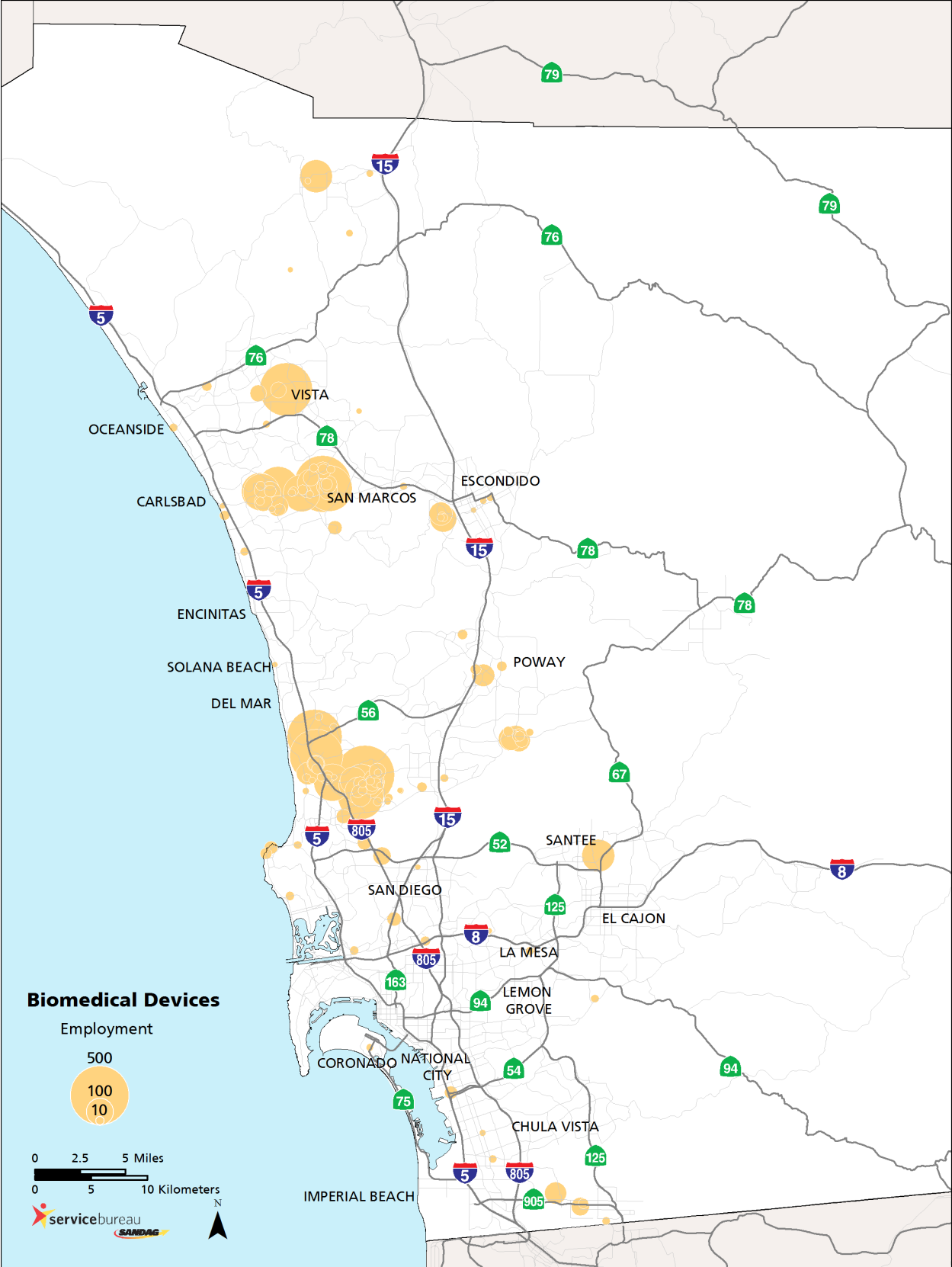
Calculated by comparing the total 2013 and 2018 jobs to staffing patterns (%), obtaining the average percentage of staffing patterns, then using the percentage to determine the average annual openings as a percentage of total annual openings.

APPENDIX E: SUBSECTOR MAPS

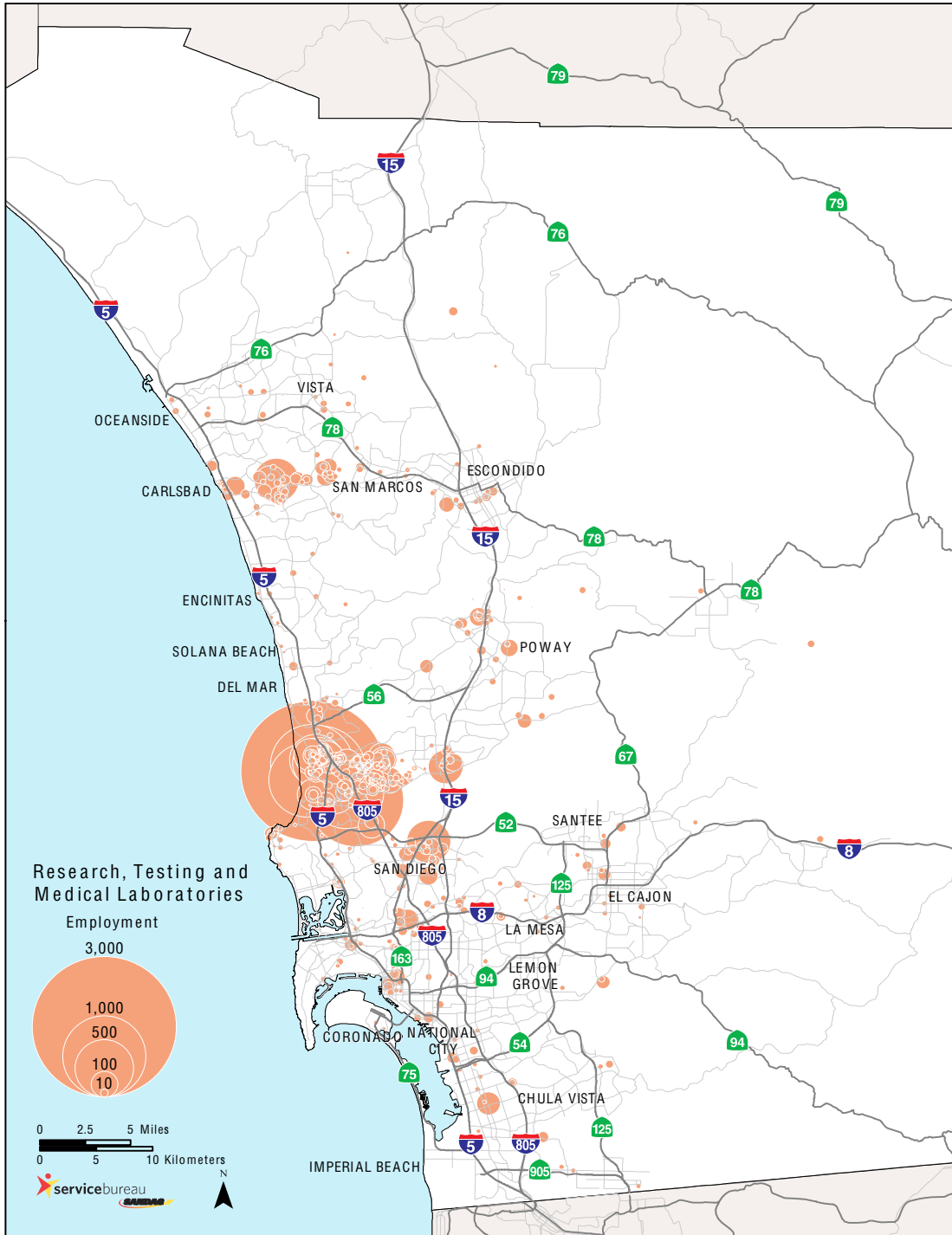
Pharmaceutical Employment in San Diego County



Biomedical Devices Employment in San Diego County

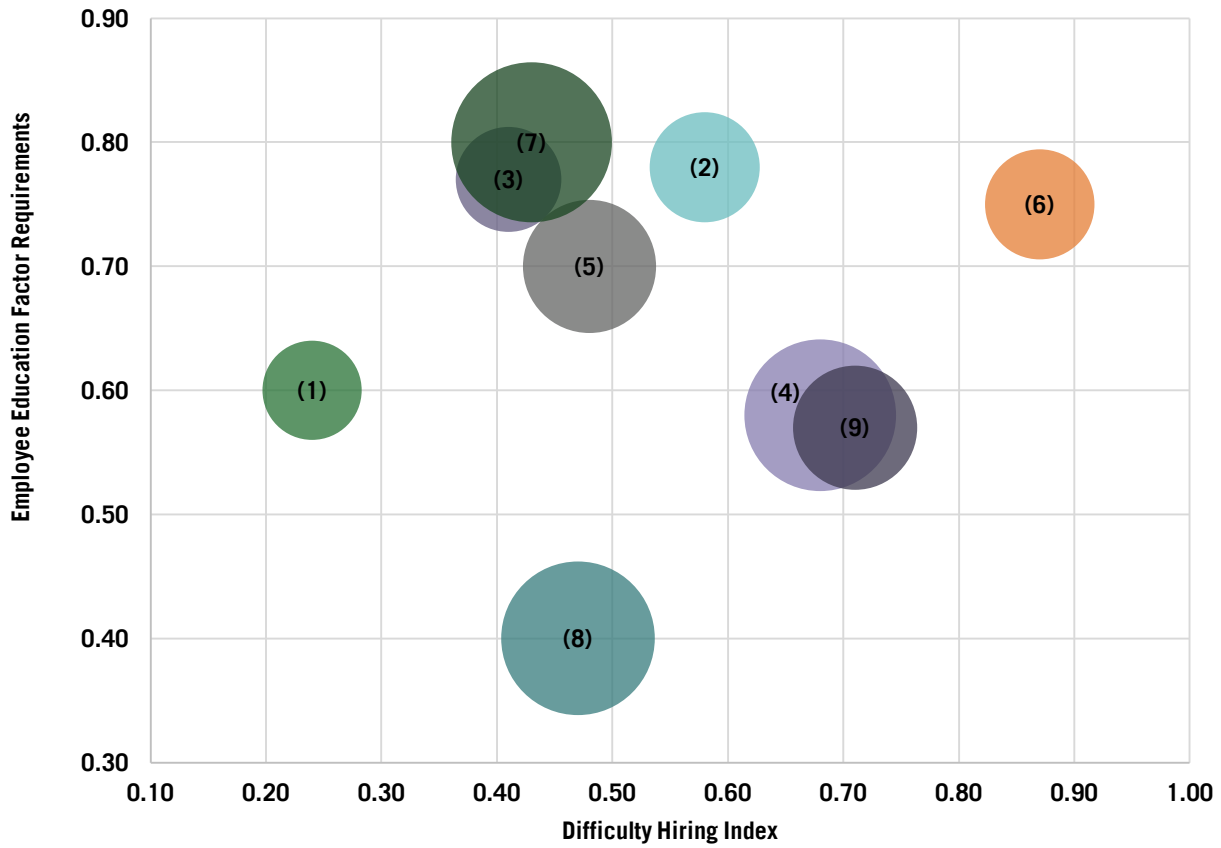


Research & Development (Life Sciences) Employment in San Diego



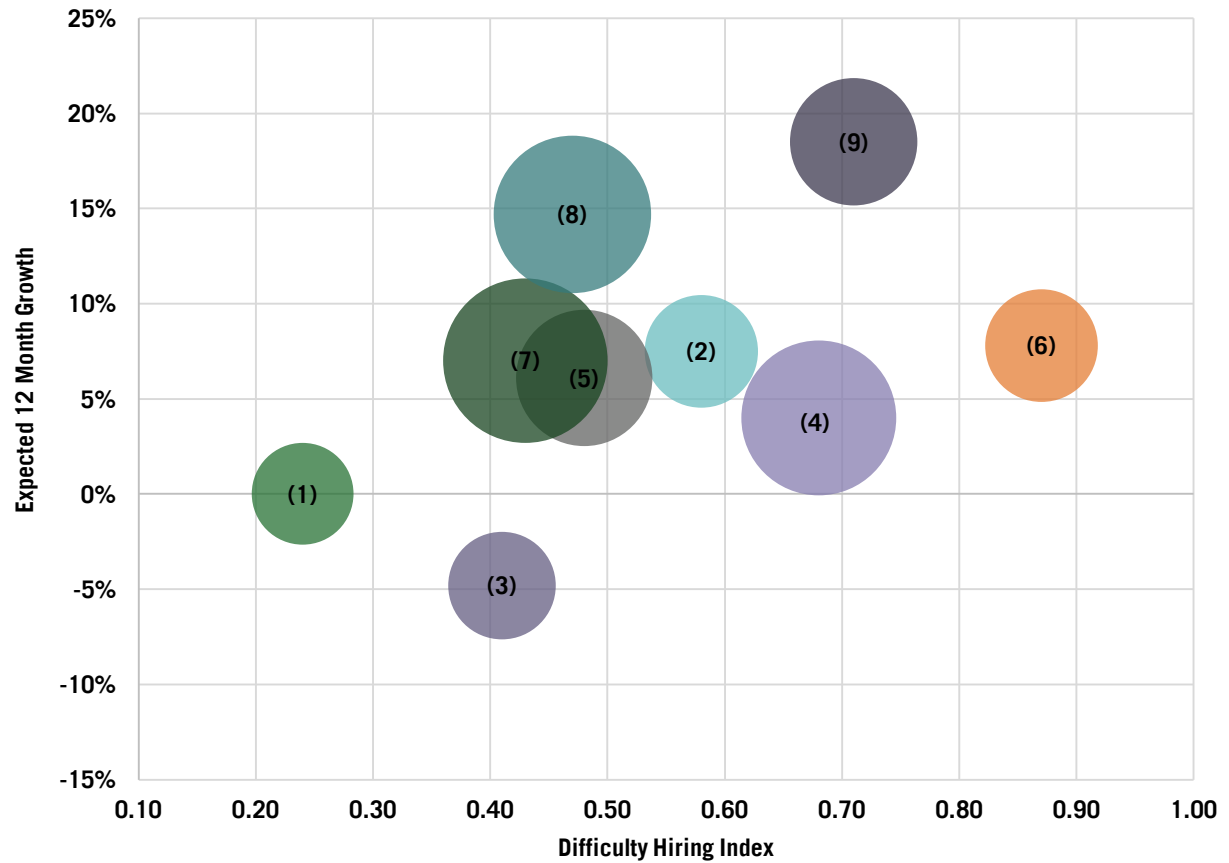
APPENDIX F: ADDITIONAL FIGURES

Employer Reported Hiring Difficulty vs. Employer Expectations for Employee Education Levels



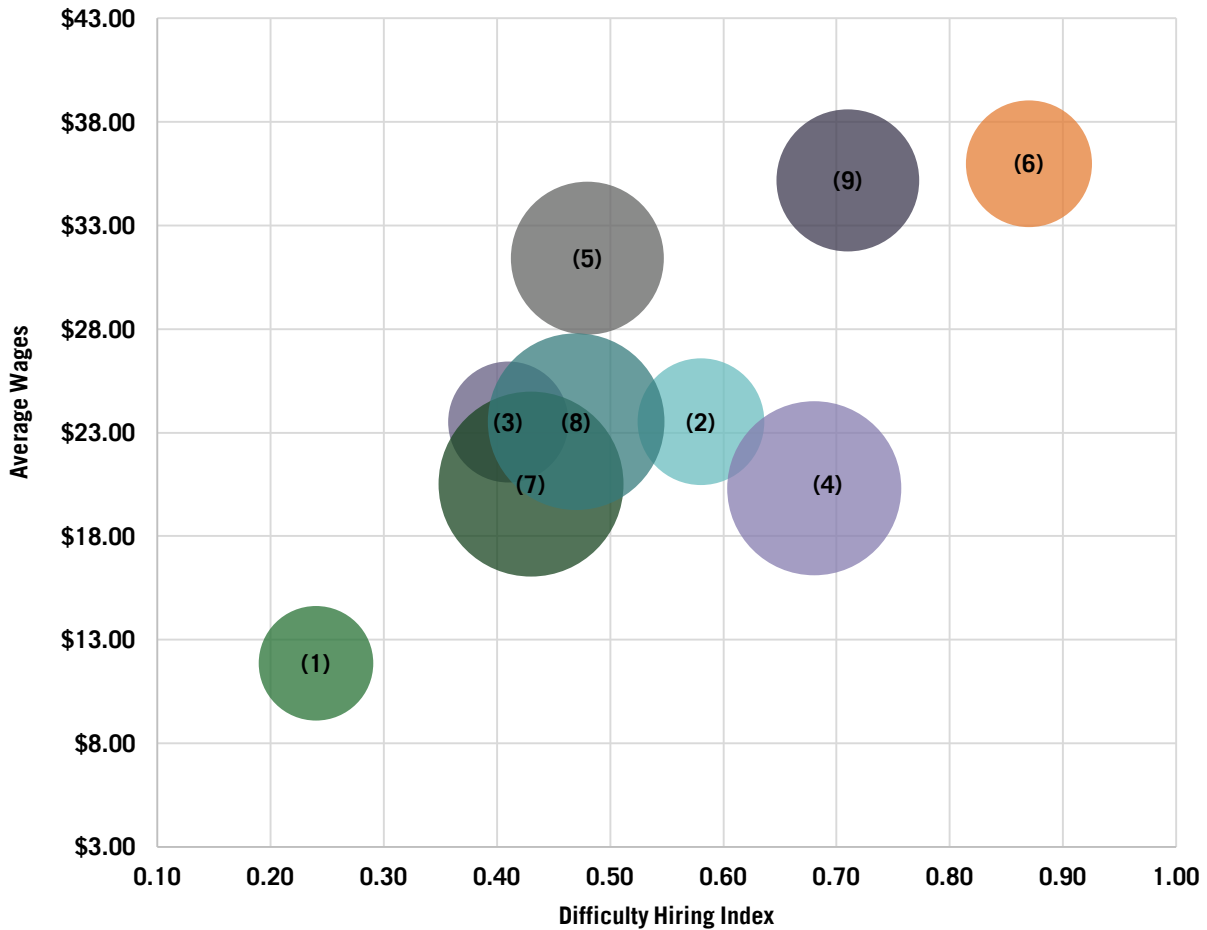
- (1) Materials handler or supply-chain technician (739 jobs)
- (2) Quality assurance analyst, auditor or specialist (909 jobs)
- (3) Quality control associate, assistant or coordinator (826 jobs)
- (4) Medical lab technician or Clinical lab scientist (1,718 jobs)
- (5) Manufacturing or production technician or assembler (1,325 jobs)
- (6) Regulatory affairs specialist or analyst (902 jobs)
- (7) Lab assistant, technician or specimen assessor or processor (1,928 jobs)
- (8) Research associate or assistant (Preclinical, R&D or Clinical) (1,767 jobs)
- (9) Sales representative or business development specialist (1,152 jobs)

Employer Reported Hiring Difficulty vs. Employer Reported 12-Month Growth Expectations



- (1) Materials handler or supply-chain technician (739 jobs)
- (2) Quality assurance analyst, auditor or specialist (909 jobs)
- (3) Quality control associate, assistant or coordinator (826 jobs)
- (4) Medical lab technician or Clinical lab scientist (1,718 jobs)
- (5) Manufacturing or production technician or assembler (1,325 jobs)
- (6) Regulatory affairs specialist or analyst (902 jobs)
- (7) Lab assistant, technician or specimen assessor or processor (1,928 jobs)
- (8) Research associate or assistant (Preclinical, R&D or Clinical) (1,767 jobs)
- (9) Sales representative or business development specialist (1,152 jobs)

Employer Reported Hiring Difficulty vs. Average Wage by Occupation



- (1) Materials handler or supply-chain technician (739 jobs)
- (2) Quality assurance analyst, auditor or specialist (909 jobs)
- (3) Quality control associate, assistant or coordinator (826 jobs)
- (4) Medical lab technician or Clinical lab scientist (1,718 jobs)
- (5) Manufacturing or production technician or assembler (1,325 jobs)
- (6) Regulatory affairs specialist or analyst (902 jobs)
- (7) Lab assistant, technician or specimen assessor or processor (1,928 jobs)
- (8) Research associate or assistant (Preclinical, R&D or Clinical) (1,767 jobs)
- (9) Sales representative or business development specialist (1,152 jobs)

APPENDIX G: TOPLINE SURVEY RESULTS

Introduction:

We would value your participation in a brief survey about San Diego County’s Life Science businesses and their talent needs.

The survey should take approximately 10 to 14 minutes of your time. By answering this survey, you can help inform how investments should be made to train and prepare workers to meet the needs of industry.

The San Diego Workforce Partnership and the local community colleges, which are committed to developing the regional workforce, commissioned this study. BW Research Partnership, an independent research organization, conducted the study.

Your individual responses will not be published; only aggregate information will be used in the reporting of the study results.

Screener Questions

A. Does your firm work in any of the following life science industry segments? (n=137)

16.1%	Pharmaceuticals
10.2%	Agricultural & industrial biotechnology
27.0%	Medical devices
14.6%	Research, testing & medical laboratories
16.8%	Other
15.3%	Multiple

B. Do you have one or more office locations with employees in San Diego County, California? (n=137)

88.3%	Yes, just one location in San Diego County [CONTINUE]
11.7%	Yes, two or more office locations in San Diego County [CONTINUE]
0.0%	No (no office locations in San Diego County) [TERMINATE]
0.0%	Not sure [TERMINATE]

[ASK QC1 IF QB=2] QC1

Do you feel comfortable answering questions about the hiring and staffing needs of all your San Diego County locations, or would you be more confident talking about the staffing and hiring needs of just your current location? (n=16)

56.3%	I feel confident talking about staffing at all San Diego County locations [CONTINUE]
43.8%	I feel more confident talking about staffing at my current location only [CONTINUE]
0.0%	I don't feel comfortable/qualified talking about staffing for the company

[ASK IF QB=1] QC2

Do you feel comfortable answering questions about the hiring and staffing needs of your location? (n=121)

100.0% Yes, I feel confident talking about staffing at my current location
 0.0% I don't feel comfortable/qualified talking about staffing for the company

[ASK IF QC1=3 OR QC2=2] QC3.

Please provide us with the contact information of someone at your firm who is better able to answer questions about hiring and staffing.

Name: _____ Email: _____ Phone: _____

TERMINATE IF RESPONDENT WAS ASKED QC3

INTRO

[DISPLAY IF QC1=1]

For the remainder of this survey please answer questions based on **all of your firms' locations in San Diego County.**

[DISPLAY IF QC1=2 OR QC2=1]

For the remainder of this survey please answer questions based on your **current location in San Diego County.**

SECTION 1 - Initial Profile

1. Including all full-time and part-time employees, how many **permanent** employees work at or from your (current) San Diego County location(s)? (n=137)

Record # of employees _____

[IF UNABLE TO PROVIDE NUMBER OFFER INTERVALS]

30.7%	Less than 5
21.2%	Between 5 and 9
19.7%	Between 10 and 24
6.6%	Between 25 and 49
9.5%	Between 50 and 99
10.9%	100 or more
1.5%	(DON'T READ) DK/NA

2. If you currently have [TAKE Q2 #] full-time and part-time **permanent** employees, how many more or less employees do you expect to have 12 months from now? (n=137)

50.4% More

2.2% Fewer
 40.1% (DON'T READ) Same
 7.3% (DON'T READ) DK/NA

	<u>Current</u>	<u>12 months</u>
n	122	122
Mean	53.30	56.75
Median	7.00	8.00
Total Employees	6,258	6,848
Change		590
% Growth		9.4%

[IF UNABLE TO PROVIDE NUMBER OFFER INTERVALS]

- 1 Less than 5
- 2 Between 5 and 9
- 3 Between 10 and 24
- 4 Between 25 and 49
- 5 Between 50 and 99
- 6 100 or more
- 7 (DON'T READ) DK/NA

[If amount differs by 10% or more in either direction, ask:]

Just to confirm, you currently have _____ employees and you expect to have _____ (more/less) employees, for a total of ___ employees 12 months from now.

Next I want to focus on those workers that are not permanent workers, they are either temporary or contract and working on a project-by-project basis or for a certain period of time.

3. How often does your (current) San Diego County location(s) hire non-permanent workers, either on a temporary or contract basis? (n=134)

20.1% Regularly (50% to 100% of the time)
 22.4% Sometimes (10% to 49% of the time)
 24.6% Rarely (1% to 9% of the time)
 30.6% Never (0% of the time)
 2.2% (DON'T READ) DK/NA

4. Now I want to focus specifically on your entry-level employees, how often do you hire entry-level employees as a temp to hire? (n=134)

Temp to hire is hiring an employee on a temporary basis, often through a temp agency, and determining if the business and/or worker makes it worthwhile to hire on a permanent basis.

- 9.7% Regularly (50% to 100% of the time)
- 21.6% Sometimes (10% to 49% of the time)
- 23.9% Rarely (1% to 9% of the time)
- 43.3% Never (0% of the time)
- 1.5% (DON'T READ) DK/NA

Now I would like to ask about your organization's need for new employees.

5. Generally, how much difficulty does your company have finding qualified **entry-level** applicants who meet the organization's hiring standards in your (current) San Diego County location(s)? (n=134)

- 47.0% Little to no difficulty
- 29.9% Some difficulty
- 11.2% Great difficulty
- 11.9% (DON'T READ) DK/NA

6. Generally, how much difficulty does your company have finding qualified **non entry-level** applicants who meet the organization's hiring standards in your (current) San Diego County location(s)? (n=134)

- 35.1% Little to no difficulty
- 38.8% Some difficulty
- 17.9% Great difficulty
- 8.2% (DON'T READ) DK/NA

IF Q6=2 OR 3 ASK Q7 OTHERWISE SKIP

7. Are there specific skills or areas of expertise that are difficult to find among non entry-level job applicants?

Verbatim responses to be provided

8. Of the [TAKE Q2 #] full-time and part-time **permanent** employees that work at or from your (current) location(s), how many of these work in **Research, Development and regulatory affairs**? (n=134)

This includes positions in bioinformatics, animal sciences, drug information and clinical and preclinical research

- 41.0% No permanent employees
- 25.4% 1 to 4 permanent employees
- 9.0% 5 to 9 permanent employees
- 9.7% 10 to 24 permanent employees
- 2.2% 25 to 49 permanent employees
- 3.0% 50 to 99 permanent employees
- 2.2% 100 to 249 permanent employees
- 0.7% 250 to 499 permanent employees
- 1.5% 500 or more permanent employees
- 5.2% (DON'T READ) DK/NA

[Q8 should be less than or equal to Q2 - BUILD IN CHECK]

9. Thinking about the [TAKE Q8 #] full-time and part-time **permanent Research, Development and regulatory affairs employees**, do you expect to have more, less or the same number of these employees 12 months from now? (n=134)

27.6%	More
2.2%	Fewer
67.9%	Same number
2.2%	(DON'T READ) DK/NA

10. Of the [TAKE Q2 #] full-time and part-time **permanent** employees that work at or from your (current) location(s), how many of these work in **Operations, manufacturing and quality control**? [IF NEEDED REREAD DEFINITION OF SEGMENT] (n=134)

This includes positions in process & product development, environmental health & safety, and quality assurance, control and validation

39.6%	No permanent employees
34.3%	1 to 4 permanent employees
7.5%	5 to 9 permanent employees
7.5%	10 to 24 permanent employees
2.2%	25 to 49 permanent employees
2.2%	50 to 99 permanent employees
0.7%	100 to 249 permanent employees
0.7%	250 to 499 permanent employees
0.7%	500 or more permanent employees
4.5%	(DON'T READ) DK/NA

[Q8 + Q10 should be less than or equal to Q2 - BUILD IN CHECK]

11. Thinking about the [TAKE Q10 #] full-time and part-time **permanent Operations, manufacturing and quality control** employees, do you expect to have more, less or the same number of these employees 12 months from now? (n=134)

23.1%	More
3.0%	Fewer
72.4%	Same number
1.5%	(DON'T READ) DK/NA

12. Of the [TAKE Q2 #] full-time and part-time **permanent** employees that work at or from your (current) location(s), how many of these work **Business Development, finance and administration**? [IF NEEDED REREAD DEFINITION OF SEGMENT] (n=134)

This includes positions in human resources, information systems, legal, marketing, sales, and project management

26.1%	No permanent employees
44.8%	1 to 4 permanent employees

9.7%	5 to 9 permanent employees
6.7%	10 to 24 permanent employees
3.0%	25 to 49 permanent employees
0.7%	50 to 99 permanent employees
2.2%	100 to 249 permanent employees
0.7%	250 to 499 permanent employees
6.0%	(DON'T READ) DK/NA

[Q8 + Q10 + Q12 should be less than or equal to Q2 - BUILD IN CHECK]

13. Thinking about the [TAKE Q12 #] full-time and part-time **permanent Business Development, finance and administration** employees, do you expect to have more, less or the same number of these employees 12 months from now? (n=104)

18.0%	More
3.0%	Fewer
75.2%	Same number
3.8%	(DON'T READ) DK/NA

SECTION 3 – Occupational Assessment Occupation-Related Questions

[NOTE - PLEASE COMMUNICATE TO RESPONDENT THAT WE WILL BE USING GENERAL OCCUPATIONAL TITLES RATHER THAN SPECIFIC JOB TITLES THAT MAY BE USED WITHIN EACH ORGANIZATION]

14. Now, examine specific occupations within your organization related to the work you do. The occupational titles we are using may differ from the specific position titles used in your organization. For these questions, I would like you to try to equate your organization’s specific position titles with the more general ones we will use here.

Please only assign one occupation to each employee. If they fall into more than one category, please assign them to the occupation in which they devote more of their time.

Please tell us if your organization employs individuals in positions matching the following general occupational titles in your (current) San Diego County location(s): (n=371)

<u>Mean</u>	<u>Occupation</u>
33.7%	1: Materials handler or supply-chain technician
40.4%	2: Quality assurance analyst, auditor or specialist
38.5%	3: Quality control associate, assistant or coordinator
5.8%	4: Animal technician
25.0%	5: Medical lab technician or clinical lab scientist
35.6%	6: Manufacturing or production technician or assembler
27.9%	7: Regulatory affairs specialist or analyst

- 41.3% 8: Lab assistant, technician or specimen accessioner or processor
- 49.0% 9: Research associate or assistant (Preclinical, R & D or Clinical)
- 59.6% 10: Sales representative or business development specialist

[FOR OCCUPATIONS USE LEAST QUOTA FILL METHOD]

Next I'm going to ask you a few questions about some of the occupations you mentioned, including__ (READ LIST OF OCCUPATIONS TO BE USED)

15. Please indicate how many individuals you have working at or from your location that are currently employed either full-time or part-time permanent employees in this occupation.

	<u>Occupation</u>	<u>Mean</u>
1	Materials handler or supply-chain technician (n=29)	2.90
2	Quality assurance analyst, auditor or specialist (n=32)	2.97
3	Quality control associate, assistant or coordinator (n=30)	2.83
4	Animal technician (n=3)	4.00
5	Medical Lab Technician or Clinical lab Scientist (n=17)	9.06
6	Manufacturing or production technician or assembler (n=22)	4.91
7	Regulatory affairs specialist or analyst (n=15)	4.27
8	Lab assistant, technician or specimen accessioner or processor (n=20)	6.15
9	Research associate or assistant (Preclinical, R & D or Clinical) (n=20)	4.75
10	Sales representative or business development specialist (n=31)	2.55

16. Please indicate how many more or less employees you estimate will be employed in each of the occupations 12 months from now.

[Use the following format for each one:]

If you currently have [TAKE Q15 #] [INSERT OCCUPATION TITLE]_____ at your location, how many more or less [INSERT OCCUPATION TITLE] do you expect to have at your location 12 months from now?

(IF NEEDED: Please exclude temporary, seasonal, and independent workers from these counts.)

	<u>Occupation</u>	<u>More</u>	<u>Fewer</u>	<u>Same number</u>	<u>DK/NA</u>
1	Materials handler or supply-chain technician (n=29)	23.3%	10.0%	63.3%	3.3%
2	Quality assurance analyst, auditor or specialist (n=32)	11.8%	5.9%	76.5%	5.9%
3	Quality control associate, assistant or coordinator (n=30)	9.7%	6.5%	80.6%	3.2%
4	Animal technician (n=3)	0.0%	0.0%	80.0%	20.0%
5	Medical Lab Technician or Clinical lab Scientist (n=17)	36.8%	0.0%	52.6%	10.5%
6	Manufacturing or production technician or assembler (n=22)	13.0%	0.0%	69.6%	17.4%
7	Regulatory affairs specialist or analyst (n=15)	25.0%	0.0%	68.8%	6.3%



8	Lab assistant, technician or specimen accessioner or processor (n=20)	27.3%	0.0%	54.5%	18.2%
9	Research associate or assistant (Preclinical, R & D or Clinical) (n=20)	50.0%	0.0%	50.0%	0.0%
10	Sales representative or business development specialist (n=31)	25.8%	0.0%	67.7%	6.5%

[If amount differs by 10% or more in either direction, ask:]

Just to confirm, you currently have _____ (insert occupation title) and you expect to have __ (more/less), for a total of _____ (insert occupation title) 12 months from now.

GROWTH

Occupation	% growth over the next 12 months
Materials handler or supply-chain technician (n=28)	0.0%
Quality assurance analyst, auditor or specialist (n=31)	7.5%
Quality control associate, assistant or coordinator (n=29)	-4.8%
Animal technician (n=3)	0.0%
Medical Lab Technician or Clinical lab Scientist (n=16)	4.0%
Medical Lab Technician or Clinical lab Scientist (n=16)	6.1%
Manufacturing or production technician or assembler (n=19)	7.8%
Regulatory affairs specialist or analyst (n=15)	7.8%
Lab assistant, technician or specimen accessioner or processor (n=18)	7.0%
Research associate or assistant (Preclinical, R & D or Clinical) (n=20)	14.7%
Sales representative or business development specialist (n=28)	18.5%

17. We are interested in the level of difficulty your location has in finding applicants who meet the organization’s hiring standards. Please indicate whether your location has no difficulty, some difficulty, or great difficulty finding qualified applicants. If you have more than one location, please answer for all of your San Diego County locations. (PRESENT IN ORDER THEY WERE PREVIOUSLY PRESENTED)

	Occupation	No Difficulty	Some Difficulty	Great Difficulty	DK/NA
1	Materials handler or supply-chain technician (n=30)	73.3%	23.3%	0.0%	3.3%
2	Quality assurance analyst, auditor or specialist (n=34)	47.1%	44.1%	5.9%	2.9%
3	Quality control associate, assistant or coordinator (n=31)	58.1%	32.3%	3.2%	6.5%
4	Animal technician (n=5)	20.0%	60.0%	20.0%	0.0%
5	Medical Lab Technician or Clinical lab Scientist (n=19)	52.6%	26.3%	21.1%	0.0%

6	Manufacturing or production technician or assembler (n=23)	56.5%	39.1%	4.3%	0.0%
7	Regulatory affairs specialist or analyst (n=16)	37.5%	31.3%	25.0%	6.3%
8	Lab assistant, technician or specimen accessioner or processor (n=22)	59.1%	31.8%	4.5%	4.5%
9	Research associate or assistant (Preclinical, R & D or Clinical) (n=20)	55.0%	35.0%	5.0%	5.0%
10	Sales representative or business development specialist (n=31)	48.4%	25.8%	19.4%	6.5%

18. Now, we'd like to know the **typical** education requirements for successful applicants within each occupation. The categories are (READ OPTIONS). Please indicate the typical education requirement for that occupation.

- 1 Completion of high school or equivalent
- 2 Certificate from an accredited college or training program
- 3 Associate's Degree from accredited college
- 4 Bachelor's Degree (B.A., B.S.)
- 5 Master's Degree or other graduate degree (M.A., M.S., MPA, MBA, Ph.D., J.D.)
- 6 (DON'T READ) DK/NA

	Occupation	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>DK/NA</u>
1	Materials handler or supply-chain technician (n=30)	56.7%	3.3%	13.3%	26.7%	0.0%	0.0%
2	Quality assurance analyst, auditor or specialist (n=34)	2.9%	5.9%	8.8%	64.7%	14.7%	2.9%
3	Quality control associate, assistant or coordinator (n=31)	12.9%	3.2%	12.9%	67.7%	3.2%	0.0%
4	Animal technician (n=5)	20.0%	60.0%	0.0%	20.0%	0.0%	0.0%
5	Medical Lab Technician or Clinical lab Scientist (n=19)	0.0%	10.5%	5.3%	73.7%	5.3%	5.3%
6	Manufacturing or production technician or assembler (n=23)	30.4%	21.7%	8.7%	39.1%	0.0%	0.0%
7	Regulatory affairs specialist or analyst (n=16)	12.5%	6.3%	0.0%	62.5%	18.8%	0.0%
8	Lab assistant, technician or specimen accessioner or processor (n=22)	9.1%	18.2%	27.3%	31.8%	9.1%	4.5%
9	Research associate or assistant (Preclinical, R & D or Clinical) (n=20)	10.0%	0.0%	0.0%	70.0%	20.0%	0.0%
10	Sales representative or business development specialist (n=31)	3.2%	3.2%	6.5%	51.6%	25.8%	9.7%



19. We are interested how often you hire applicants how have less than the typical education requirements for the position. Please indicate whether you sometimes, rarely or never hire individuals with less than the typical education requirements for that position. (PRESENT IN ORDER THEY WERE PREVIOUSLY PRESENTED)

	<u>Occupation</u>	<u>Sometimes</u>	<u>Rarely</u>	<u>Never</u>	<u>DK/NA</u>
1	Materials handler or supply-chain technician (n=30)	20.0%	20.0%	60.0%	0.0%
2	Quality assurance analyst, auditor or specialist (n=34)	23.5%	29.4%	44.1%	2.9%
3	Quality control associate, assistant or coordinator (n=31)	25.8%	25.8%	48.4%	0.0%
4	Animal technician (n=5)	40.0%	0.0%	60.0%	0.0%
5	Medical Lab Technician or Clinical lab Scientist (n=19)	21.1%	15.8%	63.2%	0.0%
6	Manufacturing or production technician or assembler (n=23)	17.4%	26.1%	43.5%	13.0%
7	Regulatory affairs specialist or analyst (n=16)	18.8%	37.5%	43.8%	0.0%
8	Lab assistant, technician or specimen accessioner or processor (n=22)	27.3%	18.2%	45.5%	9.1%
9	Research associate or assistant (Preclinical, R & D or Clinical) (n=20)	10.0%	20.0%	70.0%	0.0%
10	Sales representative or business development specialist (n=31)	16.1%	22.6%	58.1%	3.2%

20. Now we'd like to know how you prefer to train your existing employees in the occupation (READ OPTIONS). Please indicate how you prefer to train people for each occupation in the life sciences.

Check all that apply RANDOMIZE ORDER 1 - 5

- 1 On the job training
- 2 Customized training programs or courses at your location
- 3 Courses at a local training or education provider
- 4 Provide tuition reimbursement
- 5 Other, specify_
- 6 (DON'T READ) DK/NA

	<u>Occupation</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>DK/NA</u>
1	Materials handler or supply-chain technician	96.7%	33.3%	16.7%	16.7%	3.3%	0.0%
2	Quality assurance analyst, auditor or specialist	76.5%	26.5%	20.6%	20.6%	5.9%	8.8%
3	Quality control associate, assistant or coordinator	87.1%	32.3%	25.8%	22.6%	3.2%	3.2%
4	Animal technician	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5	Medical Lab Technician or Clinical lab Scientist	78.9%	15.8%	15.8%	5.3%	5.3%	10.5%
6	Manufacturing or production technician or assembler	78.3%	17.4%	17.4%	8.7%	4.3%	4.3%
7	Regulatory affairs specialist or analyst	50.0%	18.8%	6.3%	6.3%	18.8%	12.5%

8	Lab assistant, technician or specimen accessioner or processor	81.8%	18.2%	9.1%	13.6%	9.1%	4.5%
9	Research associate or assistant (Preclinical, R & D or Clinical)	80.0%	15.0%	10.0%	5.0%	10.0%	20.0%
10	Sales representative or business development specialist	77.4%	12.9%	19.4%	22.6%	12.9%	9.7%

21. We are going to present you with two applicants with different strengths. When hiring a (INSERT OCCUPATION), which would you prefer?

- Applicant One has recently completed or has almost completed their four-year college degree and is planning on going to graduate school in a related life science discipline.

or

- Applicant Two has more hands-on applied industry experience specific to (OCCUPATION NAME) but does not, and is not, in the process of a getting their four-year degree.

[IF NEEDED] Assume all other aspects of the applicants are equal.

	<u>Occupation</u>	<u>Applicant 1 Degree & Grad</u>	<u>Applicant 2 Specific Skills</u>	<u>(DON'T READ) It Depends</u>	<u>(DON'T READ) DK/NA</u>
1	Materials handler or supply-chain technician (n=30)	23.3%	63.3%	10.0%	3.3%
2	Quality assurance analyst, auditor or specialist (n=34)	41.2%	35.3%	11.8%	11.8%
3	Quality control associate, assistant or coordinator (n=31)	38.7%	41.9%	9.7%	9.7%
4	Animal technician (n=5)	0.0%	80.0%	20.0%	0.0%
5	Medical Lab Technician or Clinical lab Scientist (n=19)	63.2%	26.3%	5.3%	5.3%
6	Manufacturing or production technician or assembler (n=23)	18.2%	77.3%	4.5%	0.0%
7	Regulatory affairs specialist or analyst (n=16)	37.5%	43.8%	6.3%	12.5%
8	Lab assistant, technician or specimen accessioner or processor (n=22)	40.9%	50.0%	9.1%	0.0%
9	Research associate or assistant (Preclinical, R & D or Clinical) (n=20)	55.0%	25.0%	10.0%	10.0%
10	Sales representative or business development specialist (n=31)	25.8%	51.6%	12.9%	9.7%

[ASK FOR EACH OF THE THREE OCCUPATIONS]

22. Are there any skills, abilities or work activities that are important for [NAME OCCUPATION]_ that you are seeing deficiencies among job-applicants or current employees? If yes, what are they?

Verbatim responses to be provided

Before we finish, I'd like to ask you some general questions and verify your contact information.

23. May we contact you if we have any additional questions about your responses? (n=132)

86.4% Yes

13.6% No

24. Are you interested in receiving communications from the San Diego Workforce Partnership and the California Community Colleges including the findings of this research? (n=132)

44.7% Yes

55.3% No

Since it sometimes becomes necessary for the project manager to call back and confirm responses to certain questions, I would like to verify your contact information.

First and Last Name _____

Position _____

Phone _____

Email _____

Company Name _____

Company Address (including City, State, Zip) _____

Those are all the questions I have. Thank you very much for your time.

Date of Interview _____

Time of Interview _____

Name of Interviewer _____

Employer Type _____

Primary SIC _____

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