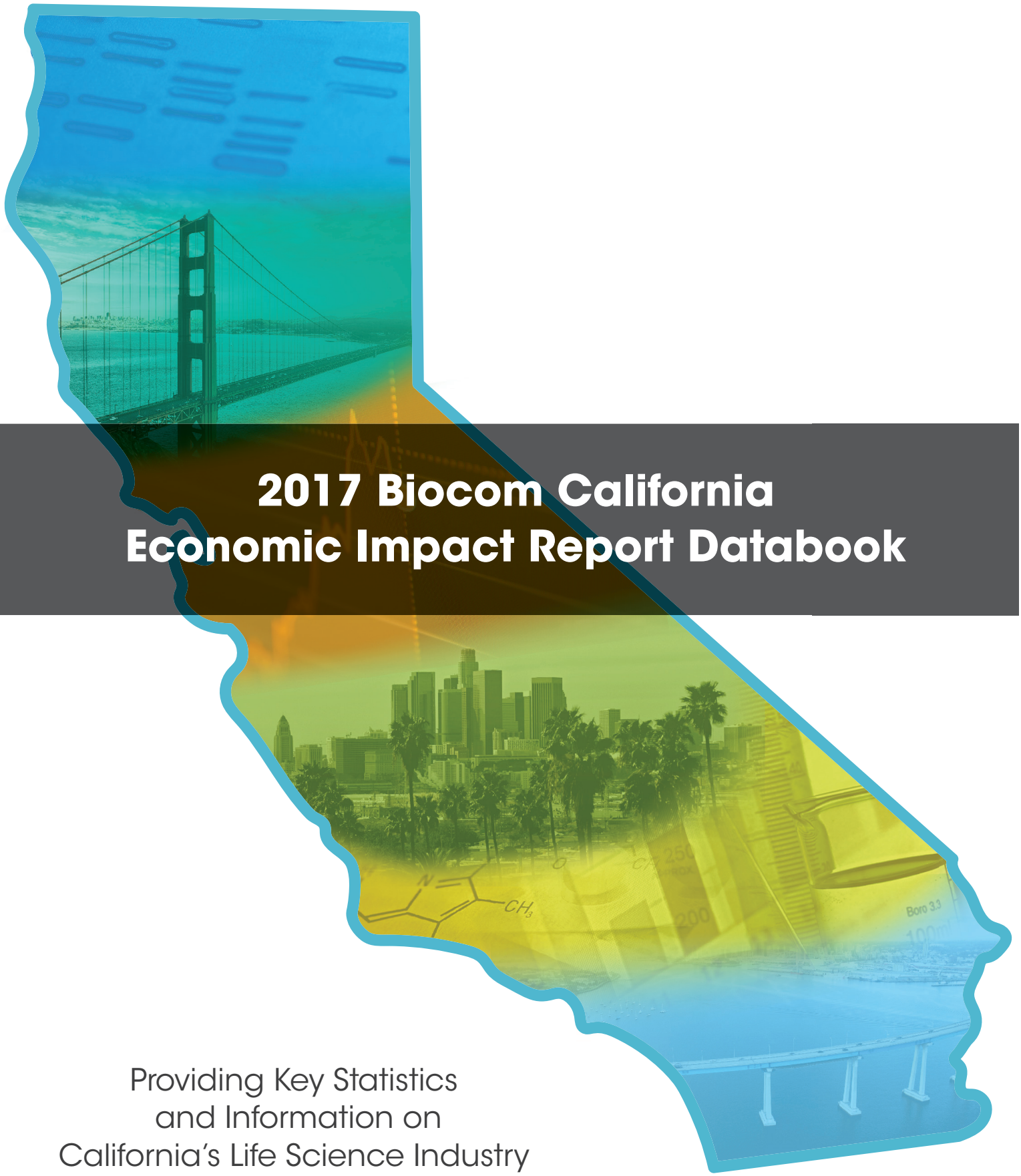

2017 Biocom California Economic Impact Report Databook

Providing Key Statistics
and Information on
California's Life Science Industry

Prepared by: TClower & Associates

BIOCOM
accelerating life science

Acknowledgement

The authors gratefully acknowledge the financial and operational support of the Biocom staff, without whose cooperation this databook would not be possible.

About the Authors

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About Biocom

Biocom is the largest, most experienced leader and advocate for California's life science sector. We work on behalf of more than 900 members to drive public policy, build an enviable network of industry leaders, create access to capital, introduce cutting-edge STEM education programs, and create robust value-driven purchasing programs.

Founded in 1995 in San Diego, Biocom provides the strongest public voice to research institutions and companies that fuel the local and state-wide economy. Our goal is simple: to help our members produce novel solutions that improve the human condition. In addition to its San Diego headquarters, Biocom operates a core office serving the Los Angeles market, satellite offices in Washington, D.C. and Tokyo, and has a continuous staff presence in San Francisco and Sacramento. Our broad membership benefits apply to biotechnology, pharmaceutical, medical device, genomics and diagnostics companies of all sizes, as well as to research universities and institutes, clinical research organizations, investors and service provide.

For more information on Biocom, please visit our website at www.biocom.org. Connect with us on LinkedIn, Facebook, and Twitter (@BiocomCA).

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Introduction

The 2017 Biocom Databook provides key economic, demographic, and industry performance data and analysis for the Life Science industry in California and selected sub-state regions. The Databook offers much the same information previously provided by Biocom in a series of Economic Impact Reports.

As in previous reports prepared for Biocom, the Life Science industry is comprised of five (5) industry clusters, which themselves are groupings of industries. A detailed listing of the industries included in each Life Science cluster can be found in Appendix 1 to this Databook. The industry clusters making up the Life Science industry in California include: BioRenewables; Biopharmaceuticals Manufacturing; Medical Devices and Diagnostic Equipment Manufacturing; Life Science Wholesale Trade; and Research, Development, and Education Labs Services.

- **BioRenewables:** This industry cluster includes biofuels, specialty enzymes and chemicals, algae research, and key elements of agriculture.
- **Biopharmaceuticals Manufacturing:** The production of medicines, botanicals, pharmaceuticals, in-vitro diagnostic substances, and biological products.
- **Medical Devices and Diagnostic Equipment Manufacturing:** Laboratory equipment and supplies, optical instruments, electromedical apparatus, surgical and medical instruments, dental equipment, and dental product producing laboratories.
- **Life Science Wholesale Trade:** Wholesaling and distributing medical equipment and supplies and the wholesaling of drugs and related products.
- **Research, Development, and Education Laboratory Services:** Includes research and development in biotechnology, medical laboratories, and portions of industries representing testing laboratories, other research and development services, and higher education.

Regional Overview

Population

- California continues to outpace the national average in population growth adding over 1.8 million new residents between 2010 and 2015.
- Northern California's pace of growth is faster than the state overall with the strongest growth in Alameda, Contra Costa, San Francisco, and Santa Clara counties.
- In Southern California, Riverside, San Diego, and Orange counties lead population growth.
- With the exception of Los Angeles County, the largest counties saw the highest growth rates, reflecting long term urbanization trends.

Geography	2010	2015	Change	Percent Annual Change
United States	**309,346,863**	**321,418,820**	**12,071,957**	**0.8%**
California	**37,334,079**	**39,144,818**	**1,810,739**	**1.0%**
Northern California	**7,167,871**	**7,654,870**	**486,999**	**1.3%**
Alameda County	1,513,754	1,638,215	124,461	1.6%
Contra Costa County	1,052,921	1,126,745	73,824	1.4%
Marin County	252,903	261,221	8,318	0.6%
Napa County	136,810	142,456	5,646	0.8%
San Francisco County	805,813	864,816	59,003	1.4%
San Mateo County	719,973	765,135	45,162	1.2%
Santa Clara County	1,786,844	1,918,044	131,200	1.4%
Solano County	414,062	436,092	22,030	1.0%
Sonoma County	484,791	502,146	17,355	0.7%
Southern California	**19,150,595**	**20,031,342**	**880,747**	**0.9%**
Imperial	174,750	180,191	5,441	0.6%
Los Angeles	9,826,009	10,170,292	344,283	0.7%
Orange	3,017,866	3,169,776	151,910	1.0%
Riverside	2,202,286	2,361,026	158,740	1.4%
San Diego	3,104,386	3,299,521	195,135	1.2%
Ventura	825,298	850,536	25,238	0.6%

Source: US Census Population Estimates Program, V2015

Employment

The data shown for employment counts are based on the most recent information available from Chmura Economics, a private data services company. Importantly, the data reported here include jobs at employer firms who are covered by unemployment insurance programs, as typically captured by the U.S. Bureau of Labor Statistics, but also includes estimates of non-employer jobs, such as sole proprietors and independent contractors who do not appear in widely publicized government jobs data. This is an increasingly important dimension to reporting jobs as short-term, outsourced, and contract jobs increase as a share of the overall job market.

Employment data represent the average number of jobs for the reported quarter and three previous quarters. The 80,999 total jobs reported for Napa County in the table below is the average total employment for that county in the period 2015Q3 through 2016Q3.

Total Employment

- About 1 in 6 US job gains occurred in California between 2011 and 2016.
- California companies, on average, pay substantially higher wages compared to U.S.
- Northern California continues its impressive run on job growth, with average wages being especially high in Silicon Valley and San Francisco.
- Southern California also shows strong job growth over the past five years.

Geography	Employment 2011 Q3	Growth demand (11-16)	Employment 2016 Q3	Growth Demand (16-21)	Employment 2021	Average Annual Wage
United States	**139,989,780**	**12,608,368**	**152,598,148**	**4,915,569**	**157,513,717**	**$52,724**
California	**15,738,118**	**2,159,602**	**17,897,720**	**690,933**	**18,588,653**	**$61,798**
Northern CA	**3,387,087**	**609,508**	**3,996,595**	**225,218**	**4,221,813**	**$87,628**
Alameda County	680,017	110,431	790,448	37,396	827,844	$68,872
Contra Costa County	347,427	44,306	391,733	16,170	407,903	$63,695
Marin County	116,022	12,023	128,045	3,241	131,286	$67,709
Napa County	69,627	11,372	80,999	3,856	84,855	$52,337
San Francisco County	589,841	147,774	737,615	59,530	797,145	$97,741
San Mateo County	346,668	65,707	412,375	23,815	436,190	$104,643
Santa Clara County	912,370	177,405	1,089,775	70,106	1,159,881	$113,594
Solano County	129,376	15,609	144,985	4,485	149,470	$53,821
Sonoma County	195,739	24,882	220,621	6,116	226,737	$50,194
Southern CA	**8,062,729**	**994,743**	**9,057,472**	**292,486**	**9,349,958**	**$57,049**
Imperial	60,754	8,837	69,591	2,852	72,443	$38,825
Los Angeles	4,241,730	476,349	4,718,079	126,336	4,844,415	$58,993
Orange	1,475,690	196,739	1,672,429	55,312	1,727,741	$58,580
Riverside	619,905	129,375	749,280	42,199	791,479	$42,844
San Diego	1,339,556	162,499	1,502,055	59,459	1,561,514	$57,454
Ventura	325,095	20,944	346,039	5,970	352,009	$55,812

Source: Chmura Economics, JobsEQ, TClower & Associates

The following series of tables provide detailed job growth estimates and projections by industry.

Employment by Industry – California

NAICS	Industry	Employment Q3 2011	Growth Demand (11-16)	Employment 2016 Q3	Growth Demand (16-21)	Employment 2021
11	Agriculture, Forestry, Fishing and Hunting	421,922	46,793	468,715	3,874	472,589
21	Mining, Quarrying, Oil and Gas Extraction	26,600	-2,806	23,794	1,346	25,140
22	Utilities	106,112	2,315	108,427	-1,296	107,131
23	Construction	707,225	207,754	914,979	57,628	972,607
31	Manufacturing	1,275,885	60,604	1,336,489	-52,510	1,283,979
42	Wholesale Trade	674,102	64,363	738,465	21,134	759,599
44	Retail Trade	1,610,191	148,913	1,759,104	36,325	1,795,429
48	Transportation and Warehousing	566,575	111,725	678,300	1,414	679,714
51	Information	461,933	89,283	551,216	18,891	570,107
52	Finance and Insurance	541,225	26,534	567,759	24,978	592,737
53	Real Estate and Rental and Leasing	300,746	28,737	329,483	9,396	338,879
54	Professional, Scientific, and Technical Services	1,226,522	174,615	1,401,137	98,540	1,499,677
55	Management of Companies and Enterprises	196,437	29,491	225,928	5,614	231,542
56	Administrative and Support and Waste Management and Remediation Services	982,663	218,038	1,200,701	56,945	1,257,646
61	Educational Services	1,334,021	85,259	1,419,280	59,362	1,478,642
62	Health Care and Social Assistance	1,778,588	639,230	2,417,818	244,542	2,662,360
71	Arts, Entertainment, and Recreation	367,235	51,401	418,636	15,103	433,739
72	Accommodation and Food Services	1,311,544	316,522	1,628,066	47,816	1,675,882
81	Other Services (except Public Administration)	969,554	-205,917	763,637	21,425	785,062
92	Public Administration	814,382	5,223	819,605	3,769	823,374
99	Unclassified	64,658	61,524	126,182	5,195	131,377
	Total - All Industries	**15,738,118**	**2,159,602**	**17,897,720**	**690,933**	**18,588,653**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Employment by Industry – Northern California

NAICS	Industry	Employment Q3 2011	Growth Demand (11-16)	Employment 2016 Q3	Growth Demand (16-21)	Employment 2021
11	Agriculture, Forestry, Fishing & Hunting	23,277	1,165	24,442	-134	24,308
21	Mining, Quarrying, & Oil & Gas Extraction	2,118	-450	1,668	68	1,736
22	Utilities	18,712	3,483	22,195	3	22,198
23	Construction	157,533	55,272	212,805	15,133	227,938
31	Manufacturing	317,869	24,248	342,117	-8,162	333,955
42	Wholesale Trade	117,247	14,561	131,808	4,998	136,806
44	Retail Trade	324,223	33,677	357,900	13,542	371,442
48	Transportation & Warehousing	117,913	20,821	138,734	591	139,325
51	Information	123,634	54,785	178,419	12,859	191,278
52	Finance & Insurance	124,743	13,487	138,230	9,662	147,892
53	Real Estate & Rental & Leasing	63,637	6,659	70,296	2,814	73,110
54	Professional, Scientific, & Technical Services	388,154	98,403	486,557	45,356	531,913
55	Management of Companies & Enterprises	59,068	11,991	71,059	2,871	73,930
56	Administrative & Support & Waste Management & Remediation Services	189,124	45,850	234,974	13,479	248,453
61	Educational Services	275,174	20,332	295,506	17,622	313,128
62	Health Care & Social Assistance	381,051	137,924	518,975	59,900	578,875
71	Arts, Entertainment, & Recreation	73,641	11,055	84,696	4,390	89,086
72	Accommodation & Food Services	285,915	73,734	359,649	16,020	375,669
81	Other Services (except Public Administration)	194,478	-28,309	166,169	6,882	173,051
92	Public Administration	137,971	-4,315	133,656	2,985	136,641
99	Unclassified	11,606	15,136	26,742	1,540	28,282
	Total - All Industries	**3,387,087**	**609,508**	**3,996,595**	**225,218**	**4,221,813**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Employment by Industry – Southern California

NAICS	Industry	Employment Q3 2011	Growth Demand (11-16)	Employment 2016 Q3	Growth Demand (16-21)	Employment 2021
11	Agriculture, Forestry, Fishing & Hunting	73,263	4,377	77,640	-999	76,641
21	Mining, Quarrying, & Oil & Gas Extraction	7,360	-781	6,579	271	6,850
22	Utilities	53,638	-2,760	50,878	-977	49,901
23	Construction	352,941	101,431	454,372	26,611	480,983
31	Manufacturing	705,793	10,637	716,430	-38,303	678,127
42	Wholesale Trade	371,929	29,037	400,966	8,072	409,038
44	Retail Trade	833,993	70,044	904,037	13,515	917,552
48	Transportation & Warehousing	280,666	53,830	334,496	-996	333,500
51	Information	276,709	35,547	312,256	6,451	318,707
52	Finance & Insurance	295,473	6,529	302,002	11,204	313,206
53	Real Estate & Rental & Leasing	174,017	16,770	190,787	4,991	195,778
54	Professional, Scientific, & Technical Services	610,071	60,318	670,389	36,259	706,648
55	Management of Companies & Enterprises	99,439	15,739	115,178	1,837	117,015
56	Administrative & Support & Waste Management & Remediation Services	534,830	77,618	612,448	24,181	636,629
61	Educational Services	680,330	36,728	717,058	28,038	745,096
62	Health Care & Social Assistance	906,091	339,622	1,245,713	123,835	1,369,548
71	Arts, Entertainment, & Recreation	211,780	34,793	246,573	7,842	254,415
72	Accommodation & Food Services	699,273	176,702	875,975	21,217	897,192
81	Other Services (except Public Administration)	533,277	-121,342	411,935	9,579	421,514
92	Public Administration	330,334	16,685	347,019	1,364	348,383
99	Unclassified	31,519	33,220	64,739	2,059	66,798
	Total - All Industries	**8,062,729**	**994,743**	**9,057,472**	**292,486**	**9,349,958**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Employment by Industry – San Diego County

NAICS	Industry	Employment Q3 2011	Growth Demand (11-16)	Employment 2016 Q3	Growth Demand (16-21)	Employment 2021
11	Agriculture, Forestry, Fishing & Hunting	12,852	-794	12,058	-322	11,736
21	Mining, Quarrying, & Oil & Gas Extraction	443	-129	314	5	319
22	Utilities	9,337	-2,031	7,306	-155	7,151
23	Construction	66,972	19,878	86,850	5,237	92,087
31	Manufacturing	96,007	13,263	109,270	-3,826	105,444
42	Wholesale Trade	42,544	3,190	45,734	1,184	46,918
44	Retail Trade	141,538	13,933	155,471	3,238	158,709
48	Transportation & Warehousing	29,254	5,999	35,253	-352	34,901
51	Information	27,222	-1,070	26,152	182	26,334
52	Finance & Insurance	44,375	2,240	46,615	1,880	48,495
53	Real Estate & Rental & Leasing	30,431	1,501	31,932	1,067	32,999
54	Professional, Scientific, & Technical Services	137,533	9,207	146,740	9,308	156,048
55	Management of Companies & Enterprises	17,190	3,746	20,936	484	21,420
56	Administrative & Support & Waste Management & Remediation Services	83,184	9,926	93,110	4,132	97,242
61	Educational Services	123,221	5,956	129,177	6,758	135,935
62	Health Care & Social Assistance	151,795	42,471	194,266	21,118	215,384
71	Arts, Entertainment, & Recreation	39,135	884	40,019	1,650	41,669
72	Accommodation & Food Services	133,373	33,753	167,126	4,881	172,007
81	Other Services (except Public Administration)	76,723	-6,260	70,463	2,074	72,537
92	Public Administration	71,016	2,625	73,641	-510	73,131
99	Unclassified	5,413	4,210	9,623	381	10,004
	Total - All Industries	**1,339,556**	**162,499**	**1,502,055**	**59,459**	**1,561,514**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Employment by Industry – Orange County

NAICS	Industry	Employment Q3 2011	Growth Demand (11-16)	Employment 2016 Q3	Growth Demand (16-21)	Employment 2021
11	Agriculture, Forestry, Fishing & Hunting	3,595	-569	3,026	-55	2,971
21	Mining, Quarrying, & Oil & Gas Extraction	656	0	656	29	685
22	Utilities	6,915	-559	6,356	-66	6,290
23	Construction	80,089	26,256	106,345	5,720	112,065
31	Manufacturing	155,941	1,810	157,751	-7,371	150,380
42	Wholesale Trade	80,587	2,203	82,790	1,679	84,469
44	Retail Trade	148,953	10,159	159,112	1,940	161,052
48	Transportation & Warehousing	34,173	765	34,938	-690	34,248
51	Information	26,108	1,533	27,641	561	28,202
52	Finance & Insurance	74,686	5,919	80,605	3,285	83,890
53	Real Estate & Rental & Leasing	40,075	4,157	44,232	1,252	45,484
54	Professional, Scientific, & Technical Services	127,310	22,819	150,129	8,725	158,854
55	Management of Companies & Enterprises	22,708	10,233	32,941	494	33,435
56	Administrative & Support & Waste Management & Remediation Services	124,246	20,201	144,447	5,828	150,275
61	Educational Services	103,371	7,254	110,625	4,129	114,754
62	Health Care & Social Assistance	148,182	38,491	186,673	20,560	207,233
71	Arts, Entertainment, & Recreation	41,771	15,123	56,894	2,246	59,140
72	Accommodation & Food Services	138,458	24,934	163,392	3,595	166,987
81	Other Services (except Public Administration)	71,241	-731	70,510	1,612	72,122
92	Public Administration	40,751	1,016	41,767	211	41,978
99	Unclassified	5,873	5,727	11,600	384	11,984
	Total - All Industries	**1,475,690**	**196,739**	**1,672,429**	**55,312**	**1,727,741**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Employment by Industry – Los Angeles County

NAICS	Industry	Employment Q3 2011	Growth Demand (11-16)	Employment 2016 Q3	Growth Demand (16-21)	Employment 2021
11	Agriculture, Forestry, Fishing & Hunting	6,849	-494	6,355	-175	6,180
21	Mining, Quarrying, & Oil & Gas Extraction	4,360	-364	3,996	183	4,179
22	Utilities	29,222	-29	29,193	-947	28,246
23	Construction	145,553	28,738	174,291	8,960	183,251
31	Manufacturing	379,152	-6,894	372,258	-25,269	346,989
42	Wholesale Trade	213,470	18,779	232,249	3,983	236,232
44	Retail Trade	413,995	29,230	443,225	4,059	447,284
48	Transportation & Warehousing	185,138	29,762	214,900	-1,206	213,694
51	Information	206,835	38,607	245,442	5,878	251,320
52	Finance & Insurance	145,582	1,732	147,314	5,142	152,456
53	Real Estate & Rental & Leasing	86,817	9,713	96,530	2,078	98,608
54	Professional, Scientific, & Technical Services	301,336	24,816	326,152	15,025	341,177
55	Management of Companies & Enterprises	53,885	1,864	55,749	701	56,450
56	Administrative & Support & Waste Management & Remediation Services	266,068	36,846	302,914	10,485	313,399
61	Educational Services	361,701	12,395	374,096	12,349	386,445
62	Health Care & Social Assistance	502,583	214,204	716,787	65,232	782,019
71	Arts, Entertainment, & Recreation	104,030	18,623	122,653	2,667	125,320
72	Accommodation & Food Services	332,353	93,009	425,362	8,149	433,511
81	Other Services (except Public Administration)	328,779	-104,714	224,065	3,983	228,048
92	Public Administration	157,150	10,953	168,103	514	168,617
99	Unclassified	16,870	19,573	36,443	976	37,419
	Total - All Industries	**4,241,730**	**476,349**	**4,718,079**	**126,336**	**4,844,415**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Education

Educational Attainment

Having an educated workforce remains one of the best predictors of economic success for states and regions as companies require highly skilled workers to compete in increasingly globalized markets—a trend that will continue. The data reported for educational attainment cover the adult population aged 25 years or older and come from the U.S. Census Bureau's American Community Survey.

- Northern California has a distinct competitive advantage in overall educational attainment.
- In Southern California, Orange County and San Diego County have strong overall educational attainment numbers.

Geography	Graduate or professional degree	Bachelor's Degree	Associate's Degree	Some college	High school diploma	Less than high school
United States	**11.6%**	**19.0%**	**8.2%**	**20.7%**	**27.6%**	**12.9%**
California	**12.0%**	**20.3%**	**7.6%**	**21.5%**	**20.8%**	**17.8%**
Northern California	**18.8%**	**26.5%**	**7.2%**	**18.8%**	**16.5%**	**12.2%**
Alameda County	19.0%	26.1%	6.2%	18.1%	18.1%	12.5%
Contra Costa County	15.0%	25.2%	7.9%	22.8%	17.9%	11.1%
Marin County	24.7%	34.2%	6.0%	16.6%	10.8%	7.6%
Napa County	10.9%	21.9%	8.6%	25.2%	17.9%	15.5%
San Francisco County	22.0%	33.2%	5.6%	14.1%	12.8%	12.4%
San Mateo County	19.6%	27.5%	7.8%	17.8%	15.2%	12.1%
Santa Clara County	23.2%	26.3%	7.1%	16.0%	14.8%	12.7%
Solano County	7.2%	18.5%	10.6%	26.7%	24.5%	12.4%
Sonoma County	12.1%	20.7%	9.5%	25.5%	19.2%	13.0%
Southern California	**11.4%**	**20.5%**	**7.3%**	**20.9%**	**20.7%**	**19.2%**
Imperial	5.0%	9.3%	7.3%	23.7%	21.3%	33.4%
Los Angeles	10.7%	20.2%	6.8%	19.2%	21.2%	21.9%
Orange	13.7%	25.1%	7.6%	20.5%	17.3%	15.9%
Riverside	7.5%	13.3%	7.7%	25.1%	26.8%	19.6%
San Diego	14.5%	22.7%	7.8%	22.8%	18.9%	13.4%
Ventura	11.9%	20.9%	8.2%	23.6%	18.4%	17.1%

Source: 2015 American Community Survey

Total Post-Secondary Degrees Awarded

Post-Secondary Degrees Awarded reflect college diplomas awarded at state/county institutions of higher education. These data help reflect a region's ability to provide an on-going supply of trained workers and scientists supporting industry growth.

- Growth in the issuance of post-secondary degrees in Southern California universities and colleges substantially outpaced U.S. and state averages between 2010 and 2015.

Geography	2010	2015	Change	Percent Annual Change
United States	**4,461,303**	**4,990,972**	**529,669**	**2.3%**
California	**502,765**	**581,031**	**78,266**	**2.9%**
Northern California	**91,384**	**102,260**	**10,876**	**2.3%**
Alameda County	25,661	27,249	1,588	1.2%
Contra Costa County	5,900	7,829	1,929	5.8%
Marin County	852	948	96	2.2%
Napa County	1,139	1,309	170	2.8%
San Francisco County	19,419	22,485	3,066	3.0%
San Mateo County	3,301	5,257	1,956	9.8%
Santa Clara County	26,601	26,979	378	0.3%
Solano County	1,978	2,835	857	7.5%
Sonoma County	6,533	7,369	836	2.4%
Southern California	**278,183**	**334,969**	**56,786**	**3.8%**
Imperial	1,505	1,901	396	4.8%
Los Angeles	143,639	160,164	16,525	2.2%
Orange	54,359	71,310	16,951	5.6%
Riverside	16,140	20,751	4,611	5.2%
San Diego	55,859	72,242	16,383	5.3%
Ventura	6,681	8,601	1,920	5.2%

Source: Integrated Post-Secondary Education Data System

STEM Degrees Awarded

Degrees awarded in Science, Technology, Engineering, and Mathematics (STEM) is considered especially important for California's technology industries, including Life Science industries.

- While growth in the awarding of STEM degrees has been strong across the state, California and the two super regions covered here have fallen behind the national pace from 2010 to 2015.

This year's Databook includes a new set of information focusing specifically on selected certificate and degree awards at colleges and universities in the study area that are particularly relevant to the Life Science industry. These data can be found in Appendix 2.

Geography	2010	2015	Change	Percent Annual Change
United States	**383,967**	**654,718**	**270,751**	**11.3%**
California	**44,082**	**70,996**	**26,914**	**10.0%**
Northern California	**9,923**	**15,425**	**5,502**	**9.2%**
Alameda County	3,992	5,540	1,548	6.8%
Contra Costa County	104	611	507	42.5%
Marin County	31	65	34	16.0%
Napa County	27	47	20	11.7%
San Francisco County	784	1,837	1,053	18.6%
San Mateo County	83	274	191	27.0%
Santa Clara County	4,569	6,370	1,801	6.9%
Solano County	156	238	82	8.8%
Sonoma County	177	443	266	20.1%
Southern California	**22,271**	**36,896**	**14,625**	**10.6%**
Imperial	54	76	22	7.1%
Los Angeles	11,854	18,662	6,808	9.5%
Orange	3,682	6,891	3,209	13.4%
Riverside	1,228	2,722	1,494	17.3%
San Diego	5,159	7,811	2,652	8.6%
Ventura	294	734	440	20.1%

Source: Integrated Post-Secondary Education Data System

Life Science Employment and Impacts

For each selected geography, we offer data indicating the status, competitiveness, and economic impacts of the Life Science industry and its component industry clusters. The following describes the data and analyses presented.

- **Employment:** Employment totals include estimates of jobs provided by employers (covered employment) and individuals who are self-employed or employed as an independent contractor.
- **Establishments:** Firms with one or more employees (not including a sole proprietor).
- **Wages:** For our sub-state regions, we show the average wages per year for all employees by industry cluster.
- **Employment by Selected Occupations:** The number of jobs help is occupations selected as particularly relevant to Life Science.
- **Location Quotient**: A location quotient shows the proportion of total employment in a given industry or occupation compared to the average representation of that industry or occupation in the United States economy. A location greater than about 1.2 indicates that a region may possess a competitive advantage for that industry/occupation. Location quotients less than 0.9 typically indicate competitive weakness, but may show opportunities for growth.
- **Industry Competitiveness:** This measure is based on a shift-share analysis of the jobs data. Shift-share analyses separate employment into factors that account for overall economic change in the United States (if the overall economy is growing, so should a given industry), and the given industry's trends at the national level. We show this analysis by comparing Expected Change to Regional Share. Expected Change is the sum of national level influences on local industry employment. Regional Share shows the number of jobs during a five year period that can be attributed to local/regional/state economic conditions. The larger the Regional Share, the more competitive the region is for that industry, on average.
- **Economic Impacts:** Economic Impacts show how the selected industry impacts overall local/regional/state economic performance. Our measures include direct, indirect, and induced impacts. Direct impacts capture the value of firm spending, such as a medical device manufacturing hiring employees and purchasing raw materials and component parts. Indirect effects measure the economic value as it flows through the medical devices firm's supply chain, such as a parts supplier purchasing shipping boxes and transportation services, hiring workers, and obtaining professional services. Induced effects capture the impacts of employees of the direct and indirect firms spending a portion of their earnings for goods and services in the state/regional/local economy. These impacts are measured for:
    - **Output:** Value of business transactions
    - **Value added:** Equivalent to gross domestic product
    - **Labor Income:** Salaries, wages and benefits paid to workers
    - **Employment:** Headcount (full-time and part-time) jobs.
- **Foreign Exports:** The value of goods and services sold to buyers outside the United States. This is a very important economic measure since the sale of export goods brings new money into the state/regional/local economy.
- **New Research Awards:** This reports the value of research grants awarded in the field of health research for federal fiscal year 2016 from the National Institutes of Health. This is an excellent proxy measure for how a region is performing in leading edge Life Science research.
- **Venture Capital Funding:** Where available, we report venture capital deals done for a given geography, which do not necessarily match the regions defined for other performance measures. As a whole, there was a general decline in venture capital deals across the nation in 2016, especially compared to the highly active 2014 and 2015.

California

Summary

California's Life Science industry provides over 360,000 jobs statewide, most of which are employed at one of the more than 12,000 establishments representing this sector of the economy. The strongest related occupations are for Biochemists and Biophysicists; Microbiologists; Medical Scientists; and technicians supporting Agricultural and Food Sciences and Biological industries.

At the state level, California is particularly competitive in Biopharmaceutical Manufacturing; Medical Devices and Diagnostic Equipment; and Research activities. State companies and institutions received almost $3.6 billion in new research awards from the National Institutes of Health in FY2016. California-based Life Science companies exported over $28 billion in goods and services in 2015.

Including direct, indirect, and induced economic impacts, the Life Science industry in California:

- Generates almost $317 billion in annual economic activity (output)
- Boosts total state gross product by $171.4 billion
- Supports over 1.1 million jobs
- Increases labor income by $92 billion per year.

California Employment by Life Science Cluster, 2016 3Q

Industry Cluster	Employment
BioRenewables	35,679
Biopharmaceutical Manufacturing	50,176
Medical Devices and Diagnostic Equipment	78,277
Life Science Wholesale	53,826
Research, Development, and Education Labs	142,528
TOTAL LIFE SCIENCE INDUSTRY	**360,486**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

California Life Science Establishments, 2016 3Q

Industry Cluster	Establishments
BioRenewables	1,620
Biopharmaceutical Manufacturing	524
Medical Devices and Diagnostic Equipment	2,163
Life Science Wholesale	3,588
Research, Development, and Education Labs	4,136
TOTAL LIFE SCIENCE INDUSTRY	**12,031**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

California Employment by Selected Occupations

Title	2016 Q3 Jobs	Avg. Annual Wages	Location Quotient	Unemployment Rate	5-Year Job Growth
Biochemists and Biophysicists	5,909	$112,400	1.45	1.4%	702
Microbiologists	3,289	$92,200	1.31	1.9%	329
Zoologists & Wildlife Biologists	2,208	$69,600	1.05	3.4%	118
Biological Scientists, All Other	3,749	$83,100	1.07	3.0%	193
Epidemiologists	623	$102,000	1.06	2.0%	42
Medical Scientists	16,324	$110,400	1.28	0.9%	1,702
Life Scientists, All Other	1,169	$94,900	1.07	1.6%	110
Environmental Scientists and Specialists, Including Health	10,995	$84,600	1.07	0.9%	680
Ag. & Food Science Techs	4,077	$41,700	1.22	2.1%	256
Biological Technicians	10,704	$55,200	1.22	3.2%	912
Chemical Technicians	7,748	$48,300	0.99	1.8%	224
Environmental Science and Protection Techs, Inc. Health	4,473	$48,900	1.08	3.1%	241
Life, Physical, and Social Science Technicians, All Other	8,866	$51,700	1.07	2.6%	729
Medical & Clinical Lab Technologists	17,594	$83,000	0.87	2.0%	1,430
Medical and Clinical Laboratory Technicians	18,885	$47,700	0.93	2.2%	2,125

Source: Chmura Economics, JobsEQ,

Industry Competitiveness - California

(The larger the Regional Share compared to Expected Change, the more competitive the industry)

	2011 Q3 Empl	2016 Q3 Empl	% Change	Expected Change	Regional Share
Total - All Industries	15,738,118	17,897,720	13.7%		
BioRenewables	33,394	35,679	6.8%	3,008	606
Biopharmaceutical manufacturing	43,150	50,176	16.3%	3,886	4,871
Medical devices and diagnostic equipment	74,402	78,277	5.2%	6,701	2,850
Life Science Wholesale	50,609	53,826	6.4%	4,558	65
Research and Lab Support	126,265	142,528	12.9%	11,372	4,714
TOTAL LIFE SCIENCE INDUSTRY	**327,820**	**360,486**	**10.0%**	**29,526**	**11,772**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Economic Impacts (Direct, Indirect, Induced) – California 2016

Industry	Output	Value Added	Labor Income	Employment
BioRenewables	$ 23,110,422,398	$ 9,208,023,719	$ 4,004,943,717	52,241
Biopharmaceutical manufacturing	$ 152,014,157,175	$ 80,308,226,640	$ 36,145,943,461	385,886
Medical devices and diagnostic equipment	$ 62,892,322,704	$ 32,700,725,168	$ 19,863,580,212	238,777
Life Science Wholesale	$ 22,559,186,373	$ 14,453,168,770	$ 7,901,407,481	109,582
Research and Lab Support	$ 56,384,643,958	$ 34,814,726,837	$ 24,146,375,423	313,775
TOTAL LIFE SCIENCE INDUSTRY	**$ 316,960,732,610**	**$171,484,871,135**	**$ 92,062,250,294**	**1,100,262**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

California Foreign Exports of Life Science Product and Services 2015

Industry Cluster	Exports
BioRenewables	$ 2,407,603,356
Biopharmaceutical Manufacturing	$ 9,462,901,706
Medical Devices and Diagnostic Equipment	$ 12,237,560,059
Life Science Wholesale	$ 1,788,686,373
Research, Development, and Education Labs	$ 2,207,012,503
TOTAL LIFE SCIENCE INDUSTRY	**$ 28,103,763,996**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

National Institutes of Health New Research Awards FY2016 – California

County	Total
Alameda	$ 250,092,740
Butte	$ 353,750
Contra Costa	$ 1,367,114
Fresno	$ 765,256
Kern	$ 176,168
Los Angeles	$ 893,066,638
Marin	$ 11,825,033
Merced	$ 2,737,772
Monterey	$ 205,955
Nevada	$ 509,295
Orange	$ 125,647,439
Placer	$ 359,195
Riverside	$ 21,164,058
Sacramento	$ 676,570
San Bernadine	$ 11,730,165
San Diego	$ 832,577,388
San Francisco	$ 671,425,008
San Joaquin	$ 302,438
San Luis Obispo	$ 2,024,722
San Mateo	$ 39,502,570
Santa Barbara	$ 21,402,836
Santa Clara	$ 460,921,840
Santa Cruz	$ 36,784,750
Solano	$ 1,930,213
Sonoma	$ 2,792,862
Ventura	$ 757,625
Yolo	$ 201,199,211
TOTAL	**$ 3,592,298,611**

Sources: NIH, TClower & Associates

Northern California

Summary

Northern California companies in the Life Science industry employed more than 96,000 in 2016, with average earnings exceeding $156,000 per year. There was impressive growth in the Biopharmaceuticals and Research industry clusters between 2011 and 2016.

Key Life Science occupations in Northern California include Biochemists and Biophysicists; Microbiologists; Biological Technicians; and Medical Scientists, each of which has more than twice the industry concentration compared to national averages (LQ>2.0). The most competitive industry clusters are Biopharmaceuticals; Medical Devices and Diagnostic Equipment; and Research Support, though the Medical Devices cluster has seen a lowering of its industry location quotient over the past 5 years, which is also reflected in our shift-share analysis.

Total Life Science exports from Northern California reached almost $10 billion in 2015. The region received over $1.4 billion in new research awards from the National institutes of Health in FY2016.

The economic impacts of the Life Science industry in Northern California:

- Generates almost $113.8 billion in annual economic activity (output)
- Boosts total state gross product by $68.6 billion
- Supports over 302,000 jobs
- Increases labor income by $34 billion per year.

Northern California Life Science Employment

Life Science Employment by County	2016 Q3	Avg. Earnings
Northern California	**96,390**	**$156,340**
Alameda County	23,206	$112,424
Contra Costa County	4,728	$89,941
Marin County	2,531	$242,772
Napa County	886	$76,252
San Francisco County	10,971	$122,498
San Mateo County	20,363	$235,710
Santa Clara County	25,248	$166,076
Solano County	4,822	$148,822
Sonoma County	3,637	$82,316

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Northern California Employment by Life Science Cluster

Life Science by Sectors	2011	2016	2021
BioRenewables	2,618	2,794	2,688
Biopharmaceutical manufacturing	16,333	21,508	21,599
Medical devices and diagnostic equipment	21,483	20,334	20,361
Life Science Wholesale	6,607	7,321	7,283
Research and Lab Support	37,079	44,433	47,615
TOTAL LIFE SCIENCE INDUSTRY	***84,120***	***96,390***	***99,546***

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Life Science Industry Establishments by Cluster

Establishments by Sector & County, 2016 Q3						
	Bio-Renewables	**Bio-Pharmaceutical manufacturing**	**Medical Devices**	**Life Science Wholesale**	**Research and Lab Support**	**All Life Science**
Northern California	**170**	**126**	**567**	**509**	**1,100**	**2,472**
Alameda County	7	33	130	109	223	501
Contra Costa County	13	6	55	60	92	226
Marin County	4	5	18	29	22	78
Napa County	28	0	10	6	10	54
San Francisco County	5	9	35	54	189	291
San Mateo County	11	30	69	79	178	367
Santa Clara County	33	26	210	131	304	704
Solano County	18	7	11	17	38	91
Sonoma County	53	10	29	24	44	161

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Wages in Life Science Clusters by County

Wages by Sector & County, 2016 Q3						
	Bio-Renewables	**Bio-Pharmaceutical manufacturing**	**Medical Devices**	**Life Science Wholesale**	**Research and Lab Support**	**All Life Science**
Northern California	**$52,656**	**$238,271**	**$129,213**	**$101,919**	**$144,582**	**$156,340**
Alameda	$41,618	$118,760	$145,336	$85,423	$96,405	$112,424
Contra Costa	$64,126	$83,533	$77,155	$80,146	$101,463	$89,941
Marin	$44,521	$293,590	$82,040	$89,016	$93,217	$242,772
Napa	$56,099	$112,410	$57,052	$42,102	$115,636	$76,252
San Francisco	$94,653	$272,569	$88,082	$118,592	$117,118	$122,498
San Mateo	$44,435	$311,443	$151,887	$140,144	$178,543	$235,710
Santa Clara	$55,772	$163,636	$123,466	$108,549	$207,242	$166,076
Solano	$55,195	$182,532	$67,926	$58,342	$83,048	$148,822
Sonoma	$48,655	$50,359	$123,417	$94,186	$60,369	$82,316

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Northern California Employment by Selected Life Science Occupations

Title	2016 Q3 Jobs	Avg. Annual Wages	Location Quotient	Unemployment Rate	5-Year Job Growth
Biochemists and Biophysicists	2,518	$120,900	2.77	1.2%	486
Microbiologists	1,239	$100,800	2.22	1.5%	234
Zoologists and Wildlife Biologists	541	$76,800	1.15	2.5%	51
Biological Scientists, All Other	1,158	$92,000	1.48	2.3%	140
Epidemiologists	162	$116,000	1.24	1.5%	18
Medical Scientists	6,268	$119,100	2.20	0.7%	1,089
Life Scientists, All Other	330	$99,100	1.35	1.3%	37
Environmental Scientists and Specialists, Including Health	2,703	$94,000	1.18	0.7%	266
Agricultural & Food Science Technicians	814	$48,000	1.09	1.4%	98
Biological Technicians	3,978	$62,200	2.03	2.6%	668
Chemical Technicians	2,499	$53,600	1.43	1.4%	373
Environmental Science and Protection Techs, Inc. Health	1,170	$50,600	1.26	2.4%	144
Life, Physical, and Social Science Technicians, All Other	2,356	$55,100	1.28	2.0%	269
Medical and Clinical Laboratory Technologists	3,930	$86,600	0.87	1.6%	398
Medical and Clinical Laboratory Technicians	4,401	$54,900	0.97	1.7%	545

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Northern California Industry Competitiveness by Location Quotient

(Location Quotients measure industry concentration. A larger location quotient (>1.2) indicates a regional competitive advantage)

Location Quotient for Region by Industry Cluster	2011	2016	2021
BioRenewables	0.42	0.40	0.39
Biopharmaceutical manufacturing	2.47	2.87	2.83
Medical devices and diagnostic equipment	2.08	1.79	1.77
Life Science Wholesale	0.68	0.66	0.66
Research and Lab Support	1.46	1.48	1.46
TOTAL LIFE SCIENCE INDUSTRY	**1.45**	**1.44**	**1.43**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Northern California Industry Competitiveness by Shift Share

(The larger the Regional Share compared to Expected Change, the more competitive the industry)

	2011Q3 Empl	2016Q3 Empl	% Change	Expected Change	Regional Share
Total - All Industries	3,387,087	3,996,595	18.0%		
BioRenewables	2,618	2,794	6.7%	236	44
Biopharmaceutical manufacturing	16,333	21,508	31.7%	1,471	4,359
Medical devices and diagnostic equipment	21,483	20,334	-5.3%	1,935	-1,445
Life Science Wholesale	6,607	7,321	10.8%	595	303
Research and Lab Support	37,079	44,433	19.8%	3,340	3,962
TOTAL LIFE SCIENCE INDUSTRY	**84,120**	**96,390**	**14.6%**	**7,576**	**6,908**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Life Science Industry Economic Impacts by Cluster (Direct, Indirect, Induced) – Northern California 2016

Industry	Output	Value Added	Labor Income	Employment
BioRenewables	$ 1,887,855,845	$ 703,700,733	$ 392,177,005	4,317
Biopharmaceutical manufacturing	$ 70,181,307,018	$ 41,482,825,551	$ 16,609,638,055	135,457
Medical devices and diagnostic equipment	$ 17,586,078,817	$ 10,155,456,541	$ 5,918,482,259	53,427
Life Science Wholesale	$ 3,207,393,035	$ 2,191,388,644	$ 1,258,815,442	13,216
Research and Lab Support	$ 20,929,179,711	$ 14,041,579,287	$ 9,893,882,617	96,140
TOTAL LIFE SCIENCE INDUSTRY	**$113,791,814,427**	**$ 68,574,950,757**	**$ 34,072,995,378**	**302,557**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

Northern California Foreign Exports of Life Science Products and Services 2015

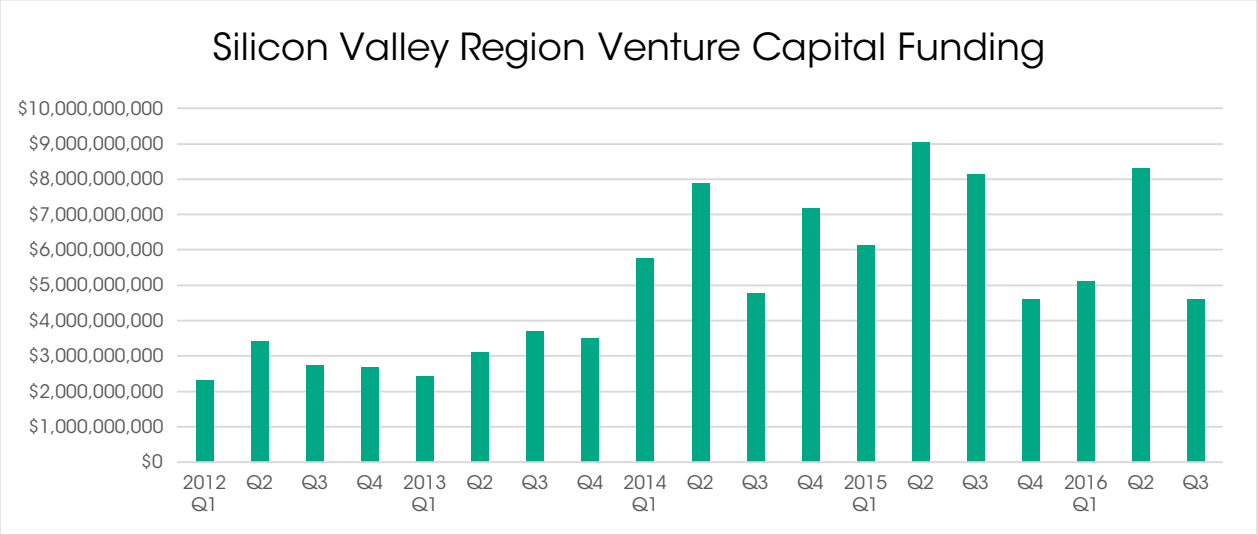
Industry Cluster	Exports
BioRenewables	$ 166,404,851
Biopharmaceutical Manufacturing	$ 4,962,697,111
Medical Devices and Diagnostic Equipment	$ 3,666,611,876
Life Science Wholesale	$ 329,205,371
Research, Development, and Education Labs	$ 853,600,009
TOTAL LIFE SCIENCE INDUSTRY	**$ 9,978,519,219**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

National Institutes of Health New Research Awards FY2016 - Northern California

County	Total
Alameda	$ 250,092,740
Contra Costa	$ 1,367,114
Marin	$ 11,825,033
San Francisco	$ 671,425,008
San Mateo	$ 39,502,570
Santa Clara	$ 460,921,840
Solano	$ 1,930,213
Sonoma	$ 2,792,862
TOTAL	**$ 1,439,857,380**

Sources: NIH, TClower & Associates



Source: National Venture Capital Association (Area definition of Silicon Valley may not align with Northern California as used elsewhere in this report.)

Southern California

Summary

The Southern California Life Science industry employed more than 190,000 individuals in 2016. The average earnings for these jobs approached $99,000 per year. There was solid job growth in all industry clusters, except for Life Science Wholesale Trade between 2011 and 2016. Wages by sector and county follow historic trends with the highest pay in Biopharmaceuticals, and wage levels being generally lower in Imperial County.

Key Life Science occupations in Southern California include Biochemists and Biophysicists; Microbiologists; and Medical Scientists, though these industries barely reach our cutoff point of a Location Quotient ≥ 2.0. Of note, several Life Science occupations suggest there is room to grow this industry in Southern California. However, when total employment in the individual Life Science clusters are examined, Southern California remains strongly competitive for the manufacturing and trade sectors of the industry.

The shift-share analysis shows that the Medical Devices cluster has been the best performing sector over the past five years, followed by Lab Services.

Total Life Science exports from Southern California totaled more than $12.5 billion in 2015. The region received almost $1.9 billion in new research awards from the National Institutes of Health in FY2016.

The economic impacts of the Life Science industry in Southern California:

- Generates about $150 billion in annual economic activity (output)
- Adds $79.6 billion to gross regional product
- Creates almost 563,000 jobs
- Boosts labor income by $44 billion per year.

Southern California Life Science Employment

Life Science Employment by County	2016 Q3	Avg. Earnings
Southern California	**190,518**	**$98,849**
Imperial	966	$52,069
Los Angeles	69,830	$72,577
Orange	48,049	$86,004
Riverside	8,686	$65,108
San Diego	49,764	$117,253
Ventura	13,222	$240,585

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Southern California Employment by Life Science Cluster

Life Science by Sectors	2011	2016	2021
BioRenewables	8,065	8,822	8,422
Biopharmaceutical Manufacturing	24,312	25,534	25,304
Medical Devices and Diagnostic Equipment	45,087	49,406	48,769
Life Science Wholesale	31,285	31,266	30,269
Research and Lab Support	67,774	75,490	80,273
TOTAL LIFE SCIENCE INDUSTRY	**176,523**	**190,518**	**193,037**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Southern California Life Science Industry Establishments by Cluster

Establishments by Sector and County, 2016 Q3						
	BioRenewables	**Biopharmaceutical manufacturing**	**Medical Devices**	**Life Science Wholesale**	**Research and Lab Support**	**All Life Science**
Southern California	**267**	**295**	**1,115**	**2,096**	**1,859**	**5,632**
Imperial	22	1	2	5	11	40
Los Angeles	51	103	436	1,071	787	2,448
Orange	21	68	342	534	336	1,301
Riverside	45	13	67	105	105	334
San Diego	65	99	211	306	544	1,224
Ventura	64	11	57	75	77	285

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Wages in Life Science Clusters by County

Wages by Sector and County, 2016 Q3						
	BioRenewables	**Biopharmaceutical manufacturing**	**Medical Devices**	**Life Science Wholesale**	**Research and Lab Support**	**All Life Science**
Southern California	**$45,197**	**$170,306**	**$87,035**	**$96,097**	**$89,819**	**$98,849**
Imperial	$51,782	$70,755	$30,484	$87,054	$42,966	$52,069
Los Angeles	$41,699	$68,871	$76,087	$69,064	$74,689	$72,577
Orange	$51,188	$77,812	$87,669	$100,170	$75,909	$86,004
Riverside	$37,755	$94,394	$86,499	$64,211	$54,727	$65,108
San Diego	$42,079	$150,853	$101,309	$125,317	$117,893	$117,253
Ventura	$47,902	$409,911	$75,498	$300,691	$70,888	$240,585

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Southern California Employment by Selected Life Science Occupations

Title	2016 Q3 Jobs	Avg. Annual Wages	Location Quotient	Unemployment Rate	5-Year Job Growth
Biochemists and Biophysicists	2,680	$106,300	1.30	1.5%	203
Microbiologists	1,511	$84,800	1.19	2.0%	76
Zoologists and Wildlife Biologists	864	$64,400	0.81	3.4%	82
Biological Scientists, All Other	1,764	$75,200	1.00	3.1%	78
Epidemiologists	249	$83,700	0.84	2.0%	22
Medical Scientists	7,611	$104,100	1.18	0.9%	549
Life Scientists, All Other	526	$92,300	0.95	1.7%	47
Environmental Scientists and Specialists, Including Health	4,863	$84,800	0.93	0.9%	408
Agricultural & Food Science Technicians	1,367	$40,000	0.81	2.0%	82
Biological Technicians	4,952	$51,900	1.12	3.3%	240
Chemical Technicians	3,853	$46,400	0.97	1.8%	-204
Environmental Science and Protection Techs, Inc. Health	2,131	$48,500	1.01	3.1%	86
Life, Physical, and Social Science Technicians, All Other	4,104	$48,900	0.98	2.6%	245
Medical and Clinical Laboratory Technologists	9,168	$80,000	0.89	2.0%	642
Medical and Clinical Laboratory Technicians	9,795	$45,600	0.96	2.1%	1,010

Source: Chmura Economics, JobsEQ

Southern California Industry Competitiveness by Location Quotient

(Location Quotients measure industry concentration. A larger location quotient (>1.2) indicates a regional competitive advantage)

Location Quotient for Region by Industry Cluster	2011	2016	2021
BioRenewables	0.55	0.55	0.56
Biopharmaceutical manufacturing	1.55	1.50	1.50
Medical devices and diagnostic equipment	1.83	1.92	1.92
Life Science Wholesale	1.36	1.24	1.23
Research and Lab Support	1.12	1.11	1.11
TOTAL LIFE SCIENCE INDUSTRY	**1.27**	**1.25**	**1.25**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Southern California Industry Competitiveness by Shift Share

(The larger the Regional Share compared to Expected Change, the more competitive the industry)

	2011 Q3 Empl	2016 Q3 Empl	% Change	Expected Change	Regional Share
Total - All Industries	8,062,729	9,057,472	12.3%		
BioRenewables	8,065	8,822	9.4%	726	352
Biopharmaceutical manufacturing	24,312	25,534	5.0%	2190	8
Medical devices and diagnostic equipment	45,087	49,406	9.6%	4061	3,698
Life Science Wholesale	31,285	31,266	-0.1%	2818	-1,967
Research and Lab Support	67,774	75,490	11.4%	6104	1,517
TOTAL LIFE SCIENCE INDUSTRY	**176,523**	**190,518**	**7.9%**	**15899**	**2,744**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Life Science Industry Economic Impacts by Cluster (Direct, Indirect, Induced) - Southern California 2016

Industry	Output	Value Added	Labor Income	Employment
BioRenewables	$ 6,131,925,134	$ 2,018,930,514	$ 1,203,552,853	15,376
Biopharmaceutical manufacturing	$ 65,355,827,217	$ 32,552,275,317	$14,915,162,530	177,436
Medical devices and diagnostic equipment	$ 37,856,440,867	$ 19,682,956,767	$11,349,037,126	142,940
Life Science Wholesale	$ 12,981,845,843	$ 8,163,991,828	$ 4,515,136,755	64,235
Research and Lab Support	$ 27,646,672,747	$ 17,193,482,514	$12,032,817,702	162,643
TOTAL LIFE SCIENCE INDUSTRY	**$ 149,972,711,809**	**$ 79,611,636,940**	**$44,015,706,966**	**562,630**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

Southern California Foreign Exports of Life Science Products and Services 2015

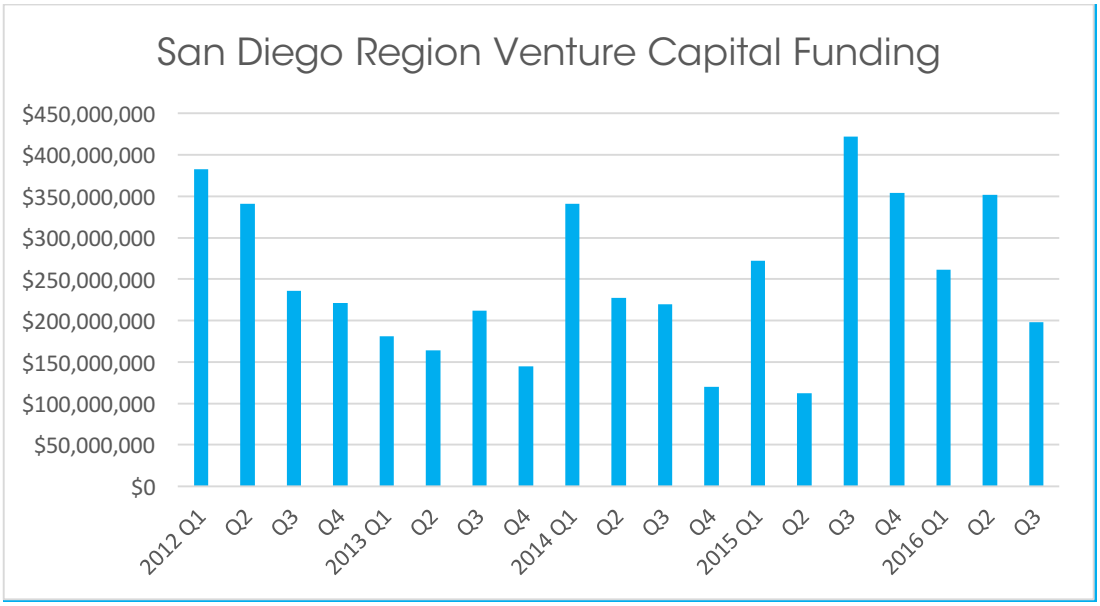
Industry Cluster	Exports
BioRenewables	$ 627,325,337
Biopharmaceutical Manufacturing	$ 3,418,507,426
Medical Devices and Diagnostic Equipment	$ 6,181,438,133
Life Science Wholesale	$ 1,124,173,886
Research, Development, and Education Labs	$ 1,151,280,736
TOTAL LIFE SCIENCE INDUSTRY	**$ 12,502,725,517**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

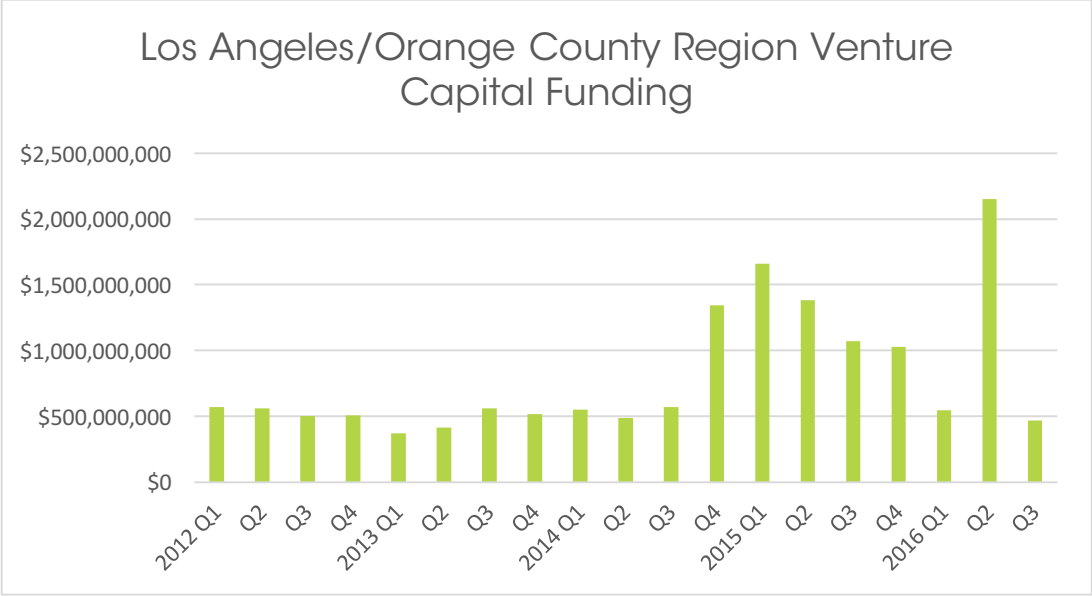
National Institutes of Health New Research Awards FY2016 - Southern California

County	Total
Los Angeles	$ 893,066,638
Orange	$ 125,647,439
Riverside	$ 21,164,058
San Diego	$ 832,577,388
Ventura	$ 757,625
TOTAL	**$1,873,213,148.00**

Source: NIH, TClower & Assoc.



Source: National Venture Capital Association (Area definition of the San Diego Region does not align with Southern California as used elsewhere in this report.)



Source: National Venture Capital Association (Area definition of the San Diego Region does not align with Southern California as used elsewhere in this report.)

San Diego County

Summary

San Diego County's Life Science industry provided almost 50,000 jobs in 2016 with average annual earnings exceeding $117,000 per year. There was solid job growth in Biopharmaceuticals, Medical Devices and Research activities between 2011 and 2016. Total employment in BioRenewables declined slightly, while Life Science Wholesale dropped almost 900 positions during this time.

Almost all key Life Science occupations in San Diego County show high to very high Location Quotients, which is a demonstration of the County's long time dominance in this industry. For example, proportionately, San Diego County boasts almost 3.4 times the concentration of Biochemists and Biophysicists as the national average. Exceptionally strong occupation sectors also include Microbiologists (LQ=2.6), Biological Scientists (LQ=2.45), Medical Scientists (LQ=2.75), and Biological Technicians (LQ=2.6). Comparing these data to the broader Southern California geography demonstrates the high concentration of all regional Life Science jobs in San Diego County. These location quotient outcomes also apply to key industry clusters with the data indicating that Biopharmaceuticals, Medical Devices, and Research Services all increased their level of competitiveness over the past five years. The conclusions are supported by our shift share analysis, which shows impressive strength in the regional share component, except in Trade and BioRenewables.

Total Life Science exports from San Diego County totaled almost $3.3 billion in 2015. San Diego County institutions and companies received $833 million in new research awards from the National Institutes of Health in FY2016.

The economic impacts of the Life Science industry in San Diego County

- Generates $33.6 billion in County economic activity (output)
- Adds $19.4 billion to local gross product
- Supports 133,000 jobs
- Increases labor income in the county by $11.2 billion per year.

San Diego Life Science Employment

Life Science Employment by County	2016 Q3	Avg. Earnings
San Diego	**49,763**	**$117,253**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

San Diego County Employment by Life Science Cluster

Life Science by Sectors	2011	2016	2021
BioRenewables	1,703	1,675	1,605
Biopharmaceutical manufacturing	5,322	6,876	6,868
Medical devices and diagnostic equipment	7,443	9,770	9,680
Life Science Wholesale	5,087	4,117	4,035
Research and Lab Support	22,040	27,325	28,945
TOTAL LIFE SCIENCE INDUSTRY	**41,595**	**49,763**	**51,133**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

San Diego Life Science Industry Establishments by Cluster

Industry Cluster	Establishments
BioRenewables	65
Biopharmaceutical manufacturing	99
Medical devices and diagnostic equipment	211
Life Science Wholesale	306
Research and Lab Support	544
TOTAL LIFE SCIENCE INDUSTRY	**1,225**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Wages in Life Science Clusters

Wages by Sector and County, 2016 Q3						
	BioRenewables	**Biopharmaceutical manufacturing**	**Medical Devices**	**Life Science Wholesale**	**Research and Lab Support**	**All Life Science**
San Diego County	**$42,079**	**$150,853**	**$101,309**	**$125,317**	**$117,893**	**$117,253**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

San Diego County Industry Competitiveness by Location Quotient

(Location Quotients measure industry concentration. A larger location quotient (>1.2) indicates a regional competitive advantage)

Location Quotient for Region by Industry Cluster	2011	2016	2021
BioRenewables	0.70	0.63	0.63
Biopharmaceutical manufacturing	2.04	2.44	2.43
Medical devices and diagnostic equipment	1.82	2.29	2.28
Life Science Wholesale	1.33	0.98	0.99
Research and Lab Support	2.19	2.42	2.41
TOTAL LIFE SCIENCE INDUSTRY	**1.81**	**1.98**	**1.99**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

San Diego County Employment by Selected Life Science Occupations

Title	2016 Q3 Jobs	Avg. Annual Wages	Location Quotient	Unemployment Rate	5-Year Job Growth
Biochemists and Biophysicists	1,150	$96,200	3.37	1.5%	112
Microbiologists	547	$96,600	2.60	1.9%	34
Zoologists and Wildlife Biologists	277	$67,700	1.57	3.1%	18
Biological Scientists, All Other	720	$72,100	2.45	2.9%	39
Epidemiologists	65	$100,900	1.33	1.8%	5
Medical Scientists	2,949	$120,200	2.75	0.9%	273
Life Scientists, All Other	149	$91,100	1.63	1.6%	10
Environmental Scientists and Specialists, Including Health	1,129	$83,200	1.31	0.8%	23
Agricultural & Food Science Technicians	326	$37,500	1.16	1.7%	2
Biological Technicians	1,902	$55,000	2.59	3.2%	72
Chemical Technicians	989	$50,500	1.51	1.7%	-312
Environmental Science and Protection Techs, Inc. Health	466	$45,600	1.34	3.0%	-81
Life, Physical, and Social Science Technicians, All Other	1,104	$48,900	1.59	2.5%	-38
Medical and Clinical Laboratory Technologists	1,886	$77,100	1.11	1.9%	285
Medical and Clinical Laboratory Technicians	2,072	$47,400	1.22	2.0%	380

Source: Chmura Economics, JobsEQ, TClower & Assoc.

San Diego County Industry Competitiveness by Shift Share

(The larger the Regional Share compared to Expected Change, the more competitive the industry)

Subsector	2011 Q3 Empl	2016 Q3 Empl	% Change	Expected Change	Regional Share
Total - All Industries	1,339,556	1,502,055	12.1%		
BioRenewables	1,703	1,675	-1.6%	153	-114
Biopharmaceutical manufacturing	5,322	6,876	29.2%	479	1,288
Medical devices and diagnostic equipment	7,443	9,770	31.3%	670	2,224
Life Science Wholesale	5,087	4,117	-19.1%	458	-1,287
Research and Lab Support	22,040	27,325	24.0%	1,985	3,269
TOTAL LIFE SCIENCE INDUSTRY	**41,595**	**49,763**	**19.6%**	**3,746**	**5,517**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Life Science Industry Economic Impacts by Cluster (Direct, Indirect, Induced) San Diego County 2016

Industry	Output	Value Added	Labor Income	Employment
BioRenewables	$885,375,638	$ 230,102,979	$ 124,816,277	1,971
Biopharmaceutical manufacturing	$10,794,092,230	$ 6,211,904,527	$ 2,775,100,078	29,675
Medical devices and diagnostic equipment	$7,491,937,375	$ 3,835,662,934	$ 2,172,018,963	26,560
Life Science Wholesale	$1,510,575,791	$ 955,368,448	$ 524,268,783	7,557
Research and Lab Support	$12,933,766,174	$8,179,103,673	$5,638,213,767	67,244
TOTAL LIFE SCIENCE INDUSTRY	**$33,615,747,208**	**$ 19,412,142,561**	**$ 11,234,417,868**	**133,007**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

San Diego County Foreign Exports of Life Science Products and Services 2015

Industry Cluster	Exports
BioRenewables	$ 122,815,626
Biopharmaceutical Manufacturing	$ 976,469,732
Medical Devices and Diagnostic Equipment	$ 1,344,376,578
Life Science Wholesale	$ 147,631,250
Research, Development, and Education Labs	$ 696,748,651
TOTAL LIFE SCIENCE INDUSTRY	**$ 3,288,041,837**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

National Institutes of Health New Research Awards FY2016

County	Total
San Diego	**$ 832,577,388**

Sources: NIH, TClower & Associates

Orange County

Summary

Orange County had 48,000 Life Science industry jobs in 2016 with annual earnings for these jobs averaging $86,000 per year. There was solid job growth in Medical Devices manufacturing in Orange County between 2011 and 2016 with a smaller gain in Research and Lab Support.

The only occupation among those examined in the Life Science showing a competitive advantage based on location quotients is Environmental Science and Protection Technicians. Most other industry occupations are proportionately equivalent in national averages, with a couple of occupations being notably underrepresented.

The key competitive Life Science industry cluster in Orange County is Medical Devices and Diagnostic Equipment Manufacturing with a huge location quotient of almost 5.0 in 2016, which rose from 4.2 in 2011. This means that there are 5 times the national average employees in this industry cluster on a proportional basis. Life Science Wholesale remains a competitive sector for Orange County, with Biopharmaceuticals just clearing our competitive threshold at 1.2, having dropped from 1.5 in 2011. Clearly, the Life Science industry is consolidating around devices manufacturing, with a still active trade sector. The shift share analysis shows much the same results with tremendous competitive strength in Medical Devices.

Total Life Science exports from Orange County totaled more than $4 billion in 2015, driven by almost $2.9 billion in Medical Devices and Diagnostic Equipment shipments. Orange County institutions and companies received $125.6 million in new research awards from the National Institutes of Health in FY2016.

The economic impacts of the Life Science industry in Orange County:

- Generates $33 billion in County economic activity (output)
- Boosts local value added (gross product) by $17.4 billion
- Supports 122,000 jobs
- Increases labor income in the County by $9.8 billion per year.

Orange County Life Science Employment

Life Science Employment by County	2016 Q3	Avg. Earnings
Orange	**48,049**	**$86,004**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Orange County Employment by Life Science Cluster

Life Science by Sectors	2011	2016	2021
BioRenewables	587	546	518
Biopharmaceutical manufacturing	4,361	3,827	3,791
Medical devices and diagnostic equipment	18,965	23,673	23,353
Life Science Wholesale	10,726	8,774	8,493
Research and Lab Support	10,882	11,229	12,130
TOTAL LIFE SCIENCE INDUSTRY	**45,521**	**48,049**	**48,285**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Orange County Life Science Industry Establishments by Cluster, 2016 3Q

Industry Cluster	Establishments
BioRenewables	21
Biopharmaceutical manufacturing	68
Medical devices and diagnostic equipment	342
Life Science Wholesale	534
Research and Lab Support	336
TOTAL LIFE SCIENCE INDUSTRY	**1,301**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Wages in Life Science Clusters

Wages by Sector and County, 2016 Q3						
	BioRenewables	Biopharmaceutical manufacturing	Medical Devices	Life Science Wholesale	Research and Lab Support	All Life Science
Orange	**$51,188**	**$77,812**	**$87,669**	**$100,170**	**$75,909**	**$86,004**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Orange County Employment by Selected Life Science Occupations

Title	2016 Q3 Jobs	Avg. Annual Wages	Location Quotient	Unemployment Rate	5-Year Job Growth
Biochemists and Biophysicists	413	$115,700	1.09	1.2%	45
Microbiologists	242	$78,000	1.03	1.6%	18
Zoologists and Wildlife Biologists	135	$62,500	0.68	2.6%	25
Biological Scientists, All Other	244	$78,300	0.75	2.4%	27
Epidemiologists	38	$78,900	0.69	1.5%	4
Medical Scientists	1,202	$92,900	1.01	0.8%	118
Life Scientists, All Other	89	$93,900	0.88	1.3%	12
Environmental Scientists and Specialists, Including Health	1,027	$86,700	1.07	0.7%	185
Agricultural & Food Science Technicians	183	$42,100	0.58	1.4%	19
Biological Technicians	760	$50,800	0.93	2.7%	73
Chemical Technicians	768	$45,300	1.05	1.4%	66
Environmental Science and Protection Techs, Inc. Health	472	$49,600	1.22	2.5%	77
Life, Physical, and Social Science Technicians, All Other	712	$48,500	0.92	2.0%	91
Medical and Clinical Laboratory Technologists	1,656	$81,600	0.87	1.6%	36
Medical and Clinical Laboratory Technicians	1,813	$45,400	0.96	1.7%	126

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Orange County Industry Competitiveness by Location Quotient

(Location Quotients measure industry concentration. A larger location quotient (>1.2) indicates a regional competitive advantage)

Location Quotient for Region by Industry Cluster	2011	2016	2021
BioRenewables	0.22	0.19	0.19
Biopharmaceutical manufacturing	1.52	1.22	1.21
Medical devices and diagnostic equipment	4.22	4.99	4.97
Life Science Wholesale	2.55	1.89	1.87
Research and Lab Support	0.98	0.89	0.91
TOTAL LIFE SCIENCE INDUSTRY	**1.80**	**1.71**	**1.70**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Orange County Industry Competitiveness by Shift Share

(The larger the Regional Share compared to Expected Change, the more competitive the industry)

	2011 Q3 Empl	2016 Q3 Empl	% Change	Expected Change	Regional Share
Total - All Industries	1,475,690	1,672,429	13.3%		
BioRenewables	587	546	-7.0%	53	-71
Biopharmaceutical manufacturing	4,361	3,827	-12.2%	393	-752
Medical devices and diagnostic equipment	18,965	23,673	24.8%	1,708	4,447
Life Science Wholesale	10,726	8,774	-18.2%	966	-2,620
Research and Lab Support	10,882	11,229	3.2%	980	-648
TOTAL LIFE SCIENCE INDUSTRY	**45,521**	**48,049**	**5.6%**	**4,100**	**-373**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Life Science Industry Economic Impacts by Cluster (Direct, Indirect, Induced) - Orange County 2016

Industry	Output	Value Added	Labor Income	Employment
BioRenewables	$1,096,231,561	$ 251,212,217	$ 137,751,785	1,784
Biopharmaceutical manufacturing	$9,686,727,438	$ 4,354,302,274	$ 2,039,678,897	25,569
Medical devices and diagnostic equipment	$15,362,040,084	$ 8,260,346,202	$ 4,782,617,991	56,971
Life Science Wholesale	$3,637,445,269	$ 2,391,524,312	$ 1,331,826,697	16,951
Research and Lab Support	$3,214,765,949	$ 2,105,551,752	$ 1,554,334,968	20,435
TOTAL LIFE SCIENCE INDUSTRY	**$ 32,997,210,302**	**$ 17,362,936,757**	**$ 9,846,210,338**	**121,711**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

Orange County Foreign Exports of Life Science Products and Services 2015

Industry Cluster	Exports
BioRenewables	$189,090,535
Biopharmaceutical Manufacturing	$575,558,608
Medical Devices and Diagnostic Equipment	$2,852,175,664
Life Science Wholesale	$349,667,018
Research, Development, and Education Labs	$94,802,473
TOTAL LIFE SCIENCE INDUSTRY	**$4,061,294,298**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

National Institutes of Health New Research Awards FY2016

County	Total
Orange County	**$125,647,439**

Sources: NIH, TClower & Assoc.

Los Angeles County

Summary

Los Angeles County was home to almost 70,000 Life science industry jobs in 2016 with average annual earnings at about $72,600. Most of the Life science industry clusters in LA County grew between 2011 and 2016, with Medical Devices and BioRenewables showing job losses. In a rarity for the areas studied in this report, Life Science Wholesale Trade added over 2,000 jobs since 2011, likely a result of the historical strength of the manufacturing industry in the region.

Location quotients for the subsectors are relatively low, but this is to be expected for this region because of the many diverse successful industries already entrenched in the area and the fact that the life sciences cluster as a whole is in a growth phase in the county. However, the regional share for Biopharmaceuticals is strongly positive, and while this sector has an LQ of 0.96 in 2016, it was an improvement over an LQ=0.81 in 2011. Biopharmaceuticals and Life Science Wholesale Trade are emerging industry clusters in Los Angeles County.

The Medical Devices cluster had more than $1 billion in export sales in 2015, remaining an economically important industry. Total industry exports in 2015 approached $3.4 billion. Los Angeles County institutions and companies received $893 million in new research awards from the National Institutes for Health in FY2016, indicating the strength of the life science research ongoing in the county, which provides opportunities for growth and expansion.

The economic impacts of the Life Science industry in Los Angeles:

- Generates $40.3 billion in county economic activity (output)
- Adds $20.5 billion to gross county product
- Supports 162,000 jobs
- Increases labor income by $11.9 billion per year.

Los Angeles County Life Science Employment

Life Science Employment by County	2016 Q3	Avg. Earnings
Los Angeles	**69,830**	**$72,577**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Los Angeles County Employment by Life Science Cluster

Life Science by Sectors	2011	2016	2021
BioRenewables	1,337	1,048	990
Biopharmaceutical manufacturing	6,676	8,457	8,356
Medical devices and diagnostic equipment	13,458	12,509	12,271
Life Science Wholesale	11,275	14,435	13,881
Research and Lab Support	31,773	33,381	35,397
TOTAL LIFE SCIENCE INDUSTRY	**64,519**	**69,830**	**70,895**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Life Science Industry Establishments by Cluster, 2016 3Q

Industry Cluster	Establishments
BioRenewables	51
Biopharmaceutical manufacturing	103
Medical devices and diagnostic equipment	436
Life Science Wholesale	1,071
Research and Lab Support	787
TOTAL LIFE SCIENCE INDUSTRY	**2,448**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Wages in Life Science Clusters by County

Wages by Sector and County, 2016 Q3						
	BioRenewables	**Biopharmaceutical manufacturing**	**Medical Devices**	**Life Science Wholesale**	**Research and Lab Support**	**All Life Science**
Los Angeles County, California	**$41,699**	**$68,871**	**$76,087**	**$69,064**	**$74,689**	**$72,577**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Los Angeles County Employment by Selected Life Science Occupations

Title	2016 Q3 Jobs	Avg. Annual Wages	Location Quotient	Unemployment Rate	5-Year Job Growth
Biochemists and Biophysicists	936	$114,100	0.87	1.6%	78
Microbiologists	548	$77,000	0.83	2.1%	52
Zoologists and Wildlife Biologists	357	$61,700	0.64	3.3%	34
Biological Scientists, All Other	639	$77,200	0.69	3.1%	17
Epidemiologists	117	$77,800	0.76	2.0%	11
Medical Scientists	2,994	$91,700	0.89	1.0%	195
Life Scientists, All Other	247	$92,600	0.86	1.7%	23
Environmental Scientists and Specialists, Including Health	2,205	$85,500	0.81	0.9%	170
Agricultural & Food Science Technicians	584	$41,600	0.66	1.8%	25
Biological Technicians	1,907	$50,100	0.83	3.5%	131
Chemical Technicians	1,708	$44,700	0.83	1.9%	59
Environmental Science and Protection Techs, Inc. Health	990	$48,900	0.90	3.2%	79
Life, Physical, and Social Science Technicians, All Other	1,865	$47,900	0.86	2.6%	152
Medical and Clinical Laboratory Technologists	4,748	$80,500	0.89	2.0%	227
Medical and Clinical Laboratory Technicians	4,987	$44,700	0.93	2.2%	380

Source: Chmura Economics, JobsEQ,TClower & Assoc.

Los Angeles County Industry Competitiveness by Location Quotient

(Location Quotients measure industry concentration. A larger location quotient (>1.2) indicates a regional competitive advantage)

Location Quotient for Region by Industry Cluster	2011	2016	2021
BioRenewables	0.17	0.13	0.13
Biopharmaceutical manufacturing	0.81	0.96	0.95
Medical devices and diagnostic equipment	1.04	0.94	0.93
Life Science Wholesale	0.93	1.10	1.09
Research and Lab Support	1.00	0.94	0.95
TOTAL LIFE SCIENCE INDUSTRY	**0.89**	**0.88**	**0.89**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Los Angeles County Industry Competitiveness by Shift Share

(The larger the Regional Share compared to Expected Change, the more competitive the industry)

	2011Q3 Empl	2016Q3 Empl	% Change	Expected Change	Regional Share
Total - All Industries	4,241,730	4,718,079	11.2%		
BioRenewables	1,337	1,048	-21.6%	120	-356
Biopharmaceutical manufacturing	6,676	8,457	26.7%	601	1,448
Medical devices and diagnostic equipment	13,458	12,509	-7.1%	1,212	-1,134
Life Science Wholesale	11,275	14,435	28.0%	1,015	2,458
Research and Lab Support	31,773	33,381	5.1%	2,862	-1,298
TOTAL LIFE SCIENCE INDUSTRY	**64,519**	**69,830**	**8.2%**	**5,811**	**1,199**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Life Science Industry Economic Impacts by Cluster (Direct, Indirect, Induced) - Los Angeles County 2016

Industry	Output	Value Added	Labor Income	Employment
BioRenewables	$ 1,269,838,913	$ 320,403,807	$ 167,820,257	2,278
Biopharmaceutical manufacturing	$ 16,984,536,160	$ 7,265,754,411	$ 3,553,384,422	45,417
Medical devices and diagnostic equipment	$8,036,922,257	$ 4,091,826,365	$ 2,361,370,794	29,911
Life Science Wholesale	$ 5,338,442,822	$ 3,354,674,426	$ 1,836,074,513	26,602
Research and Lab Support	$8,707,412,908	$ 5,522,403,447	$ 4,012,712,423	58,028
TOTAL LIFE SCIENCE INDUSTRY	**$40,337,155,296**	**$20,555,063,829**	**$ 11,931,363,194**	**162,236**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

Los Angeles County Foreign Exports of Life Science Products and Services 2015

Industry Cluster	Exports
BioRenewables	$ 188,878,071
Biopharmaceutical Manufacturing	$ 1,000,583,036
Medical Devices and Diagnostic Equipment	$ 1,498,224,919
Life Science Wholesale	$ 493,012,592
Research, Development, and Education Labs	$ 184,826,952
TOTAL LIFE SCIENCE INDUSTRY	**$ 3,365,525,570**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

National Institutes of Health New Research Awards FY2016

County	Total
Los Angeles County	$ 893,066,638

Sources: NIH, TClower & Assoc.

City of San Diego

Summary

The City of San Diego's Life Science industry provided over 32,000 jobs in 2016 with average annual earnings of about $113,000 per year. There was solid job growth in Biopharmaceuticals, Medical Devices and Research activities between 2011 and 2016 with Research and Laboratory Services adding almost 5,000 jobs over the past five years.

Almost all key Life Science occupations in the City of San Diego show high to very high Location Quotients, which is a demonstration of the county's long time dominance in this industry. For example, proportionately, City of San Diego boasts almost 3.4 times the concentration of Biochemists and Biophysicists as the national average. Exceptionally strong occupation sectors also include Microbiologists (LQ=2.6), Biological Scientists (LQ=2.45), Medical Scientists (LQ=2.75), and Biological Technicians (LQ=2.6). Comparing these data to the broader Southern California geography demonstrates the high concentration of all regional Life Science jobs in the City of San Diego. These location quotient outcomes also apply to key industry clusters with the data indicating that Biopharmaceuticals, Medical Devices, and Research Services all increased their level of competitiveness over the past five years.

Total Life Science exports from the City of San Diego totaled over $1.5 billion in 2015. The city's institutions and companies received $822 million in new research awards from the National Institutes of Health in FY2016.

The economic impacts of the Life Science industry in the City of San Diego:

- Generates $17.5 billion in city economic activity (output)
- Adds $10.3 billion to local gross product
- Supports over 73,000 jobs
- Increases labor income in the city by about $6.7 billion per year.

City of San Diego Life Science Employment

Life Science Employment	2016 Q4	Avg. Earnings
City of San Diego	**32,173**	**$113,128**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

City of San Diego Employment by Life Science Cluster

Life Science by Sectors	2011	2016	2021
BioRenewables	362	283	271
Biopharmaceutical manufacturing	2,684	3,212	3,209
Medical Devices and Diagnostic Equipment	3,049	4,474	4,433
Life Science Wholesale	3,323	2,224	2,191
Research and Lab Support	17,025	21,979	23,309
TOTAL LIFE SCIENCE INDUSTRY	**26,444**	**32,173**	**33,431**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

City of San Diego Life Science Industry Establishments by Cluster

Industry Cluster	Establishments
BioRenewables	11
Biopharmaceutical Manufacturing	46
Medical Devices and Diagnostic Equipment	97
Life Science Wholesale	165
Research and Lab Support	438
TOTAL LIFE SCIENCE INDUSTRY	**757**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Wages in Life Science Clusters

Wages by Sector and County, 2016 Q4						
	BioRenewables	**Biopharmaceutical manufacturing**	**Medical Devices**	**Life Science Wholesale**	**Research and Lab Support**	**All Life Science**
City of San Diego	**$52,448**	**$111,887**	**$96,232**	**$123,931**	**$116,438**	**$113,128**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

City of San Diego Industry Competitiveness by Location Quotient

(Location Quotients measure industry concentration. A larger location quotient (>1.2) indicates a regional competitive advantage)

Location Quotient for Region by Industry Cluster	2011	2016	2021
BioRenewables	0.15	0.19	0.21
Biopharmaceutical Manufacturing	1.84	2.03	2.20
Medical Devices and Diagnostic Equipment	1.33	1.86	2.01
Life Science Wholesale	1.55	0.95	1.04
Research and Lab Support	3.01	3.47	3.75
TOTAL LIFE SCIENCE INDUSTRY	**2.04**	**2.28**	**2.52**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

City of San Diego Employment by Selected Life Science Occupations

Title	2016 Q4 Jobs	Avg. Annual Wages	Location Quotient	Unemployment Rate	5-Year Job Growth
Biochemists and Biophysicists	956	$96,200	4.98	1.5	57
Microbiologists	411	$96,600	3.48	1.9	62
Zoologists and Wildlife Biologists	208	$67,700	2.09	3.1	6
Biological Scientists, All Other	557	$72,100	3.39	2.9	7
Epidemiologists	51	$100,900	1.85	1.8	2
Medical Scientists	2478	119800	3.93	0.9	106
Life Scientists, All Other	112	$91,100	2.19	1.6	5
Environmental Scientists and Specialists, Including Health	774	$83,200	1.6	0.8	49
Agricultural & Food Science Technicians	193	$37,500	1.23	1.7	7
Biological Technicians	1510	55000	3.66	3.2	54
Chemical Technicians	668	$50,500	1.82	1.7	37
Environmental Science and Protection Techs, Inc. Health	302	$45,600	1.55	3	20
Life, Physical, and Social Science Technicians, All Other	782	$48,900	2.02	2.5	29
Medical and Clinical Laboratory Technologists	1,312	$77,100	1.37	1.9	127
Medical and Clinical Laboratory Technicians	1,474	$47,400	1.54	2	155

Source: Chmura Economics, JobsEQ,TClower & Assoc

City of San Diego Industry Competitiveness by Shift Share

(The larger the Regional Share compared to Expected Change, the more competitive the industry)

	2011 Q4 Empl	2016 Q4 Empl	% Change	Expected Change	Regional Share
Total - All Industries	754,002	841,018	11.5%		
BioRenewables	204	283	38.7%	7	72
Biopharmaceutical Manufacturing	2,684	3,212	19.7%	161	367
Medical Devices and Diagnostic Equipment	3,049	4,474	46.7%	72	1,353
Life Science Wholesale	3,323	2,224	-33.1%	203	-1,302
Research and Lab Support	17,025	21,979	29.1%	1,607	3,347
TOTAL LIFE SCIENCE INDUSTRY	**26,444**	**32,173**	**21.7%**	**1,742**	**3,987**

Source: Chmura Economics, JobsEQ, TClower & Assoc.

Life Science Industry Economic Impacts by Cluster (Direct, Indirect, Induced) - City of San Diego 2016

Industry	Output	Value Added	Labor Income	Employment
BioRenewables	$ 303,513,000	$ 69,476,000	$ 37,101,000	532
Biopharmaceutical Manufacturing	$ 2,900,019,000	$ 1,578,382,000	$ 855,121,000	8,908
Medical Devices and Diagnostic Equipment	$ 3,512,263,000	$ 1,804,975,000	$1,017,240,000	11,382
Life Science Wholesale	$ 851,127,000	$ 538,844,000	$ 296,921,000	4,096
Research and Lab Support	$ 9,954,160,000	$ 6,303,030,000	$4,477,214,000	48,378
TOTAL LIFE SCIENCE INDUSTRY	**$17,521,082,000**	**$10,294,707,000**	**$6,683,597,000**	**73,296**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

City of San Diego Foreign Exports of Life Science Products and Services 2015

Industry Cluster	Exports
BioRenewables	$ 48,556,128
Biopharmaceutical Manufacturing	$ 412,926,537
Medical Devices and Diagnostic Equipment	$ 558,127,639
Life Science Wholesale	$ 85,184,541
Research, Development, and Education Labs	$ 418,776,309
TOTAL LIFE SCIENCE INDUSTRY	**$ 1,523,571,154**

Source: Chmura Economics, JobsEQ, IMPLAN, TClower & Assoc.

National Institutes of Health New Research Awards FY2016

County	Total
San Diego	**$821,753,490**

Sources: NIH, TClower & Associates

Appendix 1

NAICS Industry Description

INDUSTRIAL BIOTECHNOLOGY AND BIOFUELS

111000 Crop Production (15%)
113210 Forest Nurseries and Gathering of Forest Products (15%)
311221 Wet Corn Milling
311222 Soybean Processing
311223 Other Oilseed Processing
325193 Ethyl Alcohol Manufacturing
325199 All Other Basic Organic Chemical Manufacturing
325221 Cellulosic Organic Fiber Manufacturing
325311 Nitrogenous Fertilizer Manufacturing
325312 Phosphatic Fertilizer Manufacturing
325314 Fertilizer (Mixing Only) Manufacturing
325320 Pesticide and Other Agricultural Chemical Manufacturing

BIOPHARMACEUTICALS

325411 Medicinal and Botanical Manufacturing
325412 Pharmaceutical Preparation Manufacturing
325413 In-Vitro Diagnostic Substance Manufacturing
325414 Biological Product (except Diagnostic) Manufacturing

MEDICAL DEVICES AND DIAGNOSTICS EQUIPMENT

327215 Glass Product Manufacturing Made of Purchased Glass (20%)
333314 Optical Instrument and Lens Manufacturing (10%)
334510 Electromedical and Electrotherapeutic Apparatus Manufacturing
334513 Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables (3%)
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
339115 Ophthalmic Goods Manufacturing
339116 Dental Laboratories

LIFE SCIENCE TRADE

423450 Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers
424210 Drugs and Druggists' Sundries Merchant Wholesalers (82%)

RESEARCH AND LAB SERVICES

541380 Testing Laboratories (10%)
541711 Research and Development in Biotechnology
541712 R & D in the Physical, Engineering, and Life Science (except Biotechnology) (5%)
611310 Colleges, Universities, and Professional Schools (Private) (25%)
621511 Medical Laboratories
902612 Colleges, Universities, Professional Schools (State Government) (25%)
903612 Colleges, Universities, Professional Schools (Local Government) (10%)

Appendix 2

Awards of Certificates and Degrees in Selected CIP Code Programs, Academic Year 2014-2015 (most recent) - California

CIP Code	Title	Less than 1 year	At least 1 but less than 2 yrs	Assoc	At least 2 but less than 4 yr	Bachelor's	Post-Bacc	Master's	Post-master's	Doctor's degree	Total Awards
14.0501	Bioengineering and Biomedical Engineering	0	0	0	0	842	0	365	0	139	1,346
26.0101	Biology/Biological Sciences, General	11	4	1,651	0	7,474	0	413	0	96	9,649
26.0102	Biomedical Sciences, General	0	0	0	0	106	0	41	0	59	206
26.0202	Biochemistry	0	0	0	0	1,213	0	9	0	23	1,245
26.0203	Biophysics	0	0	0	0	41	0	10	0	28	79
26.0204	Molecular Biology	0	0	0	0	38	0	0	0	24	62
26.0205	Molecular Biochemistry	0	0	0	0	298	0	5	0	28	331
26.0207	Structural Biology	0	0	0	0	0	0	0	0	0	0
26.0210	Biochemistry and Molecular Biology	0	0	0	0	14	0	19	0	37	70
26.0299	Biochemistry, Biophysics and Molecular Biology	0	0	0	0	43	0	9	0	17	69
26.0301	Botany/Plant Biology	0	0	0	0	47	0	9	0	27	83
26.0305	Plant Pathology/ Phytopathology	0	0	0	0	0	0	2	0	5	7
26.0401	Cell/Cellular Biology and Histology	0	0	0	0	51	0	0	0	6	57
26.0403	Anatomy	0	0	0	0	274	0	1	0	7	282
26.0404	Developmental Biology and Embryology	0	0	0	0	0	0	0	0	11	11
26.0406	Cell/Cellular and Molecular Biology	0	0	0	0	897	0	13	0	69	979

CIP Code	Title	Less than 1 year	At least 1 but less than 2 yr	Assoc	At least 2 but less than 4 yr	Bachelor's	Post-Bacc	Master's	Post-master's	Doctor's degree	Total Awards
26.0499	Cell/Cellular Biology and Anatomical Sciences	0	0	16	0	46	0	27	0	6	95
26.0502	Microbiology, General	0	0	5	0	280	0	7	0	21	313
26.0503	Medical Microbiology and Bacteriology	0	0	0	0	0	0	2	0	6	8
26.0507	Immunology	0	0	0	0	0	0	1	0	18	19
26.0508	Microbiology and Immunology	0	0	0	0	14	0	15	0	0	29
26.0599	Microbiological Sciences and Immunology, Other	0	0	0	0	146	0	1	0	19	166
26.0801	Genetics, General	0	0	0	0	100	0	5	0	11	116
26.0802	Molecular Genetics	0	0	0	0	0	0	4	0	15	19
26.0806	Human/Medical Genetics	0	0	0	0	0	0	6	0	5	11
26.0899	Genetics, Other	0	0	0	0	0	0	0	0	3	3
26.0901	Physiology, General	0	0	0	0	215	0	17	0	6	238
26.0902	Molecular Physiology	0	0	0	0	0	0	0	0	7	7
26.0903	Cell Physiology	0	0	0	0	0	0	4	0	10	14
26.0904	Endocrinology	0	0	0	0	0	0	0	0	2	2
26.0908	Exercise Physiology	0	0	0	0	171	0	0	0	0	171
26.0909	Vision Science/ Physiological Optics	0	0	0	0	0	0	1	0	11	12
26.0910	Pathology/Experimental Pathology	0	0	0	0	0	0	10	0	23	33
26.0911	Oncology and Cancer Biology	0	0	0	0	0	0	0	0	11	11
26.0999	Physiology, Pathology, and Related Sciences, Other	0	0	0	0	0	0	0	0	0	0
26.1001	Pharmacology	0	0	0	0	33	0	1	0	4	38
26.1002	Molecular Pharmacology	0	0	0	0	0	0	3	0	15	18
26.1004	Toxicology	0	0	0	0	41	0	0	0	2	43

CIP Code	Title	Less than 1 year	At least 1 but less than 2 yr	Assoc	At least 2 but less than 4 yr	Bachelor's	Post-Bacc	Master's	Post-master's	Doctor's degree	Total Awards
26.1005	Molecular Toxicology	0	0	0	0	0	0	0	0	1	1
26.1006	Environmental Toxicology	0	0	0	0	29	0	1	0	9	39
26.1007	Pharmacology and Toxicology	0	0	0	0	0	0	5	0	13	18
26.1102	Biostatistics	0	0	0	0	0	0	62	0	17	79
26.1103	Bioinformatics	0	0	0	0	39	0	14	0	27	80
26.1104	Computational Biology	0	0	0	0	1	0	0	0	6	7
26.1199	Biomathematics, Bioinformatics, and Computational Biology, Other	0	0	0	0	14	0	11	0	1	26
26.1201	Biotechnology	0	0	0	0	115	0	84	0	0	199
26.1309	Epidemiology	0	0	0	0	0	0	70	0	43	113
26.1401	Molecular Medicine	0	0	0	0	0	0	2	0	1	3
26.1501	Neuroscience	0	0	0	0	559	0	21	0	85	665
26.1503	Neurobiology and Anatomy	0	0	0	0	428	0	0	0	0	428
26.1504	Neurobiology and Behavior	0	0	0	0	0	0	4	0	6	10
26.1599	Neurobiology and Neurosciences, Other	0	0	0	0	3	0	0	0	0	3
26.9999	Biological and Biomedical Sciences, Other	0	0	0	0	50	0	3	0	17	70

Source: Chmura Economics, JobsEQ

Awards of Certificates and Degrees in Selected CIP Code Programs, Academic Year 2014-2015 (most recent) - Northern California

CIP Code	Title	Less than 1 year	At least 1 but less than 2 yrs	Assoc	At least 2 but less than 4 yr	Bachelor's	Post-Bacc	Master's	Post-master's	Doctor's degree	Total Awards
14.0501	Bioengineering and Biomedical Engineering	0	0	0	0	155	0	94	0	38	287
26.0101	Biology/Biological Sciences, General	11	0	419	0	1,476	0	135	0	42	2,083
26.0102	Biomedical Sciences, General	0	0	0	0	0	0	21	0	22	43
26.0202	Biochemistry	0	0	0	0	128	0	1	0	7	136
26.0203	Biophysics	0	0	0	0	0	0	3	0	20	23
26.0204	Molecular Biology	0	0	0	0	0	0	0	0	0	0
26.0205	Molecular Biochemistry	0	0	0	0	0	0	1	0	20	21
26.0207	Structural Biology	0	0	0	0	0	0	0	0	0	0
26.0210	Biochemistry and Molecular Biology	0	0	0	0	5	0	0	0	0	5
26.0299	Biochemistry, Biophysics and Molecular Biology, Other	0	0	0	0	0	0	0	0	9	9
26.0301	Botany/Plant Biology	0	0	0	0	7	0	0	0	5	12
26.0401	Cell/Cellular Biology and Histology	0	0	0	0	0	0	0	0	5	5
26.0404	Developmental Biology and Embryology	0	0	0	0	0	0	0	0	10	10
26.0406	Cell/Cellular and Molecular Biology	0	0	0	0	506	0	3	0	43	552
26.0502	Microbiology, General	0	0	0	0	66	0	3	0	12	81
26.0507	Immunology	0	0	0	0	0	0	0	0	10	10
26.0599	Microbiological Sciences and Immunology, Other	0	0	0	0	0	0	0	0	6	6
26.0801	Genetics, General	0	0	0	0	0	0	0	0	1	1

CIP Code	Title	Less than 1 year	At least 1 but less than 2 yrs	Assoc	At least 2 but less than 4 yr	Bachelor's	Post-Bacc	Master's	Post-master's	Doctor's degree	Total Awards
26.0806	Human/Medical Genetics	0	0	0	0	0	0	6	0	5	11
26.0903	Cell Physiology	0	0	0	0	0	0	0	0	2	2
26.0904	Endocrinology	0	0	0	0	0	0	0	0	2	2
26.0908	Exercise Physiology	0	0	0	0	19	0	0	0	0	19
26.0909	Vision Science/Physiological Optics	0	0	0	0	0	0	0	0	11	11
26.0911	Oncology and Cancer Biology	0	0	0	0	0	0	0	0	11	11
26.1004	Toxicology	0	0	0	0	41	0	0	0	2	43
26.1102	Biostatistics	0	0	0	0	0	0	23	0	6	29
26.1199	Biomathematics, Bioinformatics, and Computational Biology, Other	0	0	0	0	2	0	0	0	0	2
26.1201	Biotechnology	0	0	0	0	0	0	13	0	0	13
26.1309	Epidemiology	0	0	0	0	0	0	49	0	6	55
26.1501	Neuroscience	0	0	0	0	0	0	9	0	30	39
26.9999	Biological and Biomedical Sciences, Other	0	0	0	0	1	0	2	0	0	3

Source: Chmura Economics, JobsEQ

Awards of Certificates and Degrees in Selected CIP Code Programs, Academic Year 2014-2015 (most recent) - Southern California

CIP Code	Title	Less than 1 year	At least 1 but less than 2 yrs	Assoc	At least 2 but less than 4 yr	Bachelor's	Post-Bacc	Master's	Post-master's	Doctor's degree	Total Awards
14.0501	Bioengineering and Biomedical Engineering	0	0	0	0	419	0	246	0	85	750
26.0101	Biology/Biological Sciences, General	0	4	591	0	3,884	0	206	0	54	4,739
26.0102	Biomedical Sciences, General	0	0	0	0	33	0	8	0	37	78
26.0202	Biochemistry	0	0	0	0	944	0	8	0	10	962
26.0203	Biophysics	0	0	0	0	41	0	6	0	8	55
26.0204	Molecular Biology	0	0	0	0	38	0	0	0	24	62
26.0205	Molecular Biochemistry	0	0	0	0	0	0	4	0	8	12
26.0210	Biochemistry and Molecular Biology	0	0	0	0	9	0	19	0	27	55
26.0299	Biochemistry, Biophysics and Molecular Biology, Other	0	0	0	0	8	0	0	0	0	8
26.0301	Botany/Plant Biology	0	0	0	0	6	0	6	0	13	25
26.0305	Plant Pathology/Phytopathology	0	0	0	0	0	0	0	0	1	1
26.0401	Cell/Cellular Biology and Histology	0	0	0	0	5	0	0	0	0	5
26.0403	Anatomy	0	0	0	0	274	0	0	0	6	280
26.0404	Developmental Biology and Embryology	0	0	0	0	0	0	0	0	1	1
26.0406	Cell/Cellular and Molecular Biology	0	0	0	0	130	0	2	0	17	149
26.0499	Cell/Cellular Biology and Anatomical Sciences, Other	0	0	16	0	0	0	22	0	0	38

CIP Code	Title	Less than 1 year	At least 1 but less than 2 yrs	Assoc	At least 2 but less than 4 yr	Bachelor's	Post-Bacc	Master's	Post-master's	Doctor's degree	Total Awards
26.0502	Microbiology, General	0	0	5	0	82	0	3	0	0	90
26.0503	Medical Microbiology and Bacteriology	0	0	0	0	0	0	1	0	4	5
26.0507	Immunology	0	0	0	0	0	0	0	0	1	1
26.0508	Microbiology and Immunology	0	0	0	0	14	0	15	0	0	29
26.0599	Microbiological Sciences and Immunology, Other	0	0	0	0	146	0	1	0	13	160
26.0801	Genetics, General	0	0	0	0	6	0	0	0	0	6
26.0802	Molecular Genetics	0	0	0	0	0	0	4	0	15	19
26.0806	Human/Medical Genetics	0	0	0	0	0	0	0	0	0	0
26.0899	Genetics, Other	0	0	0	0	0	0	0	0	3	3
26.0901	Physiology, General	0	0	0	0	205	0	16	0	2	223
26.0902	Molecular Physiology	0	0	0	0	0	0	0	0	7	7
26.0908	Exercise Physiology	0	0	0	0	6	0	0	0	0	6
26.0909	Vision Science/Physiological Optics	0	0	0	0	0	0	1	0	0	1
26.0910	Pathology/Experimental Pathology	0	0	0	0	0	0	4	0	9	13
26.0911	Oncology and Cancer Biology	0	0	0	0	0	0	0	0	0	0
26.0999	Physiology, Pathology, and Related Sciences, Other	0	0	0	0	0	0	0	0	0	0
26.1002	Molecular Pharmacology	0	0	0	0	0	0	3	0	15	18
26.1005	Molecular Toxicology	0	0	0	0	0	0	0	0	1	1
26.1006	Environmental Toxicology	0	0	0	0	0	0	0	0	6	6
26.1007	Pharmacology and Toxicology	0	0	0	0	0	0	0	0	3	3

CIP Code	Title	Less than 1 year	At least 1 but less than 2 yrs	Assoc	At least 2 but less than 4 yrs	Bachelor's	Post-Bacc	Master's	Post-master's	Doctor's degree	Total Awards
26.1102	Biostatistics	0	0	0	0	0	0	25	0	11	36
26.1103	Bioinformatics	0	0	0	0	30	0	10	0	19	59
26.1104	Computational Biology	0	0	0	0	1	0	0	0	6	7
26.1199	Biomathematics, Bioinformatics, and Computational Biology, Other	0	0	0	0	12	0	11	0	1	24
26.1201	Biotechnology	0	0	0	0	39	0	58	0	0	97
26.1309	Epidemiology	0	0	0	0	0	0	3	0	24	27
26.1401	Molecular Medicine	0	0	0	0	0	0	2	0	1	3
26.1501	Neuroscience	0	0	0	0	511	0	12	0	51	574
26.1503	Neurobiology and Anatomy	0	0	0	0	121	0	0	0	0	121
26.1504	Neurobiology and Behavior	0	0	0	0	0	0	4	0	6	10
26.1599	Neurobiology and Neurosciences, Other	0	0	0	0	3	0	0	0	0	3
26.9999	Biological and Biomedical Sciences, Other	0	0	0	0	7	0	0	0	13	20

Source: Chmura Economics, JobsEQ

Note: The life science industry cluster is dynamic. Its core attributes are innovation and evolution. Previous research by Biocom employed a variety of economic data and models to appropriately define the sub-sectors and activities that comprise the life science industry in California. Economic data, models, and approaches are constantly reviewed and revised to best capture the most accurate and timely snapshot of the industry. The definition of the life science industry has changed from previous studies issued by Biocom (see appendix). Therefore, the findings presented in this report should not be considered as commensurate with those of previous reports. A complete list of codes used in the analysis is provided in the Appendix to this report.