BAYBIO BIOCOM

2014
CALIFORNIA ECONOMIC IMPACT REPORT

Driving Growth and Innovation in California's Life Science Industry

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The Life Sciences in California: Evaluating the Economic Impact of Biotechnology in the Golden State

A Joint Report by BayBio and Biocom
Published June 2014

Greetings from BayBio and Biocom

For the past several years, both BayBio and Biocom – the life science trade associations representing the San Francisco Bay Area and the Southern California biotech clusters respectively – have published reports detailing various aspects of California's life science industry. We are excited to endeavor for the first time to publish a joint report that details not only the overall strength of the industry in the state, but also delves deeply into region-specific data on various tenets of the life sciences – employment data, economic impact to the state, research funding, product pipelines, education and workforce preparedness, and so on.

A few caveats are in order as a result of our merged efforts. First, and most importantly, comparisons to previous reports that BayBio and Biocom have participated in or published are not useful. As we have used different criteria in the past to define the life science industry in California, we had to reconcile our different definitions for this project. We have detailed the NAICS (North American Industry Classification System) codes used to define the industry in this report in the appendix. The NAICS code classifications used in this report parallel those used in the Battelle/BIO State Bioscience Industry Development report. In general, when we talk about the life science industry in this report, we include research, development, education, manufacturing, biorenewables (encompassing biofuels and bioagriculture), biopharmaceuticals, diagnostics, and medical devices; as well as the wholesale trade of the products in these categories.

Secondly, while the regional data focuses on the San Francisco Bay Area for BayBio, and the Southern California region for Biocom – that should in no way diminish the industry activity in other parts of the state. The Sacramento region is home to several bioagricultural firms, heavily clustered around UC Davis. That university, in fact, produces more baccalaureate and graduate degrees in biotech fields than any other school in the University of California system. Other parts of the state, including the Central Valley and Inland Empire, are home to manufacturing and warehousing facilities that are the lifeblood of our commercialization operations.

BayBio and Biocom are extremely proud of the history of the biotechnology industry in California – an industry that is born here, built here, and best here. It is our sincere hope that our increased collaboration on this report and, indeed, our day to day activities and public policy initiatives, will continue to bolster the position of both the Bay Area and Southern California life science clusters – and ensure that California continues to be the preeminent location in the world for life science research, development, manufacturing, and commercialization.

We invite you now to look closer at the research published here, which details vibrant economic activity, including one million jobs attributable to the life sciences in the Golden State, earning nearly $77 billion in wages, and generating more than $258 billion in economic activity.

Gail Maderis
President and CEO, BayBio

Joe Panetta
President and CEO, Biocom

Executive Summary

EMPLOYMENT

The life science industry in California continues to be a major source of employment, weathering the recent economic crisis fairly well in comparison to other industries and regions. The industry **directly employs 304,310** people in the state. When jobs attributable to the life sciences are factored in as well – things such as professional services, suppliers, construction, etc. – the figure climbs to over a million – **1,055,908 directly and indirectly employed** as a result of California's position as the world leader in biotechnology research and development.

Sector	Jobs
BioRenewables	38,964
Biopharmaceutical Manufacturing	45,514
Medical Devices & Diagnostics	80,181
Life Science Wholesale	42,374
Laboratory R&D	97,277
TOTAL JOBS	304,310

ECONOMIC IMPACT

Description	Impact
Economic Activity	$ 258,795,638,000
Attributable Jobs	1,055,908
Labor Income	$ 76,487,975,000

The life science industry accounts for a tremendous level of economic activity in the state. Including indirect and induced effects, the life science industry generates nearly $259 billion in economic activity in California. With more than one million jobs paying $76 billion in annual salaries, wages, and benefits, the industry's employees additionally provide billions in tax revenues to state and local government.

RESEARCH FUNDING

Funding innovative research in the life sciences continues to be one of the greatest struggles for our industry. With an average product development timeline of more than 10 years, and costs that can exceed $1 billion, the availability of early stage capital is key for the research clusters in California to continue to grow. In 2013, California led the nation with **$3,334,417,367 in NIH funding,** followed by Massachusetts and New York.

State	NIH Funding (in millions)
California	$3,334
Massachusetts	$2,384
New York	$1,947
North Carolina	$1,038
Minnesota	$494
New Jersey	$238

Venture capital, partnering deals, and other forms of private grant funding rounded out the state's capital development portfolio strongly in 2013. Steady sales of innovative treatments provided additional resources for research and development, and revenue from alliances and royalty payments laid the foundation for future innovation to occur.

	2009	2010	2011	2012	2013	2014	CAGR
Rx Sales Worldwide	27,718	29,744	30,499	34,054	38,145	44,732	10%
Alliance Revenue	306	324	343	383	536	558	13%
Royalty/Licensing Income	1,112	1,470	865	1,295	1,193	1,426	5%
Reported R&D Expenditures	8,229	7,985	8,759	9,698	10,742	11,563	7%

PRODUCT APPROVALS AND PIPELINE

The above labor and economic activity data yielded rich fruit in the state's product pipeline, with innovative new treatments coming to market that treat some of the most challenging unmet medical needs for patients. In 2013, California companies were awarded approval for eight new drug applications (NDA) and biologics licensing applications (BLA) from the U.S. Food and Drug Administration. That accounts for roughly a third of all approvals last year. Combined sales these products are forecast to be above $15 billion by 2018.

New Drug	Company	Approval Type
Anoro Ellipta	Theravance	Chemical (NDA)
Breo Ellipta	Theravance	Chemical (NDA)
Duavee	Ligand Pharmaceuticals	Chemical (NDA)
Imbruvica	Pharmacyclics	Chemical (NDA)
Kadcyla	Genentech	Biological (BLA)
Kynamro	Isis Pharmaceuticals	Biological (BLA)
Luzu	Topica Pharmaceuticals	Chemical (NDA)
Sovaldi	Gilead Sciences	Chemical (NDA)

Looking ahead, the Golden State is on track to continue this level of productivity, with a robust pipeline of new treatments in every stage of clinical and pre-clinical development.

	2009	2010	2011	2012	2013
Filed	28	29	48	53	45
PIII	84	77	95	83	106
PII	185	183	206	205	212
PI	145	149	150	159	156
Pre-clinical	289	282	321	324	311
Research Project	146	122	125	129	118
Total	**877**	**842**	**945**	**953**	**948**

EDUCATION AND WORKFORCE PREPAREDNESS

The life science industry sprang forth from California's world-class research universities, and grew into a vibrant industry as a result of strong collaborations between academics and company researchers. That tradition continues today, and the regions with a high concentration of life science companies also enjoy high levels of educational attainment and completion.

Degree Attainment	Graduate Degree or Higher	Bachelor's Degree	Associate's Degree	Some College Completed	High School Diploma
United States	10.3%	17.6%	7.5%	20.9%	27.9%
California	10.6%	18.8%	7.5%	21.8%	20.3%
Bay Area	16.6%	25.1%	7.2%	19.5%	17.4%
So. Cal.	10.7%	19.4%	7.9%	22.8%	19.9%

STEM Degrees	2010	2012	% Change
Bay Area	16,637	19,174	13%
So. Cal.	15,823	19,204	21.4%

LOOKING AHEAD TO 2015

The life science industry in California is resilient, and enjoys strong relationships with our local, state, and federal representatives. Recent programs enacted by Governor Jerry Brown's administration that provide sales and use tax exemptions for research and manufacturing for the life sciences will bolster the buying power of pre-commercial companies, and provide larger firms with an incentive to continue to grow in the biotech rich regions around San Diego and San Francisco. And the Governor also approved a bill that removed duplicative inspections of our facilities in the state. These initiatives provide relief for companies that are managing some of the highest infrastructure, real estate, and labor costs in the country.

Other states aggressively seek to replicate the success of our innovation clusters, and have implemented various innovative incentive structures and programs designed to aid start-up companies with targeted tax incentives, educational programs designed to prepare a workforce matched to the needs of highly technical industries, and regulatory and tort environments conducive to economic growth. BayBio and Biocom are constantly evaluating the policy choices of other states and jurisdictions, and will continue to encourage the state and our localities to enact sensible public policy that fosters continued life science growth.

At the federal level, both BayBio and Biocom have full-time staff present to manage relationships with our Congressional delegation, and to facilitate dialogue between our member companies and the various regulatory agencies that govern science funding, patent and trademark issues, and drug and device approval and reimbursement. We will continue to advocate for policies that provide predictability and transparency for product approval, enshrine fair rules for patent rights, and achieve broad patient access and reimbursement that reflects the value of the medical innovation that our products bring to the healthcare delivery system.

Finally, our associations work tirelessly to provide the tools our respective communities need to advance new and novel treatments to patients every day. Our group purchasing programs and health care trust allow pre-commercial companies to leverage buying power that they wouldn't have otherwise – saving money, and ensuring that resources are directed toward research and development. We host a series of events throughout the year that convene thought leaders and industry experts to share best practices and encourage collaboration among commercial companies and innovative startups. And the BayBio and Biocom Institutes provide strong support for entrepreneurs and work to improve science education across the state.

We are optimistic about the future of the life science industry in California, and look forward to working with our members, industry partners, educators, and public officials to build upon the success that this report details.

Economic Impact Report – In Depth

REPORT ORGANIZATION

Part 1 reports the findings of our analysis of the scope and impacts of the life science industry on the State of California. Part 2 and Part 3 report on a more detailed assessment for BayBio and Biocom, respectively. Part 2 and 3 each report several research components starting with an economic overview of the region and offering data on regional economic performance, wages, population growth, and education. Next, we examine the life science industry cluster including employment trends, economic impacts, and foreign trade. In particular, this section will illustrate clusters of competitiveness and degrees of specialization when compared with national averages. In addition, we will examine the linkages between key supporting industries and the life sciences cluster to gauge the economic contribution the life science industry is making to these industries. We include a review of investment and research funding trends. The report also details performance for the component industry clusters that make up the life science industry that will be described in the Methods section below. Finally, we report the findings of our analysis of life science industry trends and component industrial clusters for individual counties in the respective service areas for BayBio and Biocom. All methodology and data sources are provided in the appendix.

DEFINING THE LIFE SCIENCE INDUSTRY CLUSTER

The life science industry cluster is not static; its core attributes are innovation and evolution. Any attempt to define the life science industry must understand and embrace the latest industry trends, technologies and economic linkages. Previous research by Biocom and BayBio have used multiple methods of economic inquiry to define the industries and activities that make up the life science industry in California including Biopharmaceutical Manufacturing, Research, Development and Education Laboratories, Medical Device and Diagnostic Manufacturing, BioRenewables (including biofuels, specialty enzymes chemicals, algae research and agriculture), and Life Science Wholesale. A complete list of codes used in the analysis is provided in the Appendix to this report. In embracing the collaborative nature of this research report between the two entities, a definition of the life science industry has changed somewhat from previous studies issued by both organizations. Therefore, the findings presented in this report are not comparable to any previous studies.

Life Science Industry Component Clusters
Research, Development, and Education Labs
Biopharmaceutical Manufacturing
Medical Devices and Diagnostic Equipment Manufacturing
BioRenewables
Life Science Wholesale

Statewide Data for 2013

Life Sciences Employment

Using the industry definitions described above, the life science industry in California is a major generator of economic opportunity for business and residents of the Golden State. There are over 300,000 workers employed in life science companies across the state. Research, Development, and Education Labs is the biggest sector, by employment, within the life science industry representing over 97,000 statewide jobs. Medical Devices and Diagnostic Equipment Manufacturing is the second largest sector with more than 80,000 employees across California.

Industry Cluster	Employment
BioRenewables	38,964
Biopharmaceutical Manufacturing	45,514
Medical Devices and Diagnostic Equipment	80,181
Life Science Wholesale	42,374
Research, Development, and Education Labs	97,277
TOTAL LIFE SCIENCE INDUSTRY	304,310

Source: EMSI Employment Complete, T. Clower & Associates

Economic Impacts

The life science industry generates a tremendous level of economic activity in the state. Including indirect and induced effects, the life science industry creates almost $259 billion in economic activity in California. This level of activity supports over one million jobs that pay $76 billion in annual salaries, wages, and benefits.

California's Life Science Industry

Description	Impact
Economic Activity	$ 258,795,638,000
Labor Income	$ 76,487,975,000
Employment	1,055,908

Source: EMSI Employment Complete, IMPLAN, T. Clower & Associates

Research, Development, and Education Labs

Description	Impact
Economic Activity	$ 41,995,851,000
Labor Income	$ 18,091,096,000
Employment	303,654

Source: EMSI Employment Complete, IMPLAN, T. Clower & Associates

Biopharmaceutical Manufacturing

Description	Impact
Economic Activity	$ 124,412,617,000
Labor Income	$ 30,949,889,000
Employment	328,680

Source: EMSI Employment Complete, IMPLAN, T. Clower & Associates

Medical Devices and Diagnostic Equipment

Description	Impact
Economic Activity	$ 50,042,903,000
Labor Income	$ 16,233,972,000
Employment	201,877

Source: EMSI Employment Complete, IMPLAN, T. Clower & Associates

BioRenewables

Description	Impact
Economic Activity	$ 35,811,056,000
Labor Income	$ 7,376,545,000
Employment	134,935

Source: EMSI Employment Complete, IMPLAN, T. Clower & Associates

Life Science Wholesale

Description	Impact
Economic Activity	$ 15,557,680,000
Labor Income	$ 6,233,817,000
Employment	86,762

Source: EMSI Employment Complete, IMPLAN, T. Clower & Associates

California's Impact on Patients

New Treatment Options for Patients

California companies introduced eight innovative treatments to patients in 2013, representing roughly a third of the new molecular entities launched nationwide in 2013. It is estimate that the treatments will generate $15 billion in annual sales by 2018.

Treatment Name	Company	Approval Type
Sovaldi	Gilead Sciences	Chemical (NDA)
Duavee	Ligand Pharmaceuticals	Chemical (NDA)
Imbruvica	Pharmacyclics	Chemical (NDA)
Kynamro	Isis Pharmaceuticals	Biological (BLA)
Breo Ellipta	Theravance	Chemical (NDA)

Anoro Ellipta	Theravance	Chemical (NDA)
Luzu	Topica Pharmaceuticals	Chemical (NDA)
Kadcyla	Genentech	Biological (BLA)

Source: 2014 EvaluatePharma®, Evaluate Ltd., www.evaluate.com

R&D Projects by Phase

California's R&D activity represents about 10 percent of the global development pipeline, and California's innovators have consistently brought more treatments to patients than any other state.

California

	2009	2010	2011	2012	2013
Filed	28	29	48	53	45
PIII	84	77	95	83	106
PII	185	183	206	205	212
PI	145	149	150	159	156
Pre-clinical	289	282	321	324	311
Research Project	146	122	125	129	118
Total	**877**	**842**	**945**	**953**	**948**

Source: 2014 EvaluatePharma®, Evaluate Ltd., www.evaluate.com

Total Market (Global)

	2009	2010	2011	2012	2013
Filed	533	605	682	683	655
PIII	869	974	1,110	1,144	1,161
PII	1,589	1,865	1,952	2,059	2,047
PI	1,367	1,516	1,635	1,741	1,757
Pre-clinical	2,361	2,477	2,551	2,482	2,364
Research Project	1,151	1,221	1,511	1,548	1,642
Total	**7,870**	**8,658**	**9,441**	**9,657**	**9,626**

Source: 2014 EvaluatePharma®, Evaluate Ltd., www.evaluate.com

Expediting Development with Breakthrough Therapies

Companies are bringing more new treatments through the development pipeline to address life threatening conditions. The Breakthrough Therapy Designation, signed into law in 2012, allowed the FDA to expedite the development and review of six California treatments.

Breakthrough Therapy Designations (2013)

Product	Company	Therapeutic Category	Technological Category
Ledipasvir/Sofosbuvir	Gilead Sciences	Systemic Anti-infectives	Conventional
Idelalisib	Gilead Sciences	Oncology & Immunomodulators	Conventional
Andexanet Alfa	Portola Pharmaceuticals	Blood	Biotechnology
Firdapse	BioMarin	Oncology &	Conventional

	Pharmaceutical/Jazz Pharmaceuticals	Immunomodulators	
Mydicar	Celladon	Cardiovascular	Biotechnology
Palbociclib	Amgen/Onyx Pharmaceuticals	Oncology & Immunomodulators	Conventional

Source: 2014 EvaluatePharma®, Evaluate Ltd., www.evaluate.com

Partnering For Success

California based companies continue to project strong growth. Steady prescription sales have been sustained by the introduction of new innovative treatments. Revenue from alliances and royalty payments provide a foundation for future innovation to occur. The revenue, in turn, is used to fund the R&D pipeline in order to develop new treatments

	2009	2010	2011	2012	2013	2014	CAGR
Total WW Prescription (Rx) Sales	27,718	29,744	30,499	34,054	38,145	44,732	10%
Alliance/ Co-promotion Revenue	306	324	343	383	536	558	13%
Royalty & Licensing Income	1,112	1,470	865	1,295	1,193	1,426	5%
Reported R&D Expenditures	8,229.2	7,985.6	8,759.5	9,698.8	10,742.8	11,563.8	7%

Source: 2014 EvaluatePharma®, Evaluate Ltd., www.evaluate.com

San Francisco Bay Area – In Depth

About BayBio

BayBio brings together the collective strength and experience of the world's most innovative and productive life science cluster, helping companies grow, connect and advocate to solve some of humanity's most pressing challenges. BayBio provides comprehensive support and solutions tailored to the unique needs of over 2000 Bay Area life science companies and institutions, delivering tangible value through group purchasing savings, capital access, government affairs & advocacy, networking and best-practice sharing. BayBio also supports the future of bioscience innovation through the BayBio Institute's work in science education, career development and entrepreneurship. BayBio's members are comprised of the scientists, inventors, entrepreneurs and leaders that have made the Bay Area the largest, most innovative and productive life science cluster in the world. Our region continues to lead the world in life science patents, new start-ups, venture capital, and NIH grant recipients. BayBio has over 500 members comprised of the diversity of organizations required to support a productive and innovative life science cluster. These organizations range from some of the world's most promising entrepreneurial start-ups to global life science leaders as well as leading research institutions and the industry's most seasoned investors.

History of the Life Sciences in Northern California

Following in the direct entrepreneurial lead of pioneering Northern California companies like Cetus Corp, a biological engineering company - the first ever – founded in Berkeley in 1971, and Palo Alto-based Syntex Corporation, founded in 1964, a university researcher and a venture capitalist formed one of the world's most renowned biotechnology companies in 1976. Locating it in 3,000 square feet of industrial space in South San Francisco, Genentech was founded by University of California, San Francisco biochemist Herb Boyer and venture capitalist Robert Swanson.

Much of the work in biotechnology's early years was done by a handful of brilliant investigators and scientists at world-class research institutes - Stanford University, UCSF, and UC Berkeley. Charged by the federal government in the early 1970's to fight a war on cancer, researchers pushed the frontiers of genetic engineering and built more than science. They founded an industry that revolves around the Bay Area.

Silicon Valley fueled innovation to accelerate the pace of discovery. An entire industry of tool-makers and testing equipment manufacturers developed as technology, led by research done at Stanford University, drove a demand for new instruments. Later, tool companies would take techniques learned in the development of silicon chips for high tech and apply them to biotech. The new tools would be necessary for the next big revolution, and the next decade of discovery. The much-publicized Human Genome Project, begun in 1990, led to a new basis of drug research and development, from viral replication of proteins to gene-based discovery and treatment of diseases. Again, Northern California research was at the forefront, as Lawrence Livermore and Lawrence Berkeley Labs headed up the Joint

Genome Institute in Walnut Creek, playing a key role in the sequencing of the human genome, and world-leading research as UCSF would herald several more Nobel Prizes.

Bay Area research universities continue to gear up for the next wave of research. UCSF is expanding into its Mission Bay Campus, which will allow the university to perform more research projects for the NIH, and is building out QB3, a joint research program between UC Berkeley, UCSF and UC Santa Cruz. Stanford University has built the Clark Center, a multi-disciplinary building to assist in the discovery and understanding of science and medicine, and UC Berkeley is undergoing a similar transformation, expanding its college of engineering.

The California Institute of Regenerative Medicine, headquartered in San Francisco, has provided funding which has fueled research and development in regenerative medicine at academic institutions and companies, and President Obama's Brain Initiative, co-chaired by a researcher at Stanford University, is increasing CNS research in Bay Area academic centers.

Additionally, the convergence of high tech and biotech is creating an explosion of opportunities in digital health. The Bay Area is uniquely positioned to lead in this rapidly growing field given the strength of its high tech and biotech industries, and the wealth of venture capital companies in Silicon Valley that have investment experience in both of these industries.

Mushrooming from a small group of researchers, in less than thirty years, the life science industry in the Bay Area has grown to one of the largest and most productive clusters.

REGIONAL OVERVIEW

The Northern California region continues to attract new residents, which we believe is tied to the strengthening of the regional economy. Population growth in the nine-county region served by BayBio slightly outpaced both the state and nation between 2012 and 2013 adding almost 72,000 new residents. In this section, we report overall demographic and economic trends for the BayBio service area.

Regional Population, 2012 – 2013

Area	2012	2013	Change	% Change
US	314,349,407	316,994,057	2,644,650	0.8%
California	38,029,924	38,389,747	359,823	0.9%
Bay Area Region	7,313,047	7,384,840	71,793	1.0%
Alameda	1,544,517	1,559,612	15,095	1.0%
Contra Costa	1,078,728	1,091,343	12,615	1.2%
Marin	256,731	258,493	1,762	0.7%
Napa	139,393	140,746	1,353	1.0%
San Francisco	819,823	826,981	7,158	0.9%
San Mateo	732,836	738,843	6,007	0.8%
Santa Clara	1,830,804	1,852,462	21,658	1.2%
Solano	418,309	420,497	2,188	0.5%
Sonoma	491,906	495,863	3,957	0.8%

Source: EMSI Employment Complete, T. Clower & Associates

With a population approaching 7.4 million, the nine-county area served by BayBio is one of the largest metropolitan areas in the country. The population increased by 1.0% between 2012 and 2013, with Santa Clara and Contra Costa counties leading the pack in growth, but all counties are growing.

The Northern California region has seen an impressive level of job growth as the state's economy finally shakes off the worst of the effects of the Great Recession. Overall, the California economy created jobs faster than the nation (5.4% versus 5.0% from 2010 through 2013), and the region has substantially exceeded state job growth levels (8.5% versus 5.4%). Solano and Sonoma counties are lagging in job growth, but the other seven counties are moving forward nicely – not an employment boom, but good, solid growth.

Total Employment

	2010	2011	2012	2013	% Change
United States	173,710,196	176,191,091	179,277,297	182,078,697	5.0%
California	20,049,371	20,430,367	20,932,168	21,373,561	5.4%
Bay Area Region	4,304,005	4,408,536	4,549,618	4,670,472	8.5%
Alameda	851,083	864,713	893,008	914,769	7.5%
Contra Costa	469,551	477,736	489,250	498,875	6.2%
Marin	174,955	179,130	183,805	186,996	6.9%
Napa	87,877	89,689	92,674	95,363	8.5%
San Francisco	730,966	751,990	784,323	808,559	10.6%
San Mateo	451,383	466,054	483,142	497,592	10.2%
Santa Clara	1,108,189	1,144,745	1,184,830	1,220,227	10.1%
Solano	166,500	165,566	168,307	171,884	3.2%
Sonoma	263,500	268,913	270,280	276,207	4.8%

Source: EMSI Employment Complete, T. Clower & Associates

Employment projections provided by EMSI show that all counties in the Bay Area region will add jobs through 2015 with the highest rates of growth in Napa County. These data suggest that the Northern California economy may take an economic "breather" in the next two years before resuming stronger growth.

Total Employment Projections

	2013	2015	% Change
United States	182,078,697	187,952,814	3.2%
California	21,373,561	22,275,010	4.2%
Bay Area Region	4,670,472	4,910,891	5.2%
Alameda	914,769	953,157	4.2%
Contra Costa	498,875	517,012	3.5%
Marin	186,996	195,692	4.7%
Napa	95,363	102,304	7.3%
San Francisco	808,559	857,279	6.0%
San Mateo	497,592	524,769	5.5%
Santa Clara	1,220,227	1,293,663	6.0%
Solano	171,884	178,332	3.8%
Sonoma	276,207	288,683	4.5%

Source: EMSI Employment Complete, T. Clower & Associates

As one would expect with Silicon Valley and a very strong biotechnology sector, the regional economy is led in the private sector by Professional, Scientific, and Technical Services industries representing more than 12.7% of total regional employment.

Regional Employment by Major Sector

		Region		California		Unites States	
NAICS	**Industry**	**2013 Jobs**	%	**2013 Jobs**	**%**	**2013 Jobs**	%
11	Agriculture, Forestry, Fishing	29,725	0.6%	501,943	2.3%	3,503,606	1.9%
21	Mining	8,658	0.2%	63,932	0.3%	1,444,629	0.8%
22	Utilities	13,362	0.3%	61,230	0.3%	575,666	0.3%
23	Construction	211,007	4.5%	946,475	4.4%	9,071,042	5.0%
31	Manufacturing	328,058	7.0%	1,334,084	6.2%	12,633,693	6.9%
42	Wholesale Trade	135,845	2.9%	776,128	3.6%	6,317,323	3.5%
44	Retail Trade	391,031	8.4%	1,947,911	9.1%	18,073,425	9.9%
48	Transportation/ Warehousing	111,664	2.4%	612,655	2.9%	5,899,771	3.2%
51	Information	153,671	3.3%	535,421	2.5%	3,303,902	1.8%
52	Finance and Insurance	247,494	5.3%	1,075,314	5.0%	10,254,115	5.6%
53	Real Estate	288,932	6.2%	1,291,459	6.0%	8,429,239	4.6%
54	Professional, Scientific Services	591,465	12.7%	1,832,817	8.6%	12,508,449	6.9%
55	Management of Companies	72,889	1.6%	229,961	1.1%	2,251,376	1.2%
56	Administrative Services	267,009	5.7%	1,378,787	6.5%	11,313,578	6.2%
61	Education (Private)	139,911	3.0%	492,068	2.3%	4,448,949	2.4%
62	Health Care / Social Assistance	482,243	10.3%	2,250,907	10.5%	20,360,545	11.2%
71	Arts, Entertainment	127,094	2.7%	577,788	2.7%	4,036,407	2.2%
72	Lodging and Food Services	336,568	7.2%	1,502,383	7.0%	12,992,932	7.1%
81	Other Services	252,333	5.4%	1,289,424	6.0%	10,349,675	5.7%
90	Government	470,720	10.1%	2,615,530	12.2%	24,117,047	13.2%
99	Unclassified Industry	10,794	0.2%	57,343	0.3%	193,328	0.1%
	Total	4,670,472		21,373,561		182,078,697	

Source: EMSI Employment Complete, T. Clower & Associates

In keeping with a highly skilled workforce, wages in the region are high and average, more than 25% above statewide averages. San Francisco County has average wages exceeding $100,000 per year across all industries.

Wages (Total Average Wages All Industries)

	Average Annual Wages
United States	$58,117
California	$77,845
Bay Area Region	$64,505
Alameda	$61,512
Contra Costa	$57,476
Marin	$51,592
Napa	$84,542
San Francisco	$101,640
San Mateo	$58,117
Santa Clara	$95,726
Solano	$54,507
Sonoma	$46,444

Source: EMSI Employment Complete, T. Clower & Associates

Education attainment in the Bay Area region is among the highest in the nation with more than 40% of the population possessing at least a Bachelor's degree. Possessing a highly skilled workforce is one of the region's greatest strengths. Moreover, the number of graduates of college programs continues to rise with total degree completions rising by 2% from 2010 to 2012, the latest year for which data are available. Importantly, the region is also producing college graduates with technical degrees supporting the attraction and growth of industry, especially biotechnology. Between 2010 and 2012, total degrees in STEM (science, technology, engineering, and math), rose by 13% feeding the demand for a highly skilled labor force.

Educational Attainment, 2013

	Graduate Degree or Higher	Bachelor's Degree	Associate's Degree	Some College	High School Diploma
United States	10.3%	17.6%	7.5%	20.9%	27.9%
California	10.6%	18.8%	7.5%	21.8%	20.3%
Bay Area Region	16.6%	25.1%	7.2%	19.5%	17.4%
Alameda	12.4%	20.8%	8.6%	23.0%	19.0%
Contra Costa	12.0%	23.2%	7.6%	20.8%	17.4%
Marin	6.7%	12.9%	7.4%	25.5%	24.8%
Napa	9.7%	19.5%	9.0%	24.3%	19.2%
San Francisco	20.3%	31.3%	5.4%	15.1%	13.3%
San Mateo	16.8%	26.6%	7.6%	19.3%	16.9%
Santa Clara	19.8%	25.8%	7.1%	17.1%	15.7%
Solano	7.2%	16.2%	9.8%	27.7%	24.3%
Sonoma	11.6%	20.2%	8.3%	25.9%	19.0%

Source: EMSI Employment Complete, T. Clower & Associates

The region's institutions of higher education continue to produce the labor force needed to sustain economic growth and development. Total degree and certificate completions increased by 2.3% between 2011 and 2012, the latest year for which data are available. Of particular note is San Mateo County that saw a surge in degree completions between 2011 and 2012.

Total Completions by County

County	2011	2012	% Change
Alameda	27,716	27,651	-0.23%
Contra Costa	6,417	6,854	6.81%
Marin	911	936	2.74%
Napa	1,208	1,134	-6.12%
San Francisco	20,804	21,032	1.10%
San Mateo	3,023	3,790	25.37%
Santa Clara	26,453	27,171	2.71%
Solano	2,005	2,084	3.94%
Sonoma	7,140	7,115	-0.35%
Bay Area Total	95,380	97,569	2.30%

Source: EMSI Employment Complete, T. Clower & Associates

Impressively, the region is increasing the number of degree and program graduations in Science, Technology, Math and Engineering disciplines, which are critical to the future success of region to continue to attract investment in the life science sector. Between 2010 and 2012, total STEM degree completions increased by 13% rising to more than 19,000 graduations in the most recent reporting period.

STEM Completions by County

	2010	2012	% Change
Alameda	7,200	8,066	11%
Contra Costa	332	519	36%
Marin	110	156	29%
Napa	179	183	2%
San Francisco	1,915	2,208	13%
San Mateo	155	268	42%
Santa Clara	5,896	6,787	13%
Solano	352	377	7%
Sonoma	498	610	18%
Total	16,637	19,174	13%

Source: EMSI Employment Complete, T. Clower & Associates

LIFE SCIENCES

Northern California's life science cluster provided almost 100,000 jobs in 2013, an increase of 1,900 jobs over 2012. The largest concentrations of these jobs are in Alameda, San Mateo, and Santa Clara counties accounting for about two-thirds of all life science jobs in the region.

Life Science Employment by County, 2012 - 2013

	2012	2013	2013 Avg Earnings
Alameda	22,123	22,839	$62,644
Contra Costa	5,488	5,591	$95,841
Marin	1,099	1,093	$101,125
Napa	1,329	1,324	$67,608
San Francisco	13,654	13,634	$114,691
San Mateo	16,310	16,570	$125,218
Santa Clara	29,666	30,269	$68,567
Solano	4,450	4,587	$93,674
Sonoma	3,885	3,997	$52,677
Region	98,004	99,904	$79,437

Life Science Employment by County, 2013

Source: EMSI Employment Complete, T. Clower & Associates

The manufacture of medical and diagnostic devices is a major contributor to Northern California's life science industry, with Biopharmaceutical Manufacturing also being an important regional employer. The largest contribution to regional employment is the Research, Development, and Education Labs cluster that includes private sector and university laboratories and supporting education programs.

Life Sciences Employment by Sector, 2012 – 2013

	2012	2013	Change 2012-2013	2015
BioRenewables	2,133	2,194	61	2,010
Biopharmaceutical Manufacturing	17,491	17,729	238	19,441
Medical Devices and Diagnostics	22,631	23,169	538	21,696
Life Science Wholesale	4,661	5,026	365	5,068
Research, Development, and Education Labs	51,088	51,786	698	55,156
Total	98,004	99,904	1,896	103,371

Source: EMSI Employment Complete, T. Clower & Associates

There are more than 2,000 companies operating in the life sciences industry in the BayBio service area spanning the continuum of small, medium, and large firms.

All Life Science Establishments, 2013

	Establishments
Alameda	401
Contra Costa	162
Marin	66
Napa	47
San Francisco	234
San Mateo	267
Santa Clara	621
Solano	81
Sonoma	150
Region	2027

Source: EMSI Employment Complete, T. Clower & Associates

Wages in the life science industry cluster are relatively high, though there is a great deal of variance among the Northern California counties and among the sectors that make up the life science industry. Wages in the Biopharmaceutical Manufacturing industry in Alameda County average over $126,359 per year, while employees in the Research, Development, and Education Labs cluster in Sonoma County earn just under $53,000 annually.

Wages by Sector and County, 2013

	BioRenewables	Biopharmaceutical Manufacturing	Medical Devices	Life Science Wholesale	R&D Labs
Alameda	$38,478	$126,359	$105,478	$74,359	$79,786
Contra Costa	$68,968	$96,224	$76,926	$81,210	$88,284
Marin	$33,745	$187,115	$71,437	$69,677	$64,441
Napa	$38,507	$94,482	$59,699	$42,050	$77,448
San Francisco	$34,272	$351,211	$85,088	$155,553	$81,541
San Mateo	$40,838	$218,201	$144,281	$111,898	$174,066
Santa Clara	$37,374	$150,398	$134,953	$114,686	$102,233
Solano	$37,924	$202,832	$56,854	$47,812	$77,497
Sonoma	$34,205	$46,670	$109,794	$77,547	$52,677

Source: EMSI Employment Complete, T. Clower & Associates

Regional Competitive Advantage

Based on our analysis of regional location quotients, the Bay Area region is a major hub for Biopharmaceutical Manufacturing, Medical Devices and Diagnostics manufacturing, and Research, Development, and Education Lab activities. Employment projections for 2015 suggest the regional competitive advantage of the Bay Area will generally increase through 2015.

Industries with strong LQs (those greater than 1.2) are often indicative of a regional competitive advantage that would support additional growth and opportunity. Industries with low LQs (those less than 0.9) indicate goods and services that are likely imported into the region and therefore could represent opportunities for business development and recruitment.

Location Quotient for Region by Industry Cluster

	2013	2015
Research, Development, and Education Labs	0.9	1.0
Biopharmaceutical Manufacturing	2.7	2.9
Medical Devices and Diagnostic Equipment	3.3	3.1
BioRenewables	0.8	0.7
Life Science Wholesale	0.6	0.6
Total Life Science Industry	2.2	2.3

Source: EMSI Employment Complete, T. Clower & Associates

By examining the Location Quotient by industry cluster and county, we can see the diversity in the life science industries in the BayBio service area. Napa, Solano, and Sonoma counties are hubs of BioRenewable activities. San Mateo and Solano dominate for Biopharmaceutical Manufacturing. San Mateo, Santa Clara, and Alameda are the strongest regional locations for Medical Devices manufacturing. The Life Science Wholesale sector is underrepresented in the BayBio area with only Santa Clara County showing a location quotient greater than one. San Mateo County also shows the greatest concentration of Research Labs, though Alameda, Contra Costa, Marin, Santa Clara, and Solano are all very strong in this section of the life science industry.

Shift Share Analysis

A shift share analysis is another analytic technique useful for assessing the relative strength of a given industry in a regional economy over time. Here we report two statistics, the Expected Change and the Competitive Effect. The Expected Change is the number of jobs that theoretically would have increased, or decreased, between 2010 and 2013 if the local industry followed national economic trends. The competitive effect shows the number of jobs to have been added, or subtracted, because of business characteristics of the regional economy. Based on this analysis, even though there has been overall growth, the region's overall competitiveness has been challenged in Medical Devices, while growth performance remains strong in Biopharmaceutical Manufacturing.

All Life Science Shift Share Analysis, 2010 - 2013

	Expected Change	Competitive Effect
Research, Development, and Education Labs	599	202
Biopharmaceutical Manufacturing	141	1,717
Medical Devices and Diagnostic Equipment	686	-1,598
BioRenewables	-2	-182
Life Science Wholesale	240	-86
Region	1,668	51

Source: EMSI Employment Complete, T. Clower & Associates

LIFE SCIENCE ECONOMIC IMPACTS

Based on the IMPLAN economic input-output model, the life science industry cluster in the BayBio service region generated $95 billion in total regional economic activity in 2013. This economic activity supported 300,000 regional jobs paying in excess of $29 billion in annual salaries, wages, and benefits.

Economic Impacts

	Economic Activity	Labor Income	Jobs
Alameda	$13,407,362,000	$4,166,434,000	53,821
Contra Costa	$2,966,629,000	$908,947,000	11,366
Marin	$416,534,000	$130,063,000	1,913
Napa	$724,094,000	$181,317,000	2,731
San Francisco	$3,741,242,000	$1,402,055,000	20,955
San Mateo	$30,731,881,000	$8,236,406,000	57,339
Santa Clara	$15,464,075,000	$5,874,848,000	58,486
Solano	$8,758,796,000	$1,992,299,000	17,545
Sonoma	$1,900,170,000	$565,203,000	8,700
Bay Area Region	$95,003,472,000	$29,711,888,000	300,073

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

The life science industry cluster generates almost $2.8billion in economic activity among its key support industries in the Bay Area region, supporting over 6,800 related jobs.

Economic Activity in Key Support Industries

	Acct. & Tax Prep.	Insurance	Legal Svcs.	Bus. Admin.	Financial Svcs.	Mktg., Ad., Comm.	Real Estate
Alameda	$32,368,456	$20,762,420	$80,261,251	$19,905,728	$51,021,088	$64,874,785	$267,472,186
Contra Costa	$9,080,474	$7,021,407	$17,636,711	$6,092,629	$19,748,928	$9,966,266	$59,964,797
Marin	$1,484,266	$408,216	$2,469,377	$817,329	$1,545,605	$3,934,337	$7,462,928
Napa	$1,919,098	$496,813	$3,700,603	$1,236,827	$1,089,092	$664,198	$17,694,169
San Francisco	$7,252,419	$4,249,190	$16,115,927	$4,276,254	$8,090,459	$19,736,112	$37,824,162
San Mateo	$87,116,619	$29,391,017	$186,634,411	$62,218,875	$204,808,853	$79,270,670	$470,920,942
Santa Clara	$62,849,489	$16,282,935	$117,953,271	$28,870,397	$87,630,723	$24,981,082	$301,788,344
Solano	$6,099,270	$5,449,087	$9,968,023	$13,188,233	$37,648,910	$16,036,270	$89,306,681
Sonoma	$8,502,284	$3,220,684	$8,634,021	$1,712,786	$11,428,551	$3,994,573	$47,400,539
Total	$216,672,376	$87,281,769	$443,373,594	$138,319,057	$423,012,207	$223,458,295	$1,299,834,748

Source: IMPLAN

Employment in Key Support Industries

	Acct. & Tax Prep.	Insurance	Legal Svcs.	Bus. Admin.	Financial Svcs.	Mktg., Ad., Comm.	Real Estate
Alameda	246	129	355	149	90	423	1,311
Contra Costa	72	41	90	61	35	74	336
Marin	10	2	14	6	3	27	45
Napa	19	2	20	13	2	7	108
San Francisco	48	18	71	18	11	105	115
San Mateo	626	157	722	351	214	532	2,578
Santa Clara	337	120	365	136	118	151	1,551
Solano	97	52	77	112	78	210	508
Sonoma	100	24	52	16	25	45	308
Total	1,554	545	1,767	863	575	1,573	6,860

Source: IMPLAN

RESEARCH, DEVELOPMENT, AND EDUCATION LAB SERVICES

Well over 50,000 individuals are employed in the Research, Development, and Education Labs sector in Northern California for 2013, indicating a small increase over 2012. Average annual earnings per worker exceed $95,000 with the highest wages being paid in Santa Clara and San Mateo counties.

Sector Snapshot

Description	Value
2013 Employees	51,787
2013 Avg Earnings	$95,189
2013 Establishments	998

Source: EMSI Employment Complete, T. Clower & Associates

Featured Employers: Research, Development, and Education Labs

Company	Employees
Lawrence Berkeley National Laboratory	6,000
SRI International	1,430
Gladstone Institutes	450
InterMune, Inc.	249
Buck Institute for Age Research	230
Five Prime Therapeutics	120
Exelixis, Inc.	101
Raptor Pharmaceuticals, Inc.	100
Oncomed Pharmaceuticals	80
ChemoCentryx, Inc.	70
Sutro Biopharma, Inc.	58
Ultragenyx Pharmaceuticals	27

Source: Hoover's, BayBio

Research, Development, and Education Labs firms and institutions in the BayBio service area generate over $15 billion in regional economic activity, support 92,000 total jobs, and boost area labor income by almost $7 billion.

Economic Impacts

	Economic Activity	Labor Income	Jobs
Alameda	$2,868,179,000	$1,204,169,000	20,405
Contra Costa	$726,605,000	$317,495,000	4,620
Marin	$135,939,000	$55,180,000	1,092
Napa	$101,720,000	$46,032,152	743
San Francisco	$2,348,273,000	$985,437,000	17,777
San Mateo	$1,569,520,000	$770,459,000	8,289
Santa Clara	$4,675,492,000	$2,363,040,000	26,159
Solano	$199,166,000	$85,189,000	1,427
Sonoma	$269,310,000	$105,570,000	2,271
Region	$15,427,942,000	$6,994,350,000	92,121

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

BIOPHARMACEUTICAL MANUFACTURING

The Biopharmaceutical Manufacturing industry sector in the Bay Area region employs over 17,700 workers with average annual earnings exceeding $163,000.

Sector Snapshot

Description	Value
2013 Employees	17,730
2013 Avg Earnings	$163,721
2013 Establishments	131

Featured Employers: Biopharmaceutical Manufacturing

Company	Employees
Genentech, Inc.	10,000
Gilead Sciences, Inc.	3,000
BioMarin Pharmaceuticals	500
Boehringer Ingelheim	375
Bayer Healthcare Pharmaceuticals	300
Depomed, Inc.	267
Theravance Biopharma US, Inc.	250
Corium International, Inc.	150
Medical Analysis Systems, Inc.	150
Durect Corporation	89

Source: Hoovers, BayBio

Biopharmaceutical companies in the BayBio region spark $63.7 billion in annual economic activity. Impressively, there are almost eight jobs in the regional economy supported for each Biopharmaceutical Manufacturing sector job.

Economic Impacts

	Economic Activity	Labor Income	Jobs
Alameda	$6,675,424,177	$1,640,476,305	17,556
Contra Costa	$986,997,541	$244,496,301	2,443
Marin	$209,684,796	$47,468,914	437
Napa	$510,788,141	$92,162,251	1,031
San Francisco	$1,318,190,359	$367,915,137	2,384
San Mateo	$29,651,992,211	$7,253,007,757	45,038
Santa Clara	$3,135,956,197	$749,207,998	6,600
Solano	$9,058,584,500	$1,981,844,967	15,841
Sonoma	$142,577,355	$27,145,074	456
Region	$63,689,205,925	$16,939,223,433	139,778

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

MEDICAL DEVICES AND DIAGNOSTIC EQUIPMENT

The Medical Devices and Diagnostics equipment manufacturing sector in Northern California added just over 500 jobs between 2012 and 2013 bringing total employment in the sector to 23,169. This industry cluster is concentrated in Santa Clara County and Alameda County, with Contra Costa, San Mateo, and Sonoma counties all making important contributions.

Sector Snapshot

Description	Value
2013 Employees	23,169
2013 Avg Earnings	$93,835
2013 Establishments	575

Featured Employers: Medical Devices and Diagnostic Equipment

Company	Employees
Varian Medical Systems, Inc.	2,110
Medtronic Cardiovascular	1,200
LifeScan, Inc.	1,000
Cepheid	500
Thermo Finnigan LLC	500
Agilent Technologies, Inc.	500
Acclarent, Inc.	400
Penumbra, Inc.	400
Roche Molecular Systems, Inc.	400
Abbott Diabetes Care, Inc.	250
CardioDx, inc.	229
Natera, Inc.	215
Ariosa Diagnostics, Inc.	140
Veracyte, Inc.	100
Biocare Medical	99
Fluidigm	75

Source: Hoover's, BayBio

The Medical Devices and Diagnostic Equipment manufacturing cluster generates $17.9 billion in annual regional economic activity in Northern California supporting almost 62,000 jobs that pay $6.1 billion in salaries, wages, and benefits.

Economic Impacts

	Economic Activity	Labor Income	Jobs
Alameda	$4,083,605,939	$1,337,024,003	14,931
Contra Costa	$849,919,994	$271,106,962	3,183
Marin	$12,893,726	$4,836,789	72
Napa	$66,320,089	$19,608,914	294
San Francisco	$29,489,061	$11,706,348	223
San Mateo	$1,628,132,921	$629,582,905	4,968
Santa Clara	$7,272,636,122	$2,560,050,450	22,720
Solano	$84,028,914	$25,666,120	398
Sonoma	$1,028,041,228	$348,159,347	4,077
Region	$17,878,927,356	$6,118,543,895	61,957

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

BIORENEWABLES

The Northern California region served by BayBio employs 2,194 workers in the BioRenewables sector, up slightly from 2012. These jobs are concentrated in Sonoma, Napa, and Santa Clara counties. Average wages in the sector exceed $40,000 per year across the region.

Sector Snapshot

Description	Value
2013 Employees	2,195
2013 Avg Earnings	$40,479
2013 Establishments	165

Even with an overall increase in total employment for this sector, the region lost some ground to other areas with only Contra Costa County showing a gain in the competitive effect component of a shift-share analysis.

Featured Employers: BioRenewables

Business Name	Employees
Amyris, Inc.	392
Solazyme	250
Dupont Industrial Sciences	200
Codexis, Inc.	125
Calera Corporation	49
Kiverdi	24
Micromidas	28
Arcadia Biosciences	74
Siluria	49

Source: Hoover's, BayBio

The BioRenewables industry cluster in Northern California generates almost $1.8 billion in regional economic activity, boosts total labor income by $316 million, and supports almost 5,600 total direct, indirect, and induced jobs.

Economic Impacts

	Economic Activity	Labor Income	Jobs
Alameda	$167,077,225	$28,452,451	434
Contra Costa	$412,608,604	$57,238,880	713
Marin	$23,895,312	$4,590,507	69
Napa	$89,504,351	$31,405,201	738
San Mateo	$89,327,995	$14,395,737	369
Santa Clara	$69,546,457	$12,262,829	479
Solano	$90,315,398	$12,991,525	345
Sonoma	$509,538,038	$96,862,123	1,906
Region	$1,795,789,013	$316,240,536	5,579

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

LIFE SCIENCE WHOLESALE

The Life Science Wholesale sector added 361 jobs between 2012 and 2013. About 60% of total regional employment in this industry sector is located in Alameda and Santa Clara counties.

Sector Snapshot

Description	Value
2013 Employees	5,025
2013 Avg Earnings	$86,088
2013 Establishments	158

Featured Employers: Life Science Wholesale

Company	Employees
McKesson Corporation	1,405
Carl Zeiss Meditec, Inc.	705
The Doctors Company	700
Kinsale Holdings, Inc.	250
Nds Surgical Imaging, LLC	215
Lumenis Inc.	150
Angioscore Inc.	140
Intake Initiatives Inc.	110
Tradecom Medical Transcription, Inc.	110

Source: Hoover's

BayBio's Life Science Wholesale cluster creates $2.3 billion in regional economic activity each year boosting total area employment by over 11,000 jobs.

Economic Impacts

	Economic Activity	Labor Income	Jobs
Alameda	$398,592,504	$167,629,467	2,165
Contra Costa	$147,564,610	$60,803,284	744
Marin	$55,032,709	$23,327,802	284
Napa	$4,138,202	$1,759,054	23
San Francisco	$157,265,662	$66,715,729	730
San Mateo	$238,799,273	$101,553,173	1,127
Santa Clara	$1,015,219,416	$440,806,218	4,144
Solano	$54,289,172	$22,654,322	339
Sonoma	$48,540,121	$20,255,289	311
Region	$2,335,339,927	$964,196,071	11,038

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

Foreign Trade

The products and services produced in the life science industry in the BayBio region are consumed across the country and around the world. Our estimates for 2013 show that foreign exports of life science goods and services produced in Northern California totaled more than $9.6 billion.

Value of Foreign Exports by Sector and County ($000s)

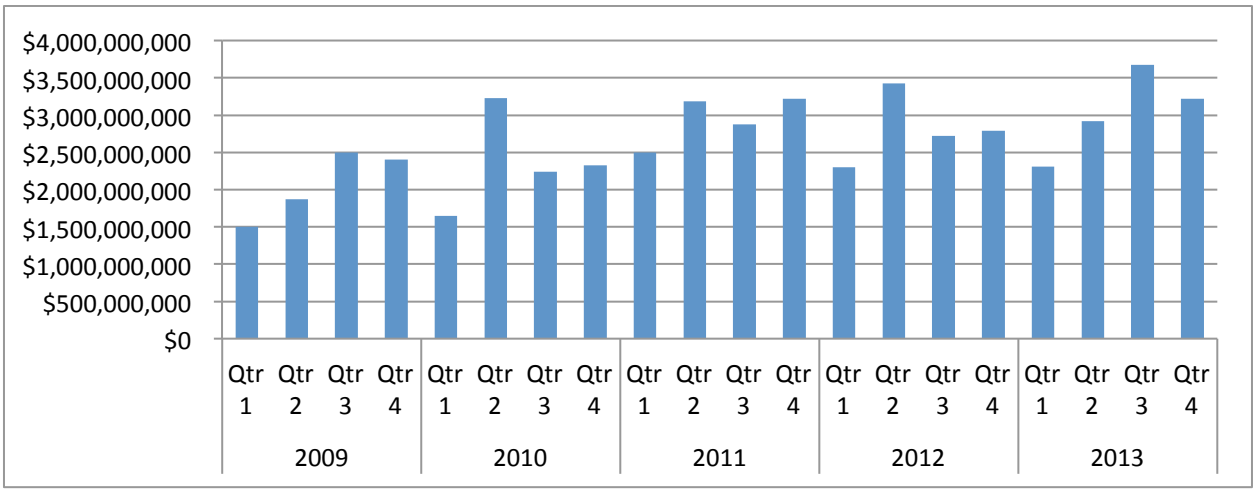
	BioRenewables	Biopharm. Manufact.	Med Dev. & Diagnostic	LS Trade	R&D	Total
Alameda	$15,951	$305,594	$816,194	$730,573	$17,079	$1,885,391
Contra Costa	$58,894	$60,004	$279,104	$189,629	$6,435	$594,066
Marin	$3,341	$8,455	$4,898	$56,525	$2,006	$75,225
Napa	$20	$70,352	$13,902	$33,634	$594	$118,502
San Francisco	$6,557	$19,091	$10,733	$288,920	$14,783	$340,084
San Mateo	$5,347	$1,973,673	$252,650	$249,807	$12,542	$2,494,019
Santa Clara	$19,901	$448,868	$1,740,893	$1,046,914	$29,548	$3,286,124
Solano	$9,997	$389,819	$21,321	$66,711	$844	$488,692
Sonoma	$26,606	$20,039	$207,464	$124,517	$2,331	$380,957
Region	$146,614	$3,295,895	$3,347,159	$2,787,230	$86,162	$9,663,060

Source: IMPLAN, T. Clower & Associates

Venture Capital and Research Funding

Total venture capital funding is growing, which bodes well for growth in the life science industry. In addition, the region attracted over $1.3 billion in research grants from the National Institute of Health (NIH) in fiscal year 2013.

San Francisco Region Venture Capital Investment, 2009 – 2013



Source: National Venture Capital Association, Money Tree Report

National Institute of Health (NIH) Funding by County, 2013

County	NIH Funding FY2013
Alameda	$237,144,691
Contra Costa	$643,005
Marin	$11,656,311
San Francisco	$618,001,372
San Mateo	$65,001,102
Santa Clara	$407,479,963
Solano	$1,462,640
Sonoma	$1,476,278
Total	**$1,342,865,362**

Source: NIH

Top Grant Receiving Institutions (receiving more than $1.3 million)

Organization	Funding	Awards
University of California San Francisco	$501,656,900	1174
Stanford University	$357,812,990	828
University of California Berkeley	$119,785,503	357
SRI International	$42,623,685	84
Kaiser Foundation Research Institute	$36,647,504	67
University of California-Lawrence Berkeley Lab	$27,116,291	45
J. David Gladstone Institutes	$26,575,146	46
Northern California Institute/Research/Education	$24,887,721	47
Palo Alto Institute For Research & Education, Inc.	$16,141,630	43
University of California, San Francisco	$15,484,153	12
Children's Hospital & Res Center at Oakland	$14,238,224	29
Blood Systems Research Institute	$11,044,343	9
Buck Institute For Research on Aging	$10,473,643	34
California Pacific Medical Center Research Institute	$10,012,814	15
Public Health Institute	$6,070,096	15
Xoma Corporation	$5,969,753	1
San Francisco State University	$5,955,274	20
Aridis Pharmaceuticals, LLC	$5,784,673	2
Cancer Prevention Institute of California	$4,362,038	7
Wave 80 Biosciences, Inc.	$3,603,350	6
Tunitas Therapeutics, Inc.	$2,831,128	3
Savant Hwp, Inc.	$2,507,295	1
Palo Alto Medical Foundation Research Institute	$2,416,766	6
Smith-Kettlewell Eye Research Institute	$2,387,278	7
Planet Biotechnology, Inc.	$2,285,731	4
University of California Lawrence Livermore National Lab	$2,268,153	3
Afasci, Inc.	$2,052,768	5
Ernest Gallo Clinic and Research Center	$2,010,883	7
Scientific Analysis Corporation	$1,790,890	4
Sociometrics Corporation	$1,760,541	5
Cellerant Therapeutics, Inc.	$1,689,823	2
Collaborative Drug Discovery, Inc.	$1,542,180	5
Cellsight Technologies, Inc.	$1,499,971	1
Touro University f California	$1,462,640	4
San Jose State University	$1,428,290	9
Phoenix Biosystem, Inc.	$1,355,176	3
Profusa, Inc.	$1,322,713	3

Source: NIH

Southern California – In Depth

About Biocom

With over 600 members across all sectors of the life sciences, Biocom is the nonprofit trade association for Southern California representing public and private industry, academia and research institutes, service providers and patient advocacy organizations. Biocom was launched in 1992 when San Diego's biotechnology start-ups realized that they needed a strong and united voice to advocate for local and regional policies conducive to industry growth and regional economic development. Twenty years later, Biocom continues to provide public policy support in city halls, in Sacramento and on Capitol Hill, where it partners with peer industry groups from across the nation. Now, in addition to advocacy, Biocom saves its members money through group purchasing, and provides numerous workforce development programs that allow current employees to enhance their skills and help train the next generation of workers – creating a sustainable, highly-skilled workforce in the region that is increasingly a model for regional economics across the globe. Biocom is also a premier networking organization, hosting over 75 events a year. Capital development for the region is a major goal, and Biocom works with member companies on a number of initiatives designed to accelerate development in the life science sector.

History of Life Science Industries in Southern California

What began more than 35 years ago with a single biotechnology startup has evolved into one of the world's largest life science hubs. Several major forces put the region on the map: scientific breakthroughs out of the research institutes on the Torrey Pines Mesa and in and around Irvine, the successful establishment of the region's first true biotechnology company, Hybritech, and the growth of the medical device industry in both San Diego and Orange counties.

Scientists out of UC San Diego founded San Diego-based Hybritech. The company's signature product, a diagnostic test for prostate cancer – the PSA test – and the company's acquisition by pharmaceutical giant Eli Lilly for $400 million cash in 1986, created the first generation of Southern California biotechnology entrepreneurs with the finances and connections to start new companies.

Those entrepreneurs went on to form and nurture scores of biopharmaceutical and medical device start-ups, including San Diego's biggest biotech drug success story, Idec, which is now part of Biogen-Idec.

In Orange County, the medical device industry's story of growth began much as it did in San Diego County. Scientists and engineers originally attracted to the region for military research and manufacturing jobs began to translate basic bioscience research from the surrounding labs and universities into potential products. Edwards Lifesciences, founded in Santa Ana in the late 1950s, anchored the device cluster to the north. It, too, graduated a new generation of entrepreneurs who started their own companies in Orange County. Meanwhile, Allergan, an Irvine eye drug company also

founded in the 1950s, began to move into the new field of biotechnology in the late 1980s, with the acquisition of Botox.

During these same years, funding for basic science from the National Institutes of Health began to grow, and the science in both Torrey Pines and the UC Irvine area started leaping ahead. Today, more than two dozen research institutes, universities and colleges in Southern California conduct basic scientific research or train future generations of scientists, entrepreneurs and life science workers.

As the industry has grown, so has the infrastructure to support it. Southern California is home to law firms, accountants, real estate firms, equipment suppliers and public relations firms that specialize in the life sciences. This critical mass of research, entrepreneurs, support services and private investors savvy about the risks and long incubation periods for life science products acts as a magnet to attract even more life science activity to the region.

While the life science industry in San Diego and the Orange County towns of Irvine and Mission Viejo have built global reputations for their prowess, the industry has also been taking root in Riverside County. There, Abbott Vascular and other medical device manufacturers take advantage of a more affordable housing market and proximity to a talented regional work force. This "neighborhood" in the region's cluster stands to become even more powerful with the opening of UC Riverside's School of Medicine.

And to the east in Imperial County, long known for its agricultural heritage, new life science sectors such as industrial biotechnology and biofuels are creating opportunities for new jobs and new relationships.

This sprawl of life-saving innovation makes Southern California a case study for investing millions of dollars to foster the creation of biotechnology clusters and the growth of well-paying jobs. The industry that generates cures and therapies for society's most devastating diseases is also developing alternative energy technologies to replace fossil fuels and chemicals that degrade the environment. A major economic driver in Southern California, this is the type of industry that economic development agencies around the world covet: it is clean and it stimulates the economy with a well-paid, well-educated workforce that demands excellent schools and plenty of first-rate cultural opportunities.

REGIONAL OVERVIEW

Southern California continues to outpace the state and nation in population growth. The four-county region represented by Biocom added more than 120,000 new residents between 2012 and 2013, a growth rate of about 1.4%. Riverside County showed the fastest growth in absolute and percentage change adding over 49,000 new residents for a growth rate of 2.1%.

Population, 2012 – 2013

Area	2012	2013	Change	% Change
United States	314,349,407	316,994,057	2,644,650	0.8%

California	38,029,924	38,389,747	359,823	0.9%
San Diego	3,175,600	3,212,098	36,498	1.1%
Orange	3,081,502	3,109,108	27,606	0.9%
Riverside	2,290,516	2,339,589	49,073	2.1%
Imperial	180,350	183,671	3,321	1.8%
Region	8,724,101	8,844,466	120,365	1.4%

Source: EMSI Employment Complete, T. Clower & Associates

Southern California has now shown several years of steady job growth as the economic recovery solidified. Between 2010 and 2013, regional employment grew by 6.4% adding about 290,000 jobs. Orange County has lead the way with ^.6% employment growth, but all counties in the Biocom region are showing steady, if not rapid, job growth.

Total Employment

	2010	2011	2012	2013	'10-'13 % Change
United States	173,710,196	176,191,091	179,277,297	182,078,697	5.0%
California	20,049,371	20,430,367	20,932,168	21,373,561	6.6%
Region	4,532,808	4,614,374	4,720,421	4,824,946	6.4%
Imperial	73,153	72,879	75,850	77,455	5.8%
Orange	1,851,623	1,889,900	1,932,942	1,974,520	6.6%
Riverside	808,249	825,511	846,584	872,766	8.0%
San Diego	1,799,784	1,826,083	1,865,044	1,900,205	5.6%

Source: EMSI Employment Complete, T. Clower & Associates

The Southern California economy's structure closely mirrors the state demonstrating excellent industrial diversification.

Regional Employment by Major Sector

		Region		California		Unites States	
NAICS	**Industry**	**2013 Jobs**	**%**	**2013 Jobs**	**%**	**2013 Jobs**	**%**
11	Agriculture, Forestry, Fishing	47,309	1.0%	501,943	2.3%	3,503,606	1.9%
21	Mining	8,372	0.2%	63,932	0.3%	1,444,629	0.8%
22	Utilities	13,516	0.3%	61,230	0.3%	575,666	0.3%
23	Construction	249,659	5.2%	946,475	4.4%	9,071,042	5.0%
31	Manufacturing	312,862	6.5%	1,334,084	6.2%	12,633,693	6.9%
42	Wholesale Trade	167,791	3.5%	776,128	3.6%	6,317,323	3.5%
44	Retail Trade	461,148	9.6%	1,947,911	9.1%	18,073,425	9.9%
48	Transportation/ Warehousing	98,345	2.0%	612,655	2.9%	5,899,771	3.2%
51	Information	72,364	1.5%	535,421	2.5%	3,303,902	1.8%
52	Finance and Insurance	283,346	5.9%	1,075,314	5.0%	10,254,115	5.6%
53	Real Estate	335,220	6.9%	1,291,459	6.0%	8,429,239	4.6%
54	Professional, Scientific Serv	417,577	8.7%	1,832,817	8.6%	12,508,449	6.9%
55	Management of Companies	51,826	1.1%	229,961	1.1%	2,251,376	1.2%
56	Administrative Services	338,457	7.0%	1,378,787	6.5%	11,313,578	6.2%
61	Education (Private)	90,285	1.9%	492,068	2.3%	4,448,949	2.4%
62	Health Care / Social Assistance	450,103	9.3%	2,250,907	10.5%	20,360,545	11.2%
71	Arts, Entertainment	129,053	2.7%	577,788	2.7%	4,036,407	2.2%
72	Lodging and Food Services	376,855	7.8%	1,502,383	7.0%	12,992,932	7.1%
81	Other Services	274,697	5.7%	1,289,424	6.0%	10,349,675	5.7%
90	Government	634,077	13.1%	2,615,530	12.2%	24,117,047	13.2%
99	Unclassified Industry	12,082	0.3%	57,343	0.3%	193,328	0.1%
	Total	4,824,946		21,373,561		182,078,697	

Source: EMSI Employment Complete, T. Clower & Associates

Job growth in the Biocom region will likely accelerate slightly over the next two years with an expectation of about 200,000 new jobs. In percentage terms, Riverside and Imperial County are expected to lead employment growth through 2015.

Total Employment Projections

	2013	2015	% Change
United States	182,078,697	187,952,814	3.2%
California	21,373,561	22,275,010	4.2%
Region	4,824,946	5,025,194	4.2%
San Diego	1,900,205	1,968,647	3.6%
Orange	1,974,520	2,051,354	3.9%
Riverside	872,766	923,422	5.8%
Imperial	77,455	81,771	5.6%

Source: EMSI Employment Complete, T. Clower & Associates

Wages in the region average $66,000 per year, which is substantially above US averages, but below state averages.

Wages (Total Average Wages All Industries)

	Average Annual Wages
United States	$62,591
California	$72,760
Region	$66,092
Imperial	$49,397
Orange	$69,556
Riverside	$51,941
San Diego	$69,328

Source: EMSI Employment Complete, T. Clower & Associates

Southern California retains its competitive advantage in education attainment by residents with 38% having a post-secondary degree, compared to 35% for the nation.

2013 Educational Attainment

	Graduate Degree or Higher	Bachelor's Degree	Associate's Degree	Some College	High School Diploma
San Diego	12.4%	20.8%	8.6%	23.0%	19.0%
Orange	12.0%	23.2%	7.6%	20.8%	17.4%
Riverside	6.7%	12.9%	7.4%	25.5%	24.8%
Imperial	4.0%	8.7%	6.1%	19.8%	19.9%
Region	10.7%	19.4%	7.9%	22.8%	19.9%
California	10.6%	18.8%	7.5%	21.8%	20.3%
United States	10.3%	17.6%	7.5%	20.9%	27.9%

Source: EMSI Employment Complete, T. Clower & Associates

In 2012, the latest year for which data are available, more than 130,000 students completed degree programs at colleges and universities across the region, an increase of 1.2%. This feeds the regional labor force and allows Southern California to remain highly competitive. This is especially true when focusing attention on science, technology, engineering, and math degree programs. Education institutions in the Biocom service area graduated over 19,200 students in STEM disciplines in 2012, a 21% increase over 2010.

Total Completions by County

	2011	2012	% Change
San Diego	55,935	55,124	-1.5%
Orange	55,402	55,354	-0.1%
Riverside	16,908	19,214	13.6%
Imperial	1,404	1,546	10.1%
Total	129,649	131,238	1.2%

Source: EMSI Employment Complete, T. Clower & Associates

STEM Completions by County

	2010	2012	% Change
San Diego	7,390	9,097	23.1%
Orange	5,765	6,839	18.6%
Riverside	2,566	3,072	19.7%
Imperial	102	196	92.2%
Total	15,823	19,204	21.4%

Source: EMSI Employment Complete, T. Clower & Associates

LIFE SCIENCES

Southern California's life science industry cluster provided over 110,000 jobs in 2013. As a reminder, the data reported here are not comparable to previous Biocom industry reports due to changes in industry definitions. San Diego and Orange counties dominate employment in the cluster. Forecasted employment change suggests the region will generally add jobs in this sector over the next two years with especially strong growth in San Diego County. Total average regional earnings by life science professionals exceed $75,000 per year, though there are substantial intraregional differences.

Life Science Employment by County, 2012 - 2013

	2012	2013	2015	2014 Avg. Earnings
San Diego	47,976	48,469	51,324	$95,446
Orange	48,797	49,448	51,272	$71,169
Riverside	12,624	11,971	12,056	$45,894
Imperial	746	644	591	$32,270
Region	110,143	110,532	115,243	$78,873

Source: EMSI Employment Complete, T. Clower & Associates

Life Science Employment by Sector

	2012	2013	2015
BioRenewables	5,276	5,123	4,934
Biopharmaceutical Manufacturing	11,408	11,357	11,507
Medical Devices and Diagnostics	33,890	34,196	35,645
Life Science Wholesale	14,962	14,362	14,797
Research, Development, and Education Labs	44,605	45,491	48,357
Total	110,141	110,529	115,240

Source: EMSI Employment Complete, T. Clower & Associates

All Life Science Establishments, 2013

	Establishments
Imperial	38
Orange	1,081
Riverside	290
San Diego	1,116
Region	2,525

Source: EMSI Employment Complete, T. Clower & Associates

Wages by Sector and County, 2013

	BioRenewables	Biopharmaceutical Manufacturing	Medical Devices and Diagnostics	Life Science Wholesale	Research and Lab Services	All Life Sciences
San Diego	$63,212	$140,293	$95,130	$150,619	$95,446	$170,112
Orange	$66,159	$74,156	$106,712	$117,096	$71,169	$24,039
Riverside	$46,307	$77,101	$69,616	$65,687	$37,968	$31,876
Imperial	$48,687	$0	$54,420	$45,912	$32,270	$79,971
Region	$56,091	$72,888	$81,470	$94,829	$98,375	$103,374

Source: EMSI Employment Complete, T. Clower & Associates

Regional Competitive Advantage

Location quotients help to identify a region's competitive industries. Southern California has strong representation in Biopharmaceutical Manufacturing, Medical Devices and Diagnostic Equipment manufacturing, and Research and Lab Services. The surprising strength of Imperial County in Medical Devices and Diagnostic Equipment manufacturing is due to employment in one sub-sector (Dental Equipment), which inflates the location quotient in this comparatively small population county.

Industries with strong LQs (those greater than 1.2) are often indicative of a regional competitive advantage that would support additional growth and opportunity. Industries with low LQs (those less than 0.9) indicate goods and services that are likely imported into the region and therefore could represent opportunities for business development and recruitment.

Location Quotients by County & Industry Sector

	BioRenewables	BioPharm Manuf	Med Dev & Diagnostic	Life Sci Wholesale	Research Labs
Imperial					
2013	12.9		4.1	0.2	1.6
2015	11.5		5.2	0.2	1.6
Orange					
2013	0.5	1.6	6.4	2.1	0.9
2015	0.4	1.5	6.9	2.2	0.9
Riverside					
2013	2.2	1.2	4.8	2	0.2
2015	2.1	1.3	4.6	2.1	0.2
San Diego					
2013	1.3	12.2	2.1	1.4	2.7
2015	1.3	12.7	2.2	1.5	2.9

Source: EMSI Employment Complete, T. Clower & Associates

Location Quotients for Region by Industry Sector

	2013	2015
BioRenewables	1.1	1.0
Biopharmaceutical Manufacturing	3.2	3.4
Medical Devices	3.8	4.0
Life Science Wholesale	0.6	0.6
Research, Development, and Education Labs	1.5	1.6
Total Life Science Industry	2.3	2.4

Source: EMSI Employment Complete, T. Clower & Associates

The life science industry remains highly competitive with the overall concentration of employment being over 2 times the national average (Location Quotient 2.3). As a reminder, the location quotient compares the concentration of regional employment in a given industry to the concentration of total employment in that same industry across the nation.

A shift share analysis, which examines industry growth trends by controlling for overall economic conditions and national industry trends. The expected change is the number of jobs that would be added (or subtracted) from a given industry in the study region if the local industry performed exactly to national trends. The competitive effect shows the number of increased (decreased) jobs in local industry attributable to local economic conditions. A positive competitive effect indicates local industry is outperforming national performance, a negative effect shows that other regions are performing better, at least during the time period being examined. The level of regional competitiveness during the 2010-2013 was strongest in Medical Devices and Research, Development, Education, and Laboratory Services in the Biocom service area.

All Life Science Shift Share Analysis, 2010-2013

Cluster	Expected Change	Competitive Effect
BioRenewables	52	-409
Biopharmaceutical Manufacturing	372	-279
Medical Devices and Diagnostic Equipment	350	3,507
Life Science Wholesale	111	-1,798
Research, Development, and Education Labs	1,348	1,150
Region	2,233	2,171

Source: EMSI Employment Complete, T. Clower & Associates

LIFE SCIENCE IMPACTS

Based on the IMPLAN economic input-output model, the business activities in the life science industry in Southern California generates almost $80 billion in regional economy activity that supports 435,000 regional jobs paying almost $28 billion in annual salaries, wages, and benefits.

Economic Impacts

	Economic Activity	Labor Income	Jobs
Imperial	$127,412,000	$34,397,000	1,068
Orange	$35,315,031,000	$11,608,038,000	164,390
Riverside	$7,402,679,000	$2,353,422,000	41,190
San Diego	$31,837,530,000	$12,115,965,000	179,134
Region	$79,835,031,000	$27,852,146,000	435,089

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

The success of the life science industry in Southern California is made possible, in part, by having strong regional linkages in key support industries. Combined, these support industries generate almost $4.7 billion in regional economic activity and boost area employment by 23,500 jobs.

Economic Activity in Key Support Industries

Industry	Imperial	Orange	Riverside	San Diego	Total
Acct. & Tax Prep.	$156,247	$173,715,054	$19,077,584	$100,751,043	$293,699,929
Insurance	$128,380	$132,047,022	$12,463,347	$92,121,941	$236,760,690
Legal Services	$205,601	$347,197,641	$30,045,130	$326,055,366	$703,503,738
Business Admin.	$39,081	$73,518,317	$14,750,186	$84,674,140	$172,981,724
Financial Services	$1,160,663	$406,578,867	$46,789,561	$306,318,738	$760,847,829
Mktg., Ad., Comm.	$54,806	$216,006,478	$28,948,381	$99,940,613	$344,950,279
Real Estate	$2,925,509	$936,207,293	$243,887,406	$996,740,834	$2,179,761,042

Source: IMPLAN

Employment in Key Support Industries

Industry	Imperial	Orange	Riverside	San Diego	Total
Acct. & Tax Prep.	3	1,261	252	872	2,387
Insurance	1	894	105	587	1,587
Legal Services	2	1,596	185	1,492	3,274
Business Admin.	0	567	142	708	1,417
Financial Services	3	763	101	630	1,496
Mktg., Ad., Comm.	1	1,652	204	761	2,617
Real Estate	16	4,072	1,456	5,210	10,754

Source: IMPLAN

RESEARCH, DEVELOPMENT, AND EDUCATION LABS

Research, Development, and Education Labs in Southern California is concentrated in San Diego County with almost 28,000 of the total 45,491 jobs in this industry sector. This sector will continue to see growth through 2015 remaining concentrated in San Diego County. Interestingly, the shift share analysis suggests that San Diego is gaining most its new jobs in this cluster due to overall industry trends.

Sector Snapshot

Description	Value
2013 Employees	48,358
2013 Avg Earnings	$98,375
2013 Establishments	926

Research, Development, and Education Labs Employment by County

	2012	2013	2015	2013 Avg Earnings
Imperial	187	108	112	$32,270
Orange	13,823	13,986	14,641	$71,169
Riverside	3,499	3,539	3,693	$37,968
San Diego	27,099	27,862	29,912	$95,446
Region	44,608	45,495	48,358	$98,375

Source: EMSI Employment Complete, T. Clower & Associates

Research, Development, and Education Labs Establishments, 2013

	Establishments
Imperial	9
Orange	313
Riverside	96
San Diego	508
Region	926

Source: EMSI Employment Complete, T. Clower & Associates

Featured Employers: Research, Development, and Education Labs

Business Name	Employment
The Scripps Research Institute	2,500
General Atomics	2,000
The Salk Institute	1,100
Sanford-Burnham Medical Research Institute	966
SynteractHCR	350
Millennium Laboratories, Inc.	258
Dart Neuroscience LLC	220
Irvine Pharmaceutical Services, Inc.	160
Geneohm Sciences, Inc.	150

Source: Hoover's, Biocom

Research, Development, and Education Labs contributes about $16.3 billion in regional economic activity in Southern California and supports almost 116,000 direct, indirect, and induced jobs.

Economic Impacts

	Economic Activity	Labor Income	Jobs

Imperial	$15,919,000	$6,612,000	161
Orange	$4,176,127,000	$1,742,948,000	29,431
Riverside	$699,435,000	$273,121,000	6,668
San Diego	$10,838,433,000	$4,824,706,000	76,076
Region	$16,331,770,000	$7,048,902,000	115,711

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

BIOPHARMACEUTICAL MANUFACTURING

Sector Snapshot

Description	Value
2013 Employees	11,357
2013 Avg Earnings	$91,853
2013 Establishments	154

Biopharmaceutical Manufacturing companies in Southern California have more than 11,300 employees earning almost $92,000 per year in earnings. Employment in this cluster is highly concentrated in San Diego and Orange Counties, with San Diego County having over 12 times the national average of employees in this sector of the life science industry. San Diego County is also the only county in the region that saw growth in this cluster over 2012 data, a trend expected to continue through 2015.

Biopharmaceutical Manufacturing Employment by County

	2012	2013	2015	2013 Avg Earnings
Imperial	0	0	0	$0
Orange	4,381	4,278	3,976	$75,639
Riverside	1,230	1,141	1,094	$148,672
San Diego	5,797	5,938	6,437	$143,099
Region	11,408	11,357	11,507	$91,853

Source: EMSI Employment Complete, T. Clower & Associates

Featured Employers: Biopharmaceutical Manufacturing

Business Name	Employees
CareFusion	4,000
Vertex Pharmaceuticals	800
Questor Pharmaceuticals, Inc.	703
Access Business Group International LLC	700
Quidel Corporation	600
Isis Pharmaceuticals, Inc.	365
Prometheus Laboratories Inc.	300
Inova Diagnostics	250
Ajinomoto Althea	246
BioLegend, Inc.	176

Source: Hoovers, Biocom

Biopharmaceutical Manufacturing Establishments, 2013

	Establishments
Imperial	0
Orange	57
Riverside	11
San Diego	86
Region	154

Source: EMSI Employment Complete, T. Clower & Associates

Biopharmaceutical Manufacturing related business activities boost total economic activity in Southern California by $27.3 billion annually. Labor income increase by about $7.8 billion through the more than 105,000 area jobs related directly or indirectly to this industry cluster.

Economic Impacts

	Economic Activity	Labor Income	Jobs
Imperial	--	--	--
Orange	$11,627,483,855	$2,886,948,377	37,431
Riverside	$2,880,007,800	$667,450,265	10,072
San Diego	$10,906,406,481	$3,550,712,172	47,011
Region	$27,212,590,299	$7,758,865,733	105,084

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

MEDICAL DEVICES AND DIAGNOSTIC EQUIPMENT

Sector Snapshot

Description	Value
2013 Employees	34,196
2013 Avg Earnings	$99,443
2013 Establishments	583

The Medical Devices and Diagnostic Equipment manufacturing cluster of the life science industry employees over 34,000 workers in the four-county region represented by Biocom. This cluster, which largely resides in Orange and San Diego counties, has seen overall growth in employment. However, a review of county level data shows a mixed picture with Orange and San Diego counties growing, but Riverside County losing jobs. Over the next two years, Orange and San Diego counties will see continued growth in this cluster.

Medical Devices and Diagnostic Equipment Employment by County

	2012	2013	2015	2013 Avg Earnings
Imperial	59	27	29	$54,420
Orange	22,105	22,531	24,007	$106,712
Riverside	3,928	3,388	3,223	$69,616
San Diego	7,798	8,250	8,387	$95,130
Region	33,890	34,196	35,646	$99,443

Source: EMSI Employment Complete, T. Clower & Associates

Major Employers: Medical Devices and Diagnostic Equipment

Business Name	Employees
Djo Global, Inc.	1,792
Illumina, Inc.	1,700
Edwards Lifesciences Corporation	1,600
ThermoFisher	1,300
James R. Glidewell Dental Ceramics, Inc.	1,100
Hologic	760
Quantum Magnetics, Inc.	609
GenOptix	575
Dexcom, Inc.	570
Nexus Dx, Inc.	480
NuVasive	450
AlphaTecSpine	305

Source: Hoover's, Biocom

Medical Devices and Diagnostic Equipment Establishments, 2013

	Establishments
Imperial	3
Orange	307
Riverside	59
San Diego	214
Region	583

Source: EMSI Employment Complete, T. Clower & Associates

The Medical Devices and Diagnostic Equipment manufacturing clusters delivers over $21 billion in total economic activity to the Southern California economy supporting over 102,000 jobs that pay in excess of $7.4 billion in salaries, wages, and benefits

Economic Impacts

	Economic Activity	Labor Income	Jobs
Imperial	$8,770,854	$2,743,831	59
Orange	$14,787,771,975	$5,111,790,086	69,022
Riverside	$654,147,110	$229,008,799	3,539
San Diego	$5,910,701,631	$2,110,875,619	29,834
Region	$21,361,391,570	$7,454,418,335	102,454

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

BIORENEWABLES

The BioRenewables cluster of the life science industry employed 5,100 workers in 2013, a decline from 2012 and reflecting a trend projected to continue through 2015. Riverside County bucked the overall trend and showed modest growth.

Sector Snapshot

Description	Value
2013 Employees	5,123
2013 Avg Earnings	$56,091
2013 Establishments	154

BioRenewables Employment by County

	2012	2013	2015	Avg. Earnings 2013
Imperial	485	493	432	$48,687
Orange	932	911	804	$66,159
Riverside	1,465	1,495	1,482	$46,307
San Diego	2,395	2,224	2,215	$63,212
Region	5,277	5,123	4,933	$56,091

Source: EMSI Employment Complete, T. Clower & Associates

Featured Employers: BioRenewables

Business Name	Employees
American Vanguard Corporation	499
Euroamerican Propagators, LLC	200
BP BioFuels	150
Synthetic Genomics	130
BASF	100
Genomatica	100
Veredezyne	54

Source: Hoover's, Biocom

BioRenewables, 2013

	Establishments
Imperial	23
Orange	23
Riverside	40
San Diego	68
Region	154

Source: EMSI Employment Complete, T. Clower & Associates

The BioRenewables cluster, though smaller in total scale than other industry clusters, still generates almost $3 billion in economic activity for Southern California supporting over 12,700 jobs.

Economic Impacts

	Economic Activity	Labor Income	Jobs
Imperial	$96,889,540	$23,304,518	813
Orange	$894,315,118	$187,504,332	2,835
Riverside	$838,235,471	$277,896,438	4,951
San Diego	$1,833,574,596	$538,274,389	8,050
Region	$2,973,429,056	$663,299,472	12,703

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

LIFE SCIENCE WHOLESALE

Sector Snapshot

Description	Value
2013 Employees	14,363
2013 Avg Earnings	$99,443
2013 Establishments	710

Employment in the Life Science Wholesale cluster has been on a declining trend, but still represents over 14,300 regional jobs. Our outlook does show this cluster will stabilize and grow slightly over the next two years. Given the competitive effect of the shift share analysis shows a loss that is much lower than actual cluster job losses, the companies in Life Science Wholesale are experiencing external challenges and we conclude that the Biocom region remains competitive for this type of business.

Life Science Wholesale Employment by County

	2012	2013	2015	2013 Avg Earnings
Imperial	16	16	17	$45,912
Orange	7,556	7,743	7,843	$117,096
Riverside	2,503	2,409	2,564	$65,687
San Diego	4,888	4,195	4,373	$150,619
Region	14,963	14,363	14,797	$99,443

Source: EMSI Employment Complete, T. Clower & Associates

Featured Employers: Life Science Wholesale

Business Name	Employees
Pacific Pharma Inc.	2,000
Professional Hospital Supply, Inc.	1,200
Allergan Sales, LLC	600
Apria Healthcare LLC	400
OptumRx, Inc.	300
Gordian Medical, Inc.	290
Signal Pharmaceuticals, LLC	134
Horiba Instruments Inc.	108
FFF Enterprises, Inc.	100
Southwood Pharmaceuticals	100
Cameron Health, Inc.	100

Source: Hoover's, BayBio

Life Science Wholesale Establishments, 2013

	Establishments
Imperial	4
Orange	381
Riverside	85
San Diego	240
Region	710

Source: EMSI Employment Complete, T. Clower & Associates

The Life Science Wholesale cluster supports more than 51,000 jobs in the regional economy boosting economic activity by $8.2 billion.

Economic Impacts

	Economic Activity	Labor Income	Jobs
Imperial	$4,478,013	$2,023,593	36
Orange	$4,434,521,125	$1,879,308,658	25,671
Riverside	$979,555,390	$426,874,416	7,563
San Diego	$2,799,690,420	$1,238,536,655	18,163
Region	$8,218,244,948	$3,546,743,322	51,433

Sources: EMSI Employment Complete, IMPLAN, T. Clower & Associates

Foreign Trade

Biocom supports its members' ability to expand and grow their markets domestically and internationally. The importance of extending markets globally and actively pursuing research and commercial collaborations with international partners is necessary for future success. Based on data from the IMPLAN model, the region exported almost $8.3 billion in life science goods and services in 2013

Value of Foreign Exports by Sector and County

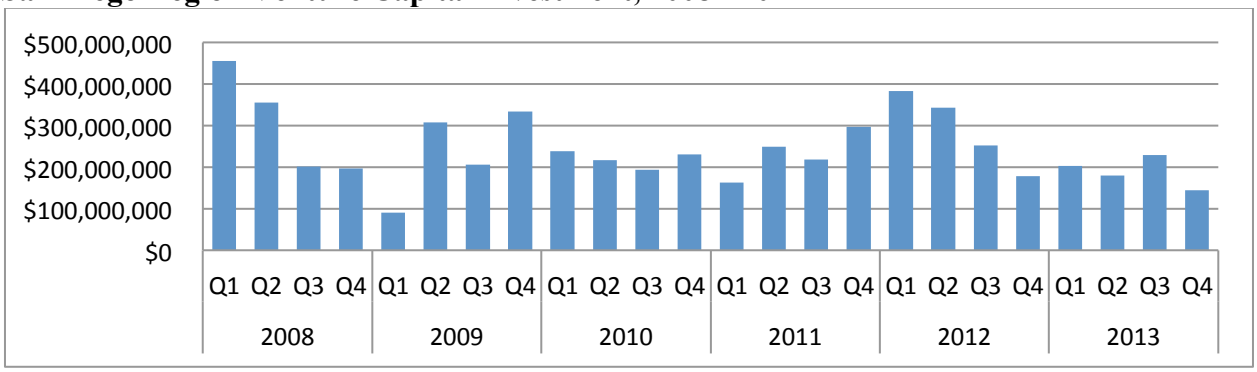
Sector	Imperial	Orange	Riverside	San Diego	Total
BioRenewables	$972,704	$209,080,393	$43,389,802	$252,865,194	$506,308,092
Biopharmaceutical Manufacturing	$0	$755,623,386	$215,801,772	$529,463,572	$1,500,888,729
Medical Devices and Diagnostics	$1,450,764	$1,737,114,140	$361,168,958	$705,410,943	$2,805,144,805
Life Science Wholesale	$27,379,763	$1,891,938,672	$318,594,501	$869,715,183	$3,107,628,119
Research, Development, and Education Labs	$114,841	$23,940,964	$2,618,566	$34,9285,721	$375,960,092
Total	$29,918,072	$4,617,697,555	$941,573,599	$2,706,740,613	$8,295,929,837

Source: IMPLAN, T. Clower & Associates

Venture Capital and Research Funding

2013 proved to the a challenging year for attracting venture capital investments to Southern California with totals falling below recent years. Research funding from the National Institute of Health continues to boost research and development that has always drive Southern California's life science industry. In fiscal year 2013, Southern California companies, universities, and institutions received about $939 million in NIH research funding.

San Diego Region Venture Capital Investment, 2008 - 2012



Source: National Venture Capital Association, Money Tree Report Q4 2012

National Institute of Health (NIH) Funding by County, 2013

COUNTY	NIH Funding 2013
ORANGE	$137,078,261
RIVERSIDE	$17,055,554
SAN DIEGO	$784,742,402
IMPERIAL	$0
REGION	$938,876,217

Source: NIH

FY 2013 Top Grant Receiving Institutions (at least $1 million in funding)

Organization	Funding	Awards
UNIVERSITY OF CALIFORNIA SAN DIEGO	$362,004,733	847
SCRIPPS RESEARCH INSTITUTE	$198,275,639	335
UNIVERSITY OF CALIFORNIA IRVINE	$126,433,097	340
SANFORD-BURNHAM MEDICAL RESEARCH INSTIT	$53,588,265	123
SALK INSTITUTE FOR BIOLOGICAL STUDIES	$41,115,822	83
SAN DIEGO STATE UNIVERSITY	$26,533,223	80
LA JOLLA INST FOR ALLERGY & IMMUNOLGY	$26,164,807	54
UNIVERSITY OF CALIFORNIA RIVERSIDE	$15,835,300	58
PAXVAX, INC.	$12,079,618	3
VETERANS MEDICAL RESEARCH FDN/SAN DIEGO	$9,335,440	22
LUDWIG INSTITUTE FOR CANCER RES LTD	$8,346,016	16
MAPP BIOPHARMACEUTICAL, INC.	$5,735,312	3
TRIUS THERAPEUTICS, INC.	$3,624,974	1
CALIFORNIA STATE UNIVERSITY FULLERTON	$2,895,311	12
CALIFORNIA STATE UNIVERSITY SAN MARCOS	$2,434,018	12
PROGNOSYS BIOSCIENCES, INC.	$1,969,762	4
LA JOLLA BIOENGINEERING INSTITUTE	$1,714,550	2
AMPLYX PHARMACEUTICALS, INC.	$1,581,107	5
VALA SCIENCES, INC.	$1,384,880	4
VENTRIX, INC.	$1,339,549	1
OPTIMUM THERAPEUTICS, LLC	$1,336,756	4
OCT MEDICAL IMAGING, INC.	$1,237,009	2
GENALYTE, INC.	$1,224,338	2
IMMPORT THERAPEUTICS, INC.	$1,080,873	2

Source: NIH

APPENDIX

NAICS Industry Description

BIORENEWABLES (INCLUDING BIOFUELS, SPECIALTY ENZYMES CHEMICALS, ALGAE RESEARCH AND AGRICULATURE)

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

BIOPHARMACEUTICAL MANUFACTURING

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

MEDICAL DEVICES AND DIAGNOSTIC EQUIPMENT

327215 Glass Product Manufacturing Made of Purchased Glass (20%)
333314 Optical Instrument and Lens Manufacturing (10%0
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 WHOLESALE

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 Sciences (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)%

DATA SOURCES

Data for this analysis come from a variety of sources. The primary source of demographic and employment data is Economic Modeling Specialists, Incorporated (EMSI). This company uses data from the US Bureau of Labor Statistics (BLS), US Census Bureau, and other sources to provide detailed estimates of employment by industry, worker earnings, business establishments, and market area demographics. The key value added by this data provider is their use of proprietary algorithms that estimate data masked by BLS to protect individual company confidentiality.

Commercial biotechnology and pharmaceutical content in this was supplied by Evaluate, Ltd. Evaluate transforms life science market intelligence into insights companies can use to perform well. Its services include: EvaluatePharma®, EvaluateMedTech™ and EvaluateClinical Trials™. Its award-winning editorial team is EP Vantage.. In addition, we draw data from Hoover's, the National Center for Education Statistics, the IMPLAN economic input-output model, PWC's MoneyTree report, and other sources

SPECIALIZATION AND REGIONAL COMPETITIVENESS

A high level of specialization fosters synergy and collaboration as though knowledge is "in the air." An effective and commonly used economic base technique to measure a region's specialization is the location quotient (LQ). This study utilizes employment as its unit of measure for assessing the Location Quotients by cluster, region, and county. The proportional employment in a selected industry for the study area is compared to a reference area, in this case, national employment.

The arithmetic nature of an LQ leads to the following rules of LQ evaluation:

- LQ>1 is interpreted as the region being more specialized than the nation in the particular industry.
- LQ<1 is interpreted as the region being less specialized than the nation in the particular industry.
- LQ=1 is interpreted as the region having an equal degree of specialization when compared with the nation in the particular industry.

Industries with strong LQs (those greater than 1.2) are often indicative of a regional competitive advantage that would support additional growth and opportunity. Industries with low LQs (those less than 0.9) indicate goods and services that are likely imported into the region and therefore could represent opportunities for business development and recruitment.

Shift share is a second economic analysis technique used to highlight the region's competitive advantages and disadvantages. It is useful for recognizing established or emerging strengths and weaknesses in local regions taking into account non-local market conditions such as overall economic trends and industry trends not tied to local conditions. In this report, we focus on two outputs of a shift share analysis:

- Expected Change: Job growth one would expect in the regional industry if it followed national trends for the overall economy and national trends for that particular industry.
- Competitive Effect: This explains how much of the change in a given industry is due to a unique competitive strength, or weakness, that the region possesses. It is the difference between Expected Change and Actual Change.

ECONOMIC IMPACT

The analysis of the economic impact of the life science industry incorporates data primarily provided by EMSI* and the IMPLAN* input-output model. These estimates of total economic activity include direct, indirect, and induced impacts based on the activities of a given industry. An example to consider is the economic impact of biopharmaceuticals. The direct effects capture spending in the subject industry for employees, materials, supplies, utilities, equipment, and professional services as part of normal business operations. Indirect effects capture the economic activities of the company's vendors. For instance, the accounting firm that provides bookkeeping services buys office supplies, rents office space, purchases computer equipment, and hires services for its business needs. Induced effects include the impact of the employees of all these firms spending a portion of their wages and salaries in the local economy. At each stage, the model accounts for spending that leaves the local area, such as spending for imported (domestic or foreign) raw materials. When added together, the adjusted total impacts are often large than direct spending by industry firms, which is the "multiplier" effect. Data used to build the IMPLAN economic input-output model also allows us to estimate the value of foreign exports of commodities and services related to the life science industry.