

2021
CALIFORNIA ECONOMIC
IMPACT REPORT
DATA BOOK



CALIFORNIA ECONOMIC IMPACT REPORT

A CATALYST FOR INNOVATION AND
GROWTH IN CALIFORNIA



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EXECUTIVE SUMMARY

The 2021 Biocom California Economic Impact Report provides key economic, demographic, investment, and industry performance data and analysis for the Life Sciences industry in California and for select regions in the state. In 2020, the Life Science sector undertook groundbreaking work at an unprecedented pace to lead the fight against the SARS-COV-2 virus. With biotech and pharma leading the pandemic response, the Life Science industry quickly developed diagnostics, therapeutics and vaccines, served as a stabilizing economic force, and retained its role as a major source of innovation. The industry demonstrated strong and sustained growth across California, defying the economic disruption experienced by most industries as a result of the pandemic. Job growth slowed, but venture capital surged.

- Total direct employment, including self-employed workers, reached 489,000 in 2020. The sector’s high paying jobs pushed average compensation to \$134,000.
- While California’s total employment dropped by 7.4% in 2020, Life Sciences registered a 0.5% job gain.
- Including all the multiplier effects of Life Sciences to the California economy, this industry generated \$239 billion in gross state product (GSP) for California and \$405 billion in total business sales in 2020. For every \$100 in initial sales, the supply chains and consumer spending yielded an additional \$85.
- The inclusion of these multiplier effects means that Life Sciences was responsible for a total of 1.38 million jobs with total earnings (labor income) of \$131 billion in 2020.

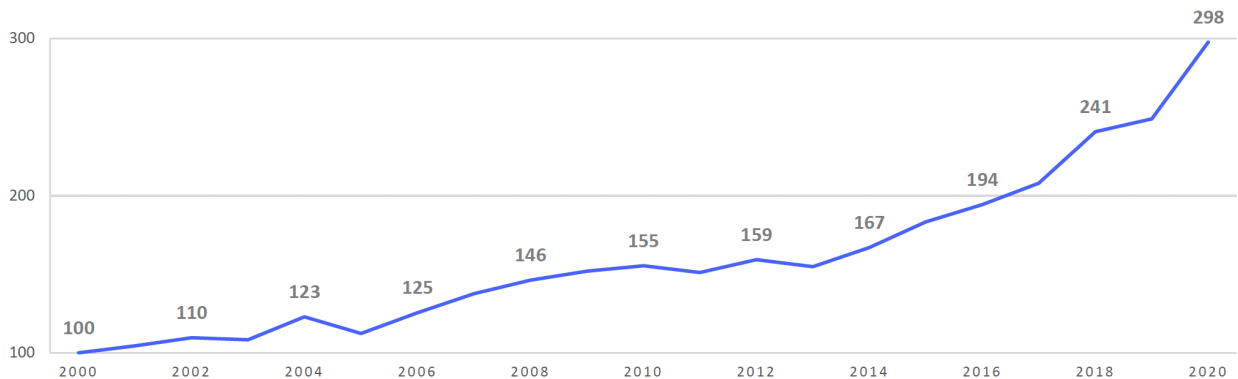
2020 Annual Economic Impact California	
	Impact
Direct Employment	488,665
Total Jobs	1,376,707
Labor Income	\$131 billion
Total Business Sales	\$405 billion
Gross State Product	\$239 billion

SOURCE: IMPLAN, FBEI



A new proprietary Biocom California Index, developed to measure the Life Science Industry's performance across critical metrics, jumped 19.6% in 2020 to an all-time high. (See page 16.) Benchmarking at a base of 100 in the year 2000, the Index reached 298 in 2020, showing that it has tripled over the past two decades, with growth skyrocketing over the past four years.

BIOCOM CALIFORNIA INDEX SHOWS LIFE SCIENCES' CLIMB
INDEX, 2000=100



SOURCE: FBEI

Key Contributing Factors:

- 11,000 Life Science companies operated from about 14,000 establishments (offices, laboratories, and manufacturing facilities) in California during 2020.
- The National Institutes of Health (NIH) awarded 10,904 grants in 2020 to California equal to \$5.55 billion. A sum of \$686 million went to universities, institutions, and companies for research and projects more narrowly defined as related to Life Sciences.
- The total number of National Science Foundation (NSF) awards to California equaled 1,452 in 2020, totaling \$676 million, while core Life Sciences funding summed to \$431 million.
- Other U.S. government agencies, led by the Department of Defense, directed \$247 billion in contracts to the Life Science sector in California during 2020.
- Venture capital directed to California's early-stage innovators in Life Sciences soared more than 60% in 2020 to a record total of \$15 billion.
- Nearly 1,700 patents were granted to California entities for Life Science products and solutions in 2020. Patents have topped 1,000 each year since 2010. Since 2000, the Life Science field in California has generated over 23,000 patents.
- Exports of Life Science goods and services from California entities that were produced in the State totaled \$55 billion in 2020.

Takeaways and Considerations:

- The outlook for the Life Science sector in California in 2021 involves mostly positive forces, but several constraints merit close attention.



- Positive forces include a sharp climb in economic activity, the Federal Reserve’s commitment to low interest rates for some time, rising stock prices, increased federal R&D funding, and the ongoing focus on viral detection, immunization, and treatment.
- Constraints include supply chain disruptions, government agency backlogs, visa restrictions, price controls, rising materials costs, and talent pipelines.

2021 already is promising to be another strong year for the Life Science sector in California. The general economy, financial markets, and federal funding will all help drive the industry forward. The nation and the world will also increasingly look to the Life Science nucleus in California to provide solutions for some of its most pressing issues involving the environment, agriculture, medicine, digital health, and healthcare.



INTRODUCTION

The pandemic catapulted Life Sciences to the forefront as the world faced the devastation of COVID-19. This added to the sector's roles as a primary innovator, source of solutions to address major diseases, and a strong contributor to economic stability and growth. The sector is especially important in California, where it has strong relationships with the state's universities and research institutions and fosters the transfer of technology between research institutions and industry.

Life Sciences represents a complex ecosystem embracing venture capitalists, government entities, universities, research scientists, manufacturers, distributors, and a vast network of professional service firms, ranging from real estate brokers to patent attorneys. It spawns a wide array of products, extending from life-saving drugs and therapies to plant-based foods. Its role in export markets and its ability to attract U.S. government funding and private capital from throughout the world make it an especially powerful contributor to California's economy.

LIFE SCIENCES SCOPE

Six major industry sub-sectors comprise Life Sciences, with each containing several more specific industries¹:

1. **Biotechnology:** This group includes research entities involved in nanotechnology as well as biotechnology.
2. **Biopharmaceuticals:** This aggregate encompasses pharmaceutical manufacturers of a wide range of products as well as distributors.
3. **Medical Devices and Equipment:** This sub-sector spans manufacturers of a large array of products for health care, including optical instruments, surgical apparatus, and dental supplies.
4. **Research and Manufacturing:** Research and development (R&D) conducted at colleges and universities or in private medical laboratories dominate this sector.
5. **Scientific/Research Tools:** This aggregate encompasses manufacturers of laboratory instruments, chemicals, and other devices used for measuring, displaying, and controlling research processes.
6. **Food and Agriculture Biotech:** This group includes cellular grown meat and seafood as well as biorenewables used in agriculture and crop production.

¹See Appendix A for a detailed comparison with past Biocom Economic Impact Reports. See Appendix B for a complete listing of all NAICS codes.



2020 PERFORMANCE

The Life Science sector in California countered some of the year’s negative economic forces that damaged large parts of the state’s economy due to the COVID-19 pandemic. Job growth was slow, but venture capital surged.

Employment

Total direct employment, including self-employed workers, reached close to 489,000 in 2020. Reflecting some of the high salaries in research and other positions in the field, average total compensation totaled \$134,000.

California’s 489,000 Life Science jobs are dispersed across all six of its primary sub-sectors. Research, medical device manufacturing, and biopharmaceuticals represent the largest shares of the sector’s overall jobs.

EXHIBIT 1

**Direct Employment By Sub-Sector
California**

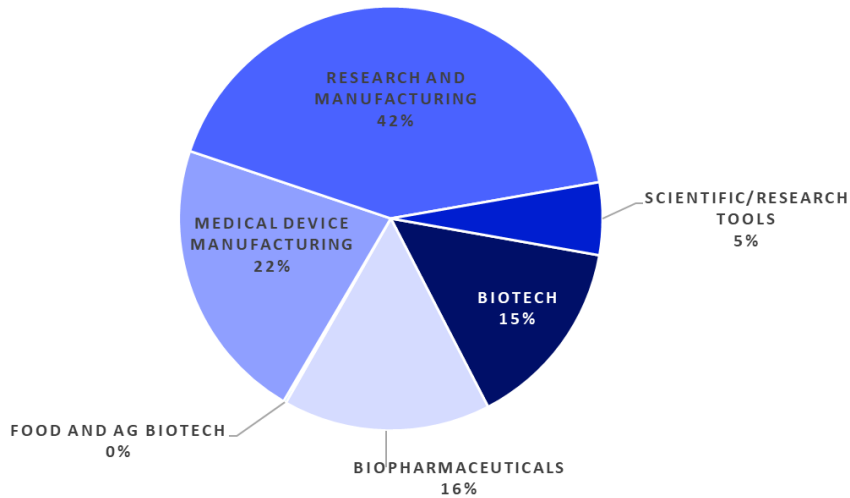
Research and Manufacturing	205,762
Medical Device Manufacturing	106,022
Biopharmaceuticals	77,433
Biotechnology	71,467
Scientific/Research Tools	26,988
Food and Ag Biotechnology	993
Total Direct Employment	488,665

SOURCE: IMPLAN, FBI



RESEARCH AND MANUFACTURING REPRESENTS LARGEST SHARE OF EMPLOYMENT

SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



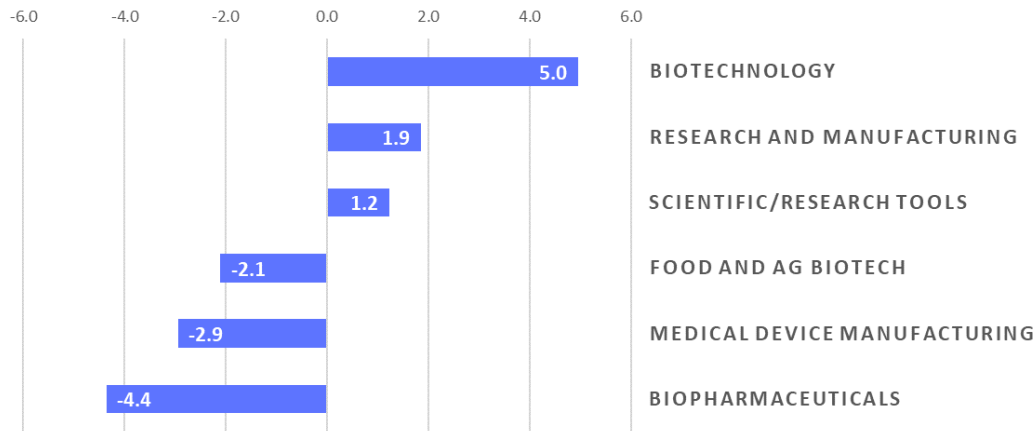
Countering many of the negatives that devastated some of California’s leading sectors, such as leisure and hospitality, Life Science employment registered a 0.5% job gain in 2020 versus the state’s sharp 7.4% total job drop.

The pandemic did, however, cause some job losses among medical device and pharmaceutical manufacturers. Disruptions in U.S. hospital surgery schedules and doctors’ offices, along with weaker export sales, may have caused these declines. Strong advances in biotechnology and other research areas more than offset these decreases to push Life Science employment in California to an all-time high.



BIOTECH AND RESEARCH OFFSET PANDEMIC JOB LOSSES

2020, PERCENT CHANGE OVER PRIOR YEAR



Total Economic Impact

Each dollar initially directed to Life Sciences triggers two additional sources of economic activity. The first involves all of the purchasing and associated job effects across the wide array of supply chains (indirect effect). The second includes the impact of consumer spending by all employees impacted directly and through the supply chains by changes in Life Sciences spending (induced effect).

After considering all ripple or multiplier effects through the economy, Life Sciences generated \$239 billion in gross state product (GSP) for California and \$405 billion in total business sales in 2020. For every \$100 in original sales, the supply chains and consumer spending yielded an additional \$85. The implied 1.85 multiplier of total or final sales relative to initial sales is relatively high compared to that of many industries, which averages closer to 1.60. The high compensation and spending from many of the sector’s employees and its robust supply chain infrastructure located within the State contribute to the multiplier’s size.

The inclusion of all multiplier effects also meant that Life Sciences was responsible for a total of 1.38 million jobs with total earnings of \$131 billion in 2020.

Much of the funding supporting the Life Sciences ecosystem also comes from outside the State. The sector attracts large amounts of venture capital and other investment from throughout the world. It receives research grants from the National Institutes of Health (NIH) and the National Science Foundation (NSF), as well as contracts from the Department of Defense (DoD) and other federal agencies. It brings in more dollars to the state’s economy through its exports. Rather than diverting spending from one sector to another within the state, Life Sciences represents a magnet for additional funds into California, making it an especially powerful economic driver.



EXHIBIT 4

**2020 Annual Economic Impact
California**

	Impact
Total Jobs	1,376,707
Labor Income	\$131 billion
Total Business Sales	\$405 billion
Gross State Product	\$239 billion

SOURCE: IMPLAN, FBEI

MAJOR CHARACTERISTICS OF THE LIFE SCIENCES SECTOR IN CALIFORNIA

Companies and Establishments

11,000 unique companies with payrolls operated about 14,000 establishments (offices, laboratories, and manufacturing facilities) in California during 2020. About one-third of companies were manufacturers of medical devices and equipment, while research and manufacturing and biotechnology sub-sectors each represented about one-fourth of total companies. Biopharmaceuticals represented about ten percent of total 2020 Life Sciences companies.

EXHIBIT 5

**Companies and Establishments By Sub-Sector
California**

	Unique Companies	Unique Companies Percent Share	Establishments	Establishments Percent Share
Medical Devices Manufacturing	3,779	34%	4,426	31%
Research and Manufacturing	3,100	28%	4,632	33%
Biotechnology	2,886	26%	3,529	25%
Biopharmaceuticals	993	9%	1,130	8%
Food and Ag Biotech	155	1%	176	1%
Scientific/Research Tools	95	1%	168	1%

SOURCE: CA EDD, FBEI

Education Levels

California possesses an abundance of educated residents to fuel the Life Sciences workforce. A total of 63% of the State’s residents aged 25 and over have received at least some college education. A



total of 13% of California adults hold a graduate or professional degree, such as a Ph.D., M.D., MBA, or J.D. Many younger people also earn certificates or degrees that enable them to work in Biotech.

EXHIBIT 6

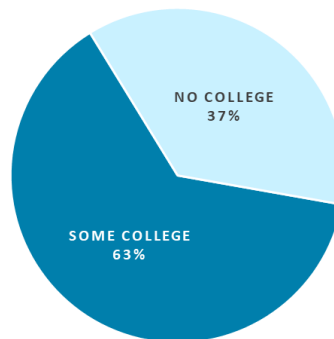
**Educational Attainment
California**

	Share of CA Residents
Less than 9th grade	9%
9th to 12th grade, no diploma	7%
High school graduate (includes equivalency)	21%
Some college, no degree	21%
Associate's degree	8%
Bachelor's degree	22%
Graduate or professional degree	13%

SOURCE: IMPLAN, FBI

EXHIBIT 7

MAJORITY OF CALIFORNIA RESIDENTS HAVE SOME COLLEGE EDUCATION
SHARE OF CALIFORNIA RESIDENTS, 2020



SOURCE: US CENSUS BUREAU, FBI

The state’s system of higher learning has a strong synergy with its Life Science sector. California’s colleges and universities attract students from inside and outside the state who can then help support the Life Science industry’s ongoing search for talent. New programs have also been created specific to the industry, such as biomanufacturing, by several California community and four-year colleges with state-of-the-art labs and hands-on learning to prepare students for work within the Life Science industry.

Occupations and Salaries

The Life Science sector encompasses a variety of occupations and spans a wide range of interests. It includes biochemists, biophysicists, and microbiologists. It employs epidemiologists who have been drawn to the spotlight since COVID-19 appeared. Individuals focused on the environment with science or technical backgrounds can find strong demand in this sector. Demand is also rising for biologists, chemists, food science technicians, and others.



Community colleges provide basic education and skills, 4-year biomanufacturing degrees, and 2-year certificates. Biotech companies work directly with the colleges to design curricula, provide guest speakers, and offer internships. The industry and its vast network of suppliers and service providers support jobs of every level of educational attainment and skill.

Average salaries top \$100,000 per year for several of the sector’s occupations, with various employment benefits boosting total compensation to an average of \$130,000. Technicians typically initially earn more moderate compensation rates, but the sector offers various career paths to advance upward.

EXHIBIT 8

**Life Sciences Wages by Occupation
California**

	<u>Average Annual Wage</u>
Medical Scientists, Except Epidemiologists	\$111,696
Biochemists and Biophysicists	\$110,143
Microbiologists	\$107,211
Life Scientists, All Other	\$102,462
Biological Scientists, All Other	\$98,713
Environmental Scientists and Specialists, Including Health	\$94,300
Epidemiologists	\$93,769
Zoologists and Wildlife Biologists	\$77,416
Life, Physical, and Social Science Technicians, All Other	\$61,267
Environmental Science and Protection Technicians, Including Health	\$57,977
Biological Technicians	\$54,893
Chemical Technicians	\$51,808
Agricultural and Food Science Technicians	\$47,732

SOURCE: CA EDD, FBEI

KEY FACTORS AND METRICS

The Life Science industry represents a unique model of funding, with financing supported by government sources and private capital.

Research Funding

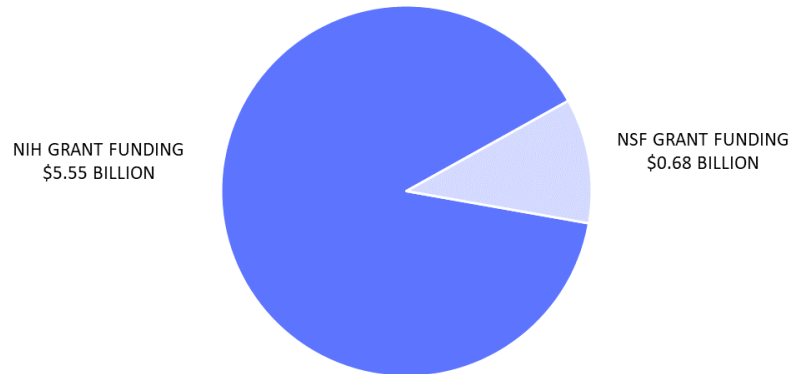
The NIH and NSF are important sources of early-stage research funding for the Life Science industry in California. In 2020, these two organizations awarded more than 12,356 research grants to the State of California, summing to a total of \$6.23 billion. The NIH accounted for a dominant 89% of this total funding. In terms of funding for core Life Sciences, the contributions from the two agencies are more equal, with NIH accounting for 61% of total core funding in 2020.²

² The NIH also funds large amounts of other health care research in addition to that central to the biotechnology, pharmaceutical, and other businesses that represent the core of Life Science.



EXHIBIT 9

NIH AND NSF GIVE \$6.23 BILLION TO CALIFORNIA IN 2020
TOTAL GRANT AMOUNTS AWARDED TO CALIFORNIA, \$



SOURCE: NIH, NSF, FBEI

Total NIH awards to the State of California numbered 10,904 in 2020, with total dollar funding of \$5.55 billion. NIH awards for the core of Life Sciences numbered 1,321 in 2020, with total dollar funding of \$686 million. California received about 12% of both total NIH awards and NIH funding for core Life Sciences in 2020.

While amounts varied widely across core Life Sciences projects, the average per award was approximately \$520,000. The total number of awards to the core of Life Sciences rose substantially from the prior year, but total funding eased slightly from the 2019 record of \$690 million.

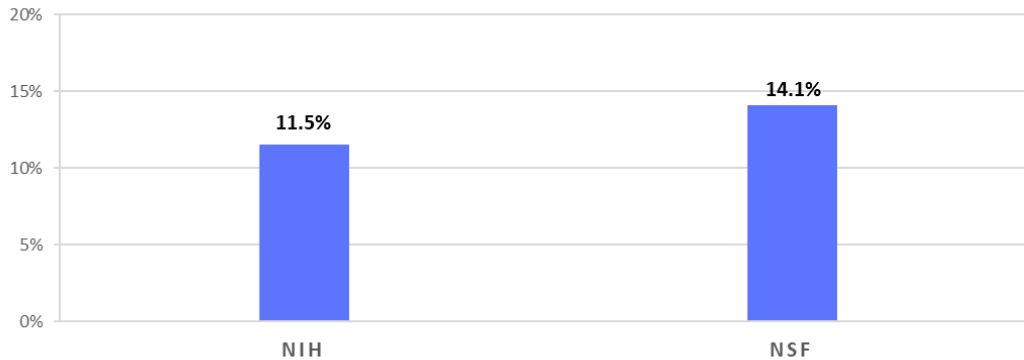
Total NSF awards to the State of California numbered 1,452 in 2020, with total dollar funding of \$676 million. NSF issued 832 awards to the core of Life Sciences in 2020, totaling \$431 million. Although California received only 1.5% of total NSF funding, its core Life Sciences segment received 14.1% of all such grants.

NSF grants to the core of Life Sciences also vary widely across projects, but the average grant amounted to \$518,000 in 2020. Both NSF grant numbers and dollar totals advanced substantially in 2020 over the prior year.



EXHIBIT 10

LIFE SCIENCES RESEARCH TARGETS CALIFORNIA
SHARE OF TOTAL 2020 CORE LIFE SCIENCES FUNDING, PERCENT

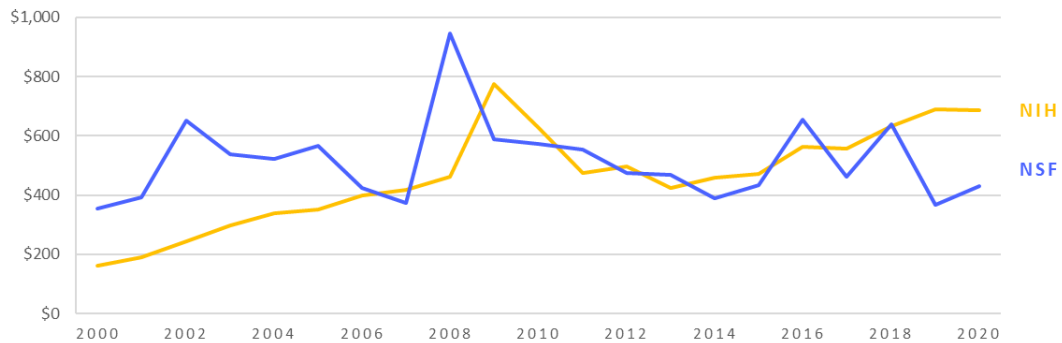


SOURCE: NIH, NSF, FBEI

Research awards specifically targeted to Life Sciences in California can vary substantially from year to year depending on Administration and congressional policies and agency priorities. While NIH funding has exceeded NSF grants substantially during the past two years, that is not always the case. As recently as 2018, NSF funding to the core of Life Sciences was somewhat higher than that from the NIH.

EXHIBIT 11

NIH OUTPACES NSF CORE FUNDING IN RECENT YEARS
MILLIONS OF DOLLARS



SOURCE: NIH, NSF, FBEI

Government Contracts

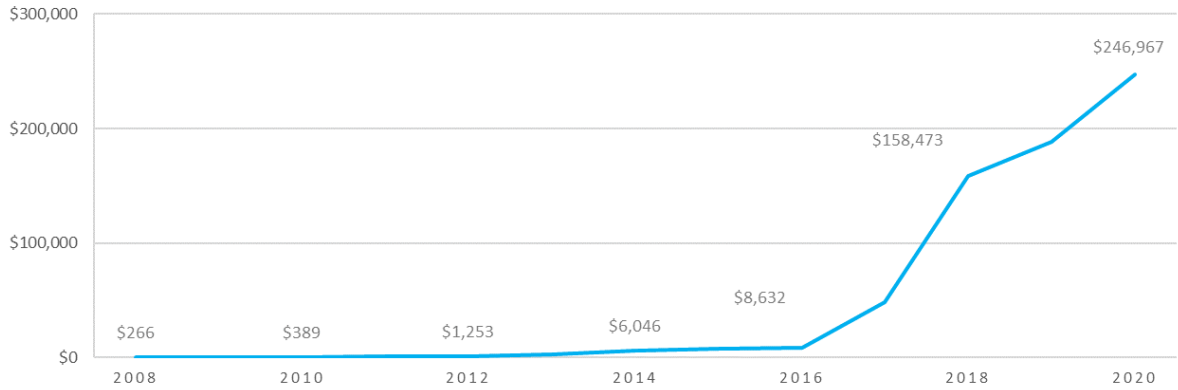
In addition to funding from the NIH and NSF, various other branches of the U.S. government award contracts to California entities, including universities, companies, and non-profit organizations involved in Life Science. In 2020, these contracts totaled \$247 billion, led by DoD procurement awards. The 2020 total represented more than a 30% jump from 2019. Its dramatic growth since 2009, when funding equaled less than \$300 million, shows the government’s increasing interest in Life Sciences. This interest has spanned a wide range of applications, ranging from treatments for long-



term diseases, such as Alzheimer’s, to finding solutions for COVID-19. The DoD has targeted such areas as disease prevention, trauma management, environmental remediation, and advanced materials.

EXHIBIT 12

GOVERNMENT CONTRACT SPENDING JUMPS 30% IN 2020
MILLIONS OF DOLLARS



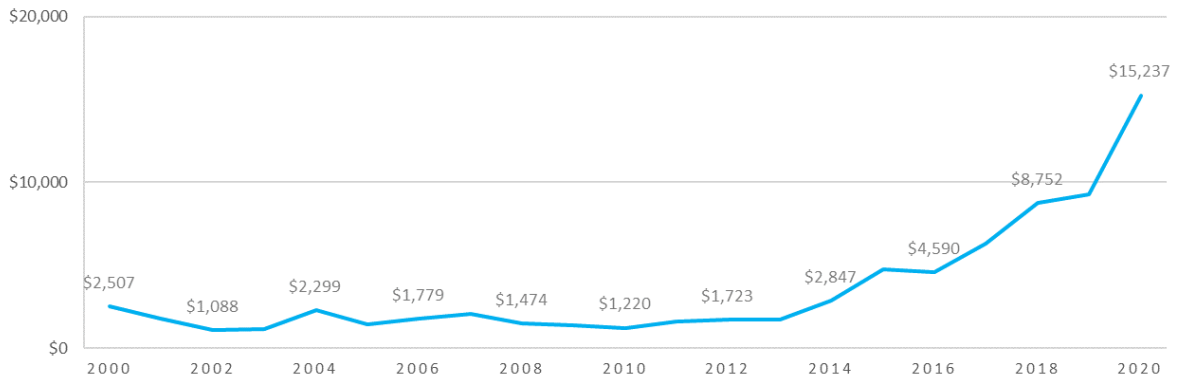
SOURCE: USASPENDING.GOV, FBEI

Venture Capital

Propelled by low interest rates and investor interest in the promising prospects under development in the Life Science sector in California, venture capital soared to a record high of \$15 billion in 2020. This represented a leap of over 60% from 2019 and more than tripled the amount attracted just four years earlier. The Life Science sector in California drew 11.4% of total U.S. venture capital directed to the field in 2020.

EXHIBIT 13

VENTURE CAPITAL REACHES ALL-TIME HIGH IN 2020
LIFE SCIENCES IN CALIFORNIA, MILLIONS OF DOLLARS



SOURCE: PRICEWATERHOUSECOOPERS, FBEI

Patents

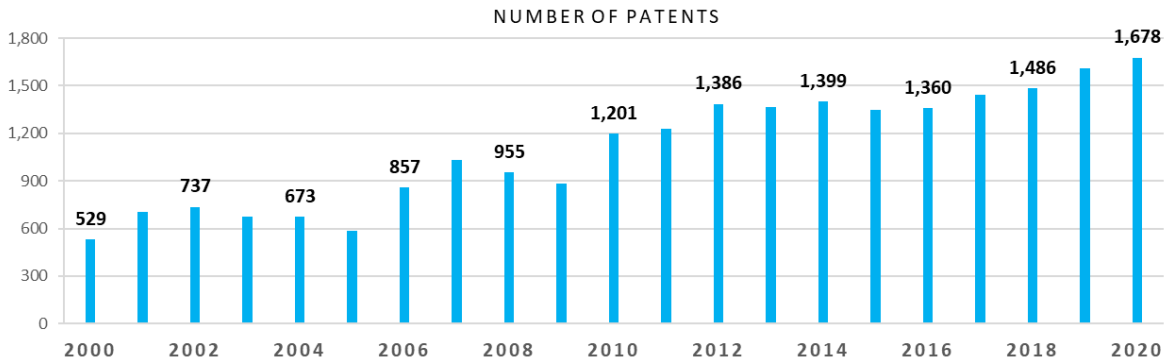


Patents granted to Life Science innovations in California reached an all-time high in 2020. The year's 1,678 total increased from the prior year's patent total of 1,611 patents

These grants have topped 1,000 each year since 2010. Since 2000, the Life Science field in California has earned over 23,000 patents.³

EXHIBIT 14

LIFE SCIENCES IN CA RECEIVES 23,000 PATENTS SINCE 2000



SOURCE: USPTO, FBI

Exports

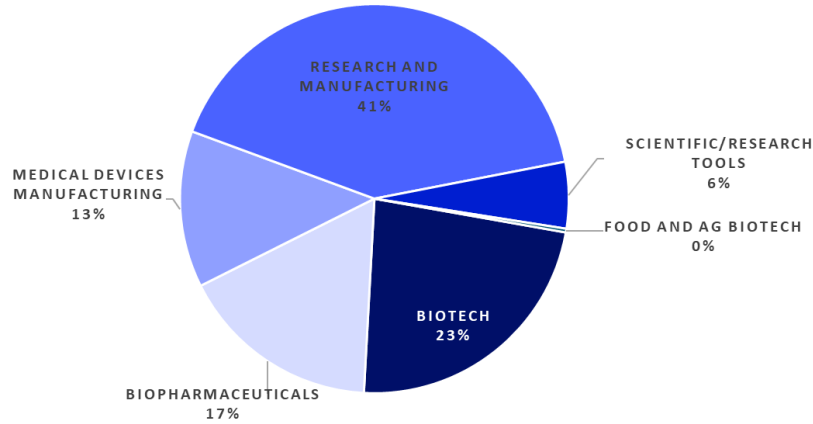
Exports of goods and services from Life Science entities in California produced within the state totaled \$55 billion in 2020. The global recession and border restrictions sharply reduced demand for U.S. product relative to the prior year. At nearly \$23 billion, research and manufacturing represented more than two-fifths of the total. Biotechnology, biopharmaceuticals, and medical devices or equipment also represented large volumes of exports.

³ Patent grants are not equivalent to those that are cleared or approved by the U.S. Food and Drug Administration (FDA).



RESEARCH AND MANUFACTURING REPRESENTS LARGEST SHARE OF FOREIGN EXPORTS

SHARE OF LIFE SCIENCES FOREIGN EXPORTS, 2020



BIOCOM CALIFORNIA INDEX

This report presents a proprietary Biocom California Index to track California’s Life Science sector performance over time with respect to a variety of different metrics.

It includes the following elements:

- NIH grants, number
- NIH grants, \$ value
- NSF grants, number
- NSF grants, \$ value
- Patent grants, number
- Payroll jobs, number
- Establishments, number
- Venture capital, \$ value

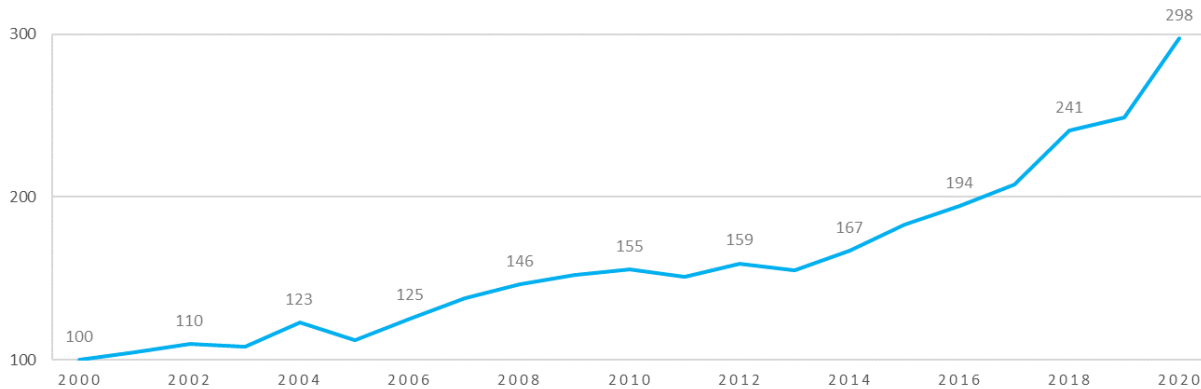
The Biocom California Index, based on a weighted-average of these components, has grown impressively over the last two decades. From the year 2000 base value of 100, the Index reached 298 in 2020. This means that the Life Science sector in California, measured with respect to several dimensions, has tripled since the year of 2000. This represents a compound annual average growth rate of 5.6%.



In 2020, while the pandemic ravaged large segments of California’s economy, the Biocom California Index highlighted the Life Science sector’s resilience and its value. The Index jumped 19.6%, the largest gain over its 21-year history. Only one component, the value of NIH funding, declined.

EXHIBIT 16

BIOCOM INDEX SHOWS LIFE SCIENCES' CLIMB IN CALIFORNIA
INDEX, 2000=100



SOURCE: FBFI

The Biocom California Index has advanced nearly every year since 2000. Only four years (2003, 2005, 2011, and 2013) experienced declines, with those drops due to the performance of different components. Declines in government funding, either through the NIH or NSF, contributed to all of these overall decreases in the Index. The components of the Index exhibiting the strongest gains of 2020 over 2000 include the value of venture capital, the value of NIH grants, and the number of patents granted.

ECONOMIC AND FINANCIAL FORCES DRIVING LIFE SCIENCES

How sensitive is Life Sciences to changes in the overall economy, financial markets, national policies regarding interest rates and research funding? To understand the major economic and financial forces that impact the performance of the Life Science sector in California, a statistical or econometric model was developed.⁴ Four different factors appear to drive sector employment significantly.

U.S. real gross domestic product (GDP): Upswings and downswings in the national economy significantly affect Life Science, although other factors can and do moderate that influence. Isolating the U.S. economy’s effect, each percentage point change in real (inflation-adjusted) GDP growth causes approximately a 0.7 percent change in total Life Science employment.

⁴ See Appendix C for the model’s specification.



NIH and NSF grant funding: The combined dollar amounts from the NIH and NSF significantly influence the number of Life Science jobs in California each year as those dollars are put to work.

Federal Funds Target: The base short-term interest rate targeted by the Federal Reserve impacts Life Science employment in California. Lower interest rates lead to more hiring in the sector, while higher rates cause less hiring. Interest rates affect the amount of risk Life Science firms are willing to take with respect to expansion and their ability to borrow funds.

NASDAQ: The performance of the NASDAQ Composite stock market index shows changes in investors' demand for technology and other stocks targeted for growth. Rising stock prices, especially as measured by this index, reflect investor appetite to deploy capital in areas such as Life Science.

The combination of these variables helps to explain the performance of Life Science employment in California. In 2020, total real GDP dropped substantially, while NIH and NSF grant funding dipped modestly. A robust gain in NASDAQ coupled with a sharply more expansive monetary policy in terms of a lower federal funds target offset those negatives. The net result was a 0.5% gain in Life Science employment in the State.



REGIONAL PERFORMANCE

Life Science represents a particularly important force in twelve of California's regions. In this section, key data points relevant to the Life Sciences are reported for the following regions:

1. The Bay Area: including Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma Counties
2. The Peninsula: including San Mateo and Santa Clara Counties
3. East Bay: including Alameda and Contra Costa Counties
4. City and County of San Francisco
5. Marin County
6. Southern California: including Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura Counties
7. Ventura County
8. Los Angeles County
9. City of Los Angeles
10. Orange County
11. San Diego County
12. City of San Diego

The Bay Area

The Bay Area consists of nine counties surrounding the San Francisco Bay. These include Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma Counties. Nearly 179,000 people in the Bay Area were directly employed by Life Sciences companies in 2020. Average annual earnings exceeded \$179,000. Research and Manufacturing represented about 43% of Life Sciences direct employment, with Medical Devices and Equipment following at 20% of direct employment. Biotechnology represented 17% and Biopharmaceuticals represented 14% of Life Sciences direct employment, with Scientific Research/Tools making up 6% and Food and Agriculture making up 0.1%.



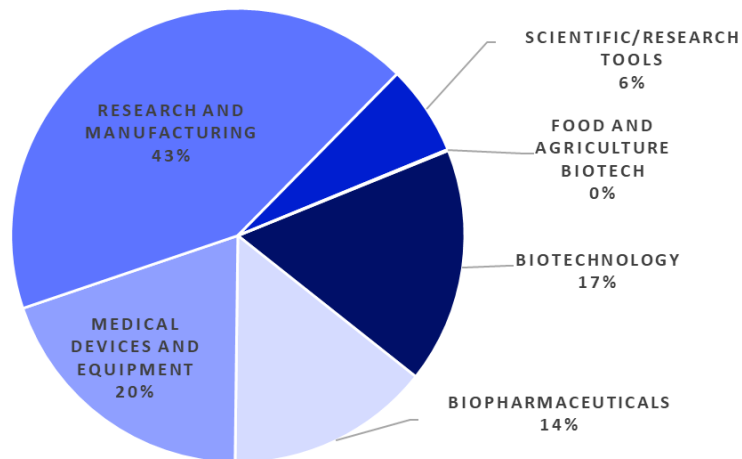
EXHIBIT 17

2020 Key Metrics
Bay Area

Establishments	4,028
Unique Companies	3,063
Direct Employment	178,958
Average Compensation	\$179,528
Share of Total Employment	3.4%
Total NIH Funding	\$2,320,804,635
Total NSF Funding	\$209,581,080
Government Contract Funding	\$119,194,849,892

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBI

RESEARCH AND MANUFACTURING REPRESENTS
LARGEST SHARE OF BAY AREA EMPLOYMENT
SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Science in the Bay Area generated \$104 billion in Gross Regional Product (GRP) and \$159 billion in total business sales in 2020. Additionally, including all multipliers, Life Sciences was responsible for over 411,000 jobs with total earnings of \$54.5 billion.



EXHIBIT 19

**2020 Annual Economic Impact
Bay Area**

	Impact
Total Jobs	411,198
Labor Income	\$54.5 billion
Total Business Sales	\$159 billion
Gross Regional Product	\$104 billion

SOURCE: IMPLAN, FBEI

EXHIBIT 20

**2020 County-Specific Key Metrics
Bay Area**

	<u>Establishments</u>	<u>Unique Companies</u>	<u>Direct Employment</u>	<u>Average Compensation</u>	<u>Share of Total Employment</u>	<u>Total NIH Funding</u>	<u>Total NSF Funding</u>
Alameda County	937	663	38,034	\$134,736	3.7%	\$383,894,796	\$82,891,690
Contra Costa County	383	283	7,724	\$104,442	1.4%	\$11,400,377	\$2,698,179
Marin County	170	150	4,760	\$200,318	2.5%	\$23,309,291	\$0
Napa County	47	45	720	\$67,449	0.7%	\$0	\$0
San Francisco County	622	438	17,636	\$185,550	1.8%	\$1,067,574,147	\$24,656,970
San Mateo County	553	483	37,268	\$227,384	6.6%	\$127,470,364	\$12,013,360
Santa Clara County	1,026	773	62,972	\$187,906	4.4%	\$704,269,279	\$80,648,612
Solano County	98	93	4,329	\$213,520	2.3%	\$1,892,381	\$0
Sonoma County	193	136	5,514	\$125,363	1.9%	\$994,000	\$6,672,269

SOURCE: IMPLAN, CA EDD, NIH, NSF, FBEI



EXHIBIT 21

2020 County-Specific Annual Economic Impacts Bay Area

	<u>Total Jobs</u>	<u>Labor Income</u>	<u>Total Business Sales</u>	<u>Gross Regional Product</u>
Alameda County	77,332	\$8,331,581,167	\$23,771,529,217	\$14,084,157,967
Contra Costa County	14,331	\$1,269,435,388	\$3,788,853,017	\$2,152,217,082
Marin County	11,198	\$1,555,322,590	\$7,657,975,809	\$4,673,783,441
Napa County	1,137	\$73,304,247	\$229,324,677	\$111,327,639
San Francisco County	29,907	\$4,788,146,639	\$10,757,848,453	\$7,479,682,048
San Mateo County	64,631	\$11,461,699,417	\$40,561,996,244	\$27,644,991,605
Santa Clara County	109,902	\$16,563,851,738	\$40,077,113,987	\$26,787,650,086
Solano County	8,645	\$1,153,319,934	\$7,227,084,575	\$4,578,767,569
Sonoma County	11,874	\$1,082,984,061	\$3,397,039,526	\$1,828,455,777

SOURCE: IMPLAN, FBEI

EXHIBIT 22

2020 County-Specific Educational Attainment

	<u>Alameda County</u>	<u>Contra Costa County</u>	<u>Marin County</u>	<u>Napa County</u>	<u>San Francisco County</u>	<u>San Mateo County</u>	<u>Santa Clara County</u>	<u>Solano County</u>	<u>Sonoma County</u>
Less than 9th grade	5%	5%	5%	8%	7%	6%	7%	6%	5%
9th to 12th grade, no diploma	5%	6%	3%	7%	5%	4%	5%	5%	5%
High school graduate (includes equivalency)	17%	18%	11%	18%	12%	15%	14%	24%	19%
Some college, no degree	16%	20%	16%	23%	12%	15%	15%	27%	24%
Associate's degree	6%	8%	6%	8%	5%	7%	7%	10%	10%
Bachelor's degree	29%	26%	36%	22%	35%	29%	28%	19%	23%
Graduate or professional degree	21%	17%	23%	14%	24%	24%	26%	10%	14%

SOURCE: U.S. CENSUS, FBEI

The Peninsula

The Bay Area Peninsula consists of San Mateo and Santa Clara counties. Approximately 100,000 people in the Peninsula were directly employed by Life Science companies in 2020, the most of any other part of the Bay Area. Average annual earnings exceeded \$202,000. Research and Manufacturing represented over 43% of Life Science direct employment, with Medical Devices and Equipment following at 19% of direct employment. Biotechnology represented 18% and



Biopharmaceuticals represented 14% of Life Science direct employment, with Scientific Research/Tools making up 6% and Food and Agriculture making up less than 0.1%.

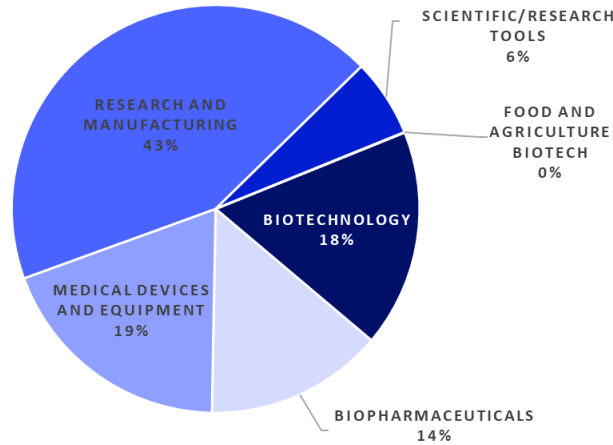
EXHIBIT 23

**2020 Key Metrics
The Peninsula**

Establishments	1,579
Unique Companies	1,255
Direct Employment	100,239
Average Compensation	\$202,584
Share of Total Employment	5.1%
Total NIH Funding	\$831,739,643
Total NSF Funding	\$92,661,972
Government Contract Funding	\$39,309,633,718

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBI

RESEARCH AND MANUFACTURING REPRESENTS LARGEST SHARE OF PENINSULA EMPLOYMENT SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Science in the Peninsula generated \$56.9 billion in GRP and \$84.3 billion in total business sales in 2020. Additionally, including all multipliers, Life Science was responsible for nearly 188,000 jobs with total earnings of \$29.5 billion.



EXHIBIT 25

**2020 Annual Economic Impact
The Peninsula**

	Impact
Total Jobs	187,869
Labor Income	\$29.5 billion
Total Business Sales	\$84.3 billion
Gross Regional Product	\$56.9 billion

SOURCE: IMPLAN, FBEI

The East Bay

The East Bay includes Alameda and Contra Costa counties. Over 45,000 people in the East Bay were directly employed by Life Science companies in 2020. Average annual earnings totaled close to \$130,000. Research and Manufacturing represented 42% of Life Science direct employment, with Medical Devices and Equipment following at over 23% of direct employment. Biotechnology represented 18% and Biopharmaceuticals represented 9% of Life Science direct employment, with Scientific Research/Tools making up 8% and Food and Agriculture making up around 0.1%.

EXHIBIT 26

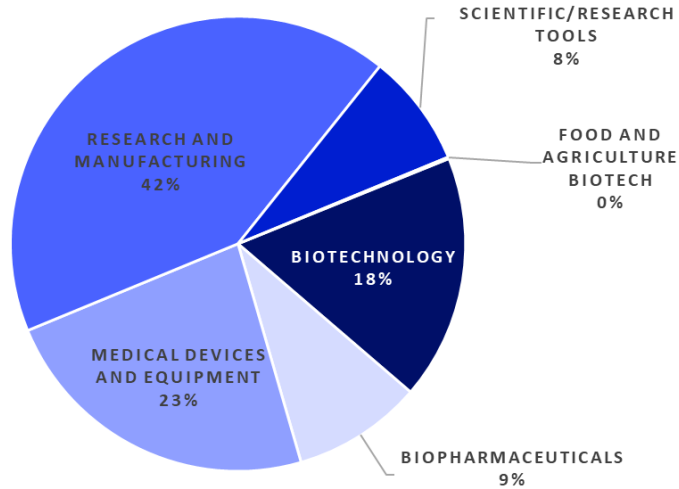
**2020 Key Metrics
The East Bay**

Establishments	1,319
Unique Companies	946
Direct Employment	45,758
Average Compensation	\$129,617
Share of Total Employment	2.9%
Total NIH Funding	\$395,295,173
Total NSF Funding	\$85,589,869
Government Contract Funding	\$75,458,703,587

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBEI



RESEARCH AND MANUFACTURING REPRESENTS LARGEST SHARE OF EAST BAY EMPLOYMENT
SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Science in the East Bay generated \$17 billion in GRP and \$28.9 billion in total business sales in 2020. Additionally, including all multipliers, Life Science was responsible for almost 98,000 jobs with total earnings of \$9.9 billion.

EXHIBIT 28

**2020 Annual Economic Impact
The East Bay**

	Impact
Total Jobs	97,964
Labor Income	\$9.9 billion
Total Business Sales	\$28.9 billion
Gross Regional Product	\$17.0 billion

SOURCE: IMPLAN, FBFI

City and County of San Francisco

Over 17,000 people in San Francisco were directly employed by Life Sciences companies in 2020. Average annual earnings exceeded \$185,000. Research and Manufacturing represented 55% of Life Sciences direct employment, with Biotechnology following at about 19% of direct employment. Medical Devices and Equipment represented 14% and Biopharmaceuticals represented 9% of Life



Sciences direct employment, with Scientific Research/Tools making up 3% and Food and Agriculture making up around 0.2%.

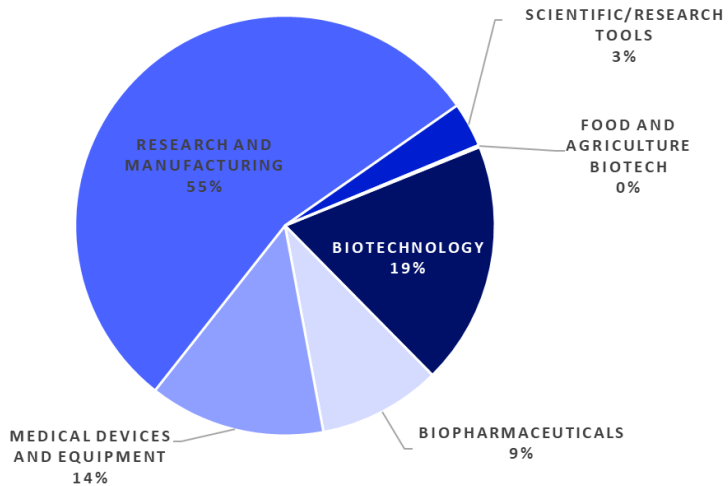
EXHIBIT 29

2020 Key Metrics
City and County of San Francisco

Establishments	622
Unique Companies	438
Direct Employment	17,636
Average Compensation	\$185,550
Share of Total Employment	1.8%
Total NIH Funding	\$1,067,574,147
Total NSF Funding	\$24,656,970
Government Contract Funding	\$4,307,500,286

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBI

RESEARCH AND MANUFACTURING REPRESENTS LARGEST SHARE OF SAN FRANCISCO EMPLOYMENT SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Science in San Francisco generated \$7.5 billion in GRP and \$10.8 billion in total business sales in 2020. Additionally, including all multipliers, Life Science was responsible for almost 30,000 jobs with total earnings of \$4.8 billion.



EXHIBIT 31

**2020 Annual Economic Impact
City and County of San Francisco**

	Impact
Total Jobs	29,907
Labor Income	\$4.8 billion
Total Business Sales	\$10.8 billion
Gross Regional Product	\$7.5 billion

SOURCE: IMPLAN, FBEI

Marin County

Almost 5,000 people in Marin County were directly employed by Life Science companies in 2020. Average annual earnings exceeded \$200,000. Biopharmaceuticals represented 64% of Life Sciences direct employment, with Research and Manufacturing following at 23% of direct employment. Biotechnology represented 8% and Medical Devices and Equipment represented 3% of Life Science direct employment, with Scientific Research/Tools making up 2% and Food and Agriculture making up less than 0.1%.

EXHIBIT 32

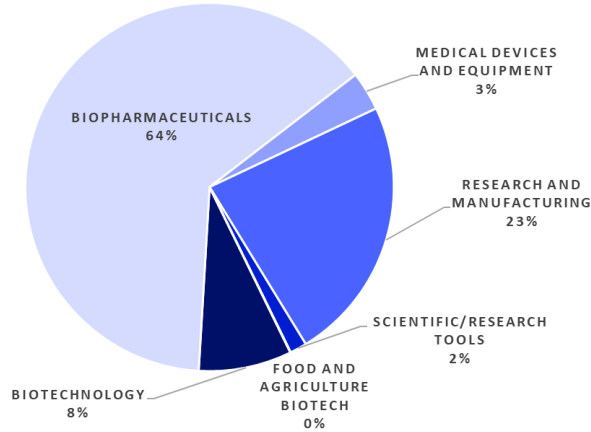
**2020 Key Metrics
Marin County**

Establishments	170
Unique Companies	150
Direct Employment	4,760
Average Compensation	\$200,318
Share of Total Employment	2.5%
Total NIH Funding	\$23,309,291
Total NSF Funding	\$0
Government Contract Funding	\$62,033,648

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBEI



BIOPHARMACEUTICALS REPRESENTS LARGEST SHARE OF MARIN COUNTY EMPLOYMENT
SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Science in Marin County generated \$4.7 billion in GRP and \$7.7 billion in total business sales in 2020. Additionally, including all multipliers, Life Sciences was responsible for over 11,000 jobs with total earnings of \$1.6 billion.

EXHIBIT 34

**2020 Annual Economic Impact
Marin County**

	Impact
Total Jobs	11,198
Labor Income	\$1.6 billion
Total Business Sales	\$7.7 billion
Gross Regional Product	\$4.7 billion

SOURCE: IMPLAN, FBI

Southern California

Southern California consists of nine counties: Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura counties. Over 270,000 people in Southern California were directly employed by Life Sciences companies in 2020. Average annual earnings approached \$111,000. Research and Manufacturing represented almost 41% of Life Sciences direct employment, with Medical Devices and Equipment following at about 24% of direct employment. Biopharmaceuticals represented 17% and Biotechnology represented 13% of Life Sciences direct employment, with Scientific Research/Tools making up 5% and Food and Agriculture making up about 0.1%.



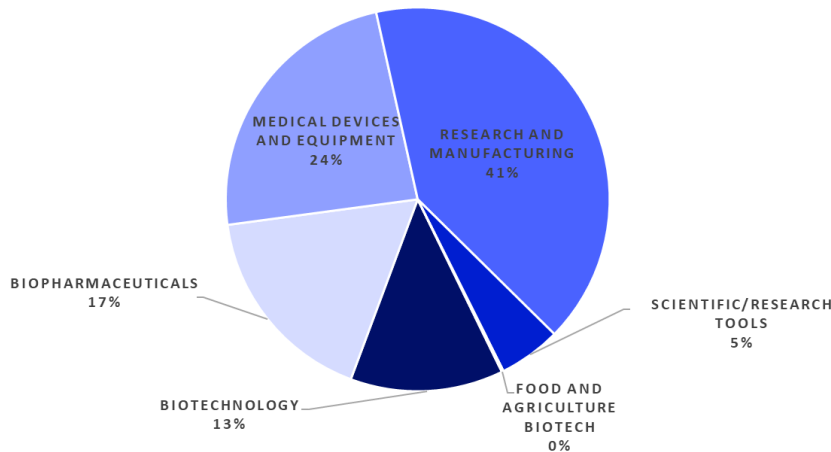
EXHIBIT 35

**2020 Key Metrics
Southern California**

Establishments	9,335
Unique Companies	6,341
Direct Employment	270,799
Average Compensation	\$110,926
Share of Total Employment	2.0%
Total NIH Funding	\$3,448,059,801
Total NSF Funding	\$390,325,888
Government Contract Funding	\$126,760,233,991

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBI

RESEARCH AND MANUFACTURING REPRESENTS LARGEST SHARE OF SOUTHERN CALIFORNIA EMPLOYMENT
SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Sciences in Southern California generated \$112 billion in GRP and \$200 billion in total business sales in 2020. Additionally, including all multipliers, Life Sciences was responsible for almost 768,000 jobs with total earnings of \$63.7 billion.



EXHIBIT 37

**2020 Annual Economic Impact
Southern California**

	Impact
Total Jobs	767,837
Labor Income	\$63.7 billion
Total Business Sales	\$200 billion
Gross Regional Product	\$112 billion

SOURCE: IMPLAN, FBEI

EXHIBIT 38

**2020 County-Specific Key Metrics
Southern California**

	<u>Establishments</u>	<u>Unique Companies</u>	<u>Direct Employment</u>	<u>Average Compensation</u>	<u>Share of Total Employment</u>	<u>Total NIH Funding</u>	<u>Total NSF Funding</u>
Imperial County	38	20	392	\$61,939	0.5%	\$0	\$0
Los Angeles County	3,876	2,433	96,844	\$97,847	1.6%	\$1,938,196,365	\$151,947,527
Orange County	2,066	1,465	65,262	\$122,010	3.0%	\$221,670,090	\$56,328,412
Riverside County	527	393	10,260	\$83,619	1.0%	\$45,257,785	\$26,117,362
San Bernardino County	510	379	8,959	\$77,974	0.9%	\$12,982,272	\$951,148
San Diego County	1,695	1,295	72,403	\$126,833	3.5%	\$1,196,283,123	\$109,935,911
San Luis Obispo County	196	131	1,893	\$60,907	1.2%	\$1,512,614	\$3,467,075
Santa Barbara County	111	58	6,679	\$99,756	2.4%	\$29,675,857	\$40,728,647
Ventura County	316	166	8,107	\$130,135	1.8%	\$2,481,695	\$849,806

SOURCE: IMPLAN, CA EDD, NIH, NSF, FBEI



EXHIBIT 39

2020 County-Specific Annual Economic Impacts Southern California

	<u>Total Jobs</u>	<u>Labor Income</u>	<u>Total Business Sales</u>	<u>Gross Regional Product</u>
Imperial County	586	\$33,157,674	\$111,119,562	\$51,315,510
Los Angeles County	231,904	\$19,005,420,404	\$60,760,088,164	\$33,386,742,378
Orange County	162,206	\$15,014,929,691	\$46,468,962,952	\$26,599,256,308
Riverside County	22,035	\$1,407,058,398	\$5,115,939,173	\$2,544,751,154
San Bernardino County	16,355	\$1,067,407,886	\$4,362,286,948	\$2,094,893,938
San Diego County	177,884	\$16,005,182,332	\$47,833,871,820	\$27,702,477,275
San Luis Obispo County	3,403	\$191,729,593	\$741,584,759	\$320,495,970
Santa Barbara County	13,916	\$1,151,727,728	\$3,650,623,846	\$1,871,119,853
Ventura County	20,983	\$1,908,023,560	\$6,485,508,123	\$3,801,377,727

SOURCE: IMPLAN, FBI

EXHIBIT 40

2020 County-Specific Educational Attainment Southern California

	<u>Imperial County</u>	<u>Los Angeles</u>	<u>Orange County</u>	<u>Riverside County</u>	<u>San Bernardino</u>	<u>San Diego County</u>	<u>San Luis Obispo</u>	<u>Santa Barbara</u>	<u>Ventura County</u>
Less than 9th grade	12%	12%	7%	9%	8%	6%	3%	13%	8%
9th to 12th grade, no diploma	16%	8%	7%	8%	11%	6%	6%	6%	5%
High school graduate (includes equivalency)	23%	21%	18%	26%	26%	18%	19%	18%	21%
Some college, no degree	24%	19%	20%	25%	24%	22%	25%	21%	22%
Associate's degree	6%	7%	8%	8%	8%	8%	9%	8%	9%
Bachelor's degree	14%	22%	26%	15%	15%	25%	23%	21%	22%
Graduate or professional degree	5%	12%	15%	9%	8%	15%	14%	14%	13%

SOURCE: U.S. CENSUS, FBI

Ventura County

Over 8,100 people in Ventura were directly employed by Life Sciences companies in 2020. Average annual earnings exceeded \$130,000. Research and Manufacturing represented 36% of Life Sciences direct employment, with Biopharmaceuticals following at about 33% of direct employment. Medical Devices and Equipment represented 16% and Biotechnology represented 12% of Life Sciences direct employment, with Scientific Research/Tools making up 3% and Food and Agriculture making up about 0.1%.



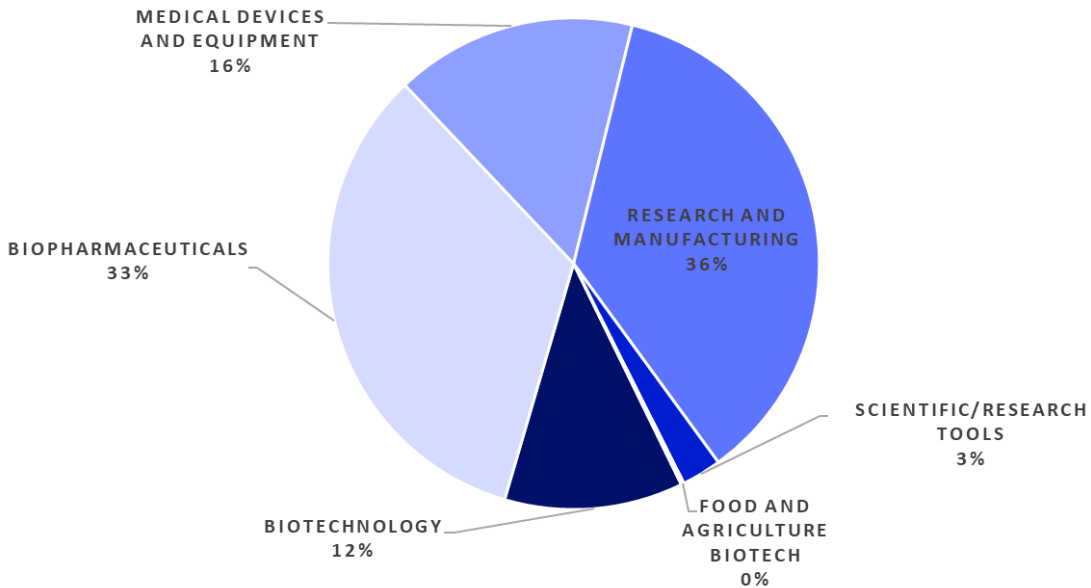
EXHIBIT 41

2020 Key Metrics
Ventura County

Establishments	316
Unique Companies	166
Direct Employment	8,107
Average Compensation	\$130,135
Share of Total Employment	1.8%
NIH Funding	\$2,481,695
NSF Funding	\$849,806
Government Contract Funding	\$48,415,058

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBI

RESEARCH AND MANUFACTURING REPRESENTS LARGEST SHARE OF VENTURA EMPLOYMENT
SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Sciences in Ventura County generated \$3.8 billion in GRP and \$6.5 billion in total business sales in 2020. Additionally, including all multipliers, Life Sciences was responsible for over 20,000 jobs with total earnings of \$1.9 billion.



EXHIBIT 43

**2020 Annual Economic Impact
Ventura County**

	Impact
Total Jobs	20,983
Labor Income	\$1.9 billion
Total Business Sales	\$6.5 billion
Gross Regional Product	\$3.8 billion

SOURCE: IMPLAN, FBFI

Los Angeles County

Almost 97,000 people in Los Angeles County were directly employed by Life Sciences companies in 2020, representing 36% of Southern California’s direct Life Science employment. Average annual earnings approached \$98,000. Research and Manufacturing represented 48% of Life Sciences direct employment, with Biopharmaceuticals following at about 19% of direct employment. Medical Devices and Equipment represented almost 17% and Biotechnology represented 13% of Life Sciences direct employment, with Scientific Research/Tools making up around 3% and Food and Agriculture making up about 0.2%.

EXHIBIT 44

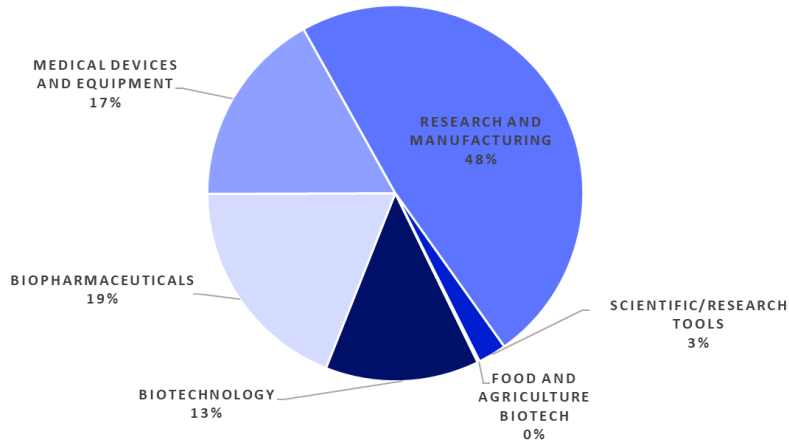
**2020 Key Metrics
Los Angeles County**

Establishments	3,876
Unique Companies	2,433
Direct Employment	96,844
Average Compensation	\$97,847
Share of Total Employment	1.6%
Total NIH Funding	\$1,938,196,365
Total NSF Funding	\$151,947,527
Government Contract Funding	\$116,313,617,158

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBFI



RESEARCH AND MANUFACTURING REPRESENTS LARGEST SHARE OF LOS ANGELES COUNTY EMPLOYMENT
SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Sciences in Los Angeles County generated \$33.4 billion in GRP and \$60.8 billion in total business sales in 2020. Additionally, including all multipliers, Life Sciences was responsible for almost 232,000 jobs with total earnings of \$19 billion.

EXHIBIT 46

**2020 Annual Economic Impact
Los Angeles County**

	Impact
Total Jobs	231,904
Labor Income	\$19.0 billion
Total Business Sales	\$60.8 billion
Gross Regional Product	\$33.4 billion

SOURCE: IMPLAN, FBFI

City of Los Angeles

Nearly 47,000 people in the City of Los Angeles were directly employed by Life Sciences companies in 2020. Average annual earnings approached \$97,000. Research and Manufacturing represented 52% of Life Sciences direct employment, with Biopharmaceuticals following at about 20% of direct employment. Biotechnology represented 14% and Medical Devices and Equipment represented 13% of Life Sciences direct employment, with Scientific Research/Tools making up less than 1% and Food and Agriculture making up about 0.1%.



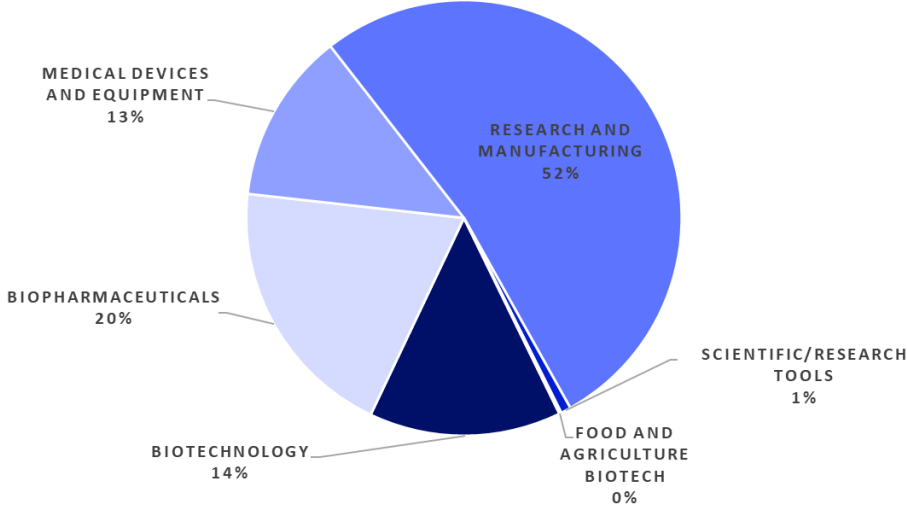
EXHIBIT 47

2020 Key Metrics
City of Los Angeles

Establishments	658
Unique Companies	507
Direct Employment	46,779
Average Compensation	\$96,642
Share of Total Employment	1.3%
Total NIH Funding	\$1,270,885,094
Total NSF Funding	\$91,009,971
Government Contract Funding	\$2,441,498,976

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBI

RESEARCH AND MANUFACTURING REPRESENTS LARGEST SHARE OF CITY OF LOS ANGELES EMPLOYMENT
SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Sciences in the City of Los Angeles generated \$9.3 billion in GRP and \$17.9 billion in total business sales in 2020. Additionally, including all multipliers, Life Sciences was responsible for almost 53,000 jobs with total earnings of \$5 billion.



EXHIBIT 49

**2020 Annual Economic Impact
City of Los Angeles**

	Impact
Total Jobs	52,964
Labor Income	\$5.0 billion
Total Business Sales	\$17.9 billion
Gross Regional Product	\$9.3 billion

SOURCE: IMPLAN, FBEI

Orange County

Over 65,000 people in Orange County were directly employed by Life Sciences companies in 2020. Average annual earnings exceeded \$122,000. Medical Devices and Equipment represented 40% of Life Sciences direct employment, with Research and Manufacturing following at about 26% of direct employment. Biopharmaceuticals represented 17% and Scientific Research/Tools represented almost 10% of Life Sciences direct employment, with Biotechnology making up 7% and Food and Agriculture making up about 0.1%.

EXHIBIT 50

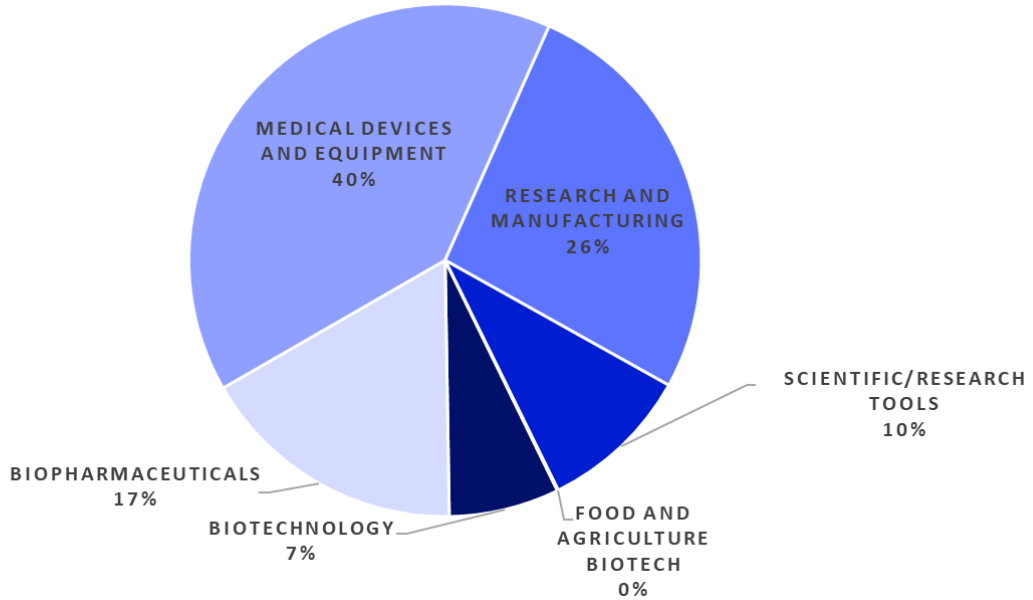
**2020 Key Metrics
Orange County**

Establishments	2,066
Unique Companies	1,465
Direct Employment	65,262
Average Compensation	\$122,010
Share of Total Employment	3.1%
Total NIH Funding	\$221,670,090
Total NSF Funding	\$56,328,412
Government Contract Funding	\$1,571,156,679

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBEI



MEDICAL DEVICES AND EQUIPMENT REPRESENTS LARGEST SHARE OF ORANGE COUNTY EMPLOYMENT
SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Sciences in Orange County generated \$26.6 billion in GRP and \$46.5 billion in total business sales in 2020. Additionally, including all multipliers, Life Sciences was responsible for over 162,000 jobs with total earnings of \$15 billion.

EXHIBIT 52

**2020 Annual Economic Impact
Orange County**

	Impact
Total Jobs	162,206
Labor Income	\$15.0 billion
Total Business Sales	\$46.5 billion
Gross Regional Product	\$26.6 billion

SOURCE: IMPLAN, FBFI

San Diego County



Over 72,000 people in San Diego County were directly employed by Life Sciences companies in 2020. Average annual earnings equaled nearly \$127,000. Research and Manufacturing represented 45% of Life Sciences direct employment, with Biotechnology following at about 18% of direct employment. Medical Devices and Equipment represented 17% and Biopharmaceuticals represented almost 14% of Life Sciences direct employment, with Scientific Research/Tools making up 6% and Food and Agriculture making up about 0.1%.

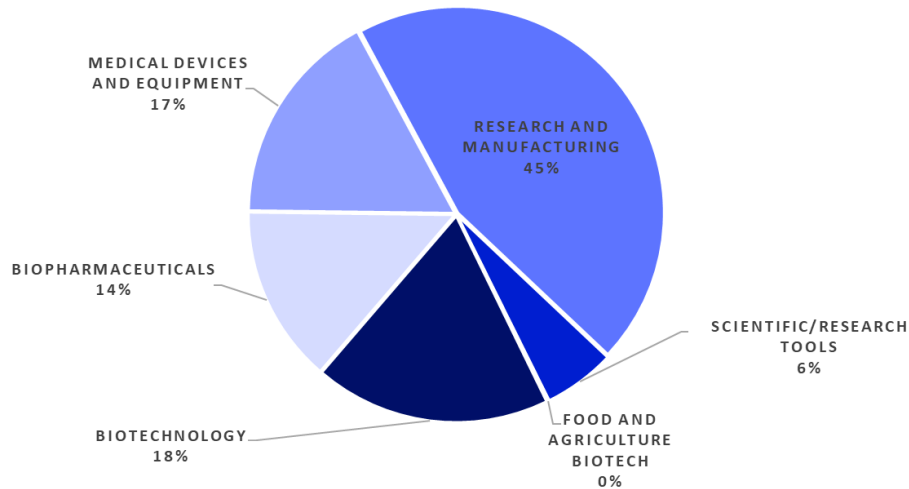
EXHIBIT 53

**2020 Key Metrics
San Diego County**

Establishments	1,695
Unique Companies	1,295
Direct Employment	72,403
Average Compensation	\$126,833
Share of Total Employment	3.5%
Total NIH Funding	\$1,196,283,123
Total NSF Funding	\$109,935,911
Government Contract Funding	\$7,331,389,045

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBI

RESEARCH AND MANUFACTURING REPRESENTS LARGEST SHARE OF SAN DIEGO COUNTY EMPLOYMENT
SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Sciences in San Diego County generated \$27.7 billion in GRP and \$47.8 billion in total business sales in 2020. Additionally, including all multipliers, Life Sciences was responsible for almost 178,000 jobs with total earnings of \$16 billion.



EXHIBIT 55

**2020 Annual Economic Impact
San Diego County**

	Impact
Total Jobs	177,884
Labor Income	\$16.0 billion
Total Business Sales	\$47.8 billion
Gross Regional Product	\$27.7 billion

SOURCE: IMPLAN, FBEI

City of San Diego

Over 52,000 people in the City of San Diego were directly employed by Life Sciences companies in 2020. Average annual earnings exceeded \$121,000. Research and Manufacturing represented 54% of Life Sciences direct employment, with Biotechnology following at about 23% of direct employment. Medical Devices and Equipment represented about 11% and Biopharmaceuticals represented almost 10% of Life Sciences direct employment, with Scientific Research/Tools making up 2% and Food and Agriculture making up about 0.1%.

EXHIBIT 56

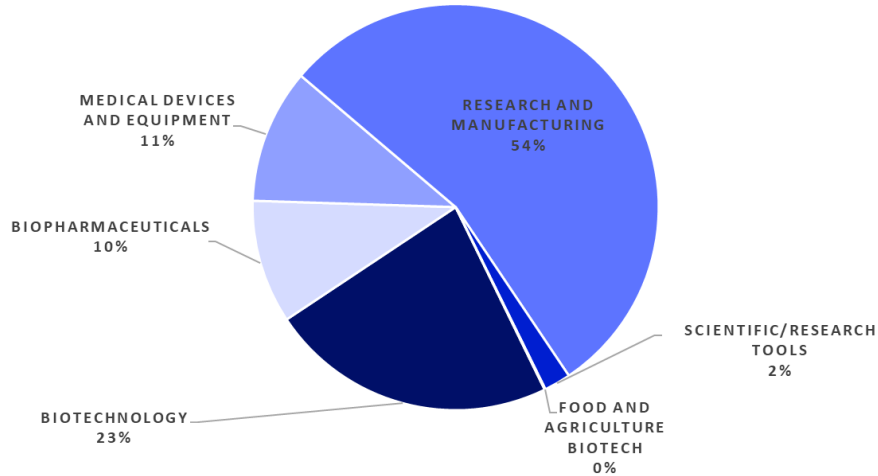
**2020 Key Metrics
City of San Diego**

Establishments	846
Unique Companies	705
Direct Employment	52,257
Average Compensation	\$121,521
Share of Total Employment	4.6%
Total NIH Funding	\$120,573,065
Total NSF Funding	\$16,911,999
Government Contract Funding	\$6,566,306,523

SOURCE: IMPLAN, CA EDD, NIH, NSF, USA Spending, FBEI



RESEARCH AND MANUFACTURING REPRESENTS LARGEST SHARE OF CITY OF SAN DIEGO EMPLOYMENT
SHARE OF LIFE SCIENCES EMPLOYMENT, 2020



Considering all ripple and multiplier effects, Life Sciences in the City of San Diego generated \$13 billion in GRP and \$22.2 billion in total business sales in 2020. Additionally, including all multipliers, Life Sciences was responsible for almost 78,000 jobs with total earnings of \$8.3 billion.

EXHIBIT 58

**2020 Annual Economic Impact
City of San Diego**

	Impact
Total Jobs	77,824
Labor Income	\$8.3 billion
Total Business Sales	\$22.2 billion
Gross Regional Product	\$13.0 billion

SOURCE: IMPLAN, FBEI



OUTLOOK

The outlook for Life Sciences in 2021 involves mostly positive forces, but several negatives and risks merit close attention.

Positives

- Strong recovery and GDP growth: The sizable number of vaccinated Americans will enable a continuing reopening of the U.S. economy, although the Delta variant has blunted some gains. The unleashing of pent-up demand, powerful fiscal stimulus, and accommodative monetary policy will power a strong general economic rebound.
- Low interest rates: The Federal Reserve has indicated that it will maintain its key policy target anchored close to zero for some time. It is dedicated to achieving full employment and has indicated that it believes any uptick in inflation is likely to be transitory.
- Rising stock values: Rising corporate profits combined with a monetary policy focused on holding interest rates down are likely to push stock prices higher again in 2021, although short periods of sell-offs could occur.
- Federal research funding: The Biden Administration's focus on increasing U.S. competitiveness and basic research will lead to higher levels of grant funding by the NIH and NSF. Despite some concern about budget deficits, Congress has endorsed larger support for research and development to invest in U.S. health and sustainability and to make the nation more competitive internationally.
- Focus on viral detection, immunization, and treatment: As COVID-19 and its mutations continue to present risks, additional research and products will be in demand. mRNA and other technologies could be developed for other applications as Life Sciences has demonstrated its critical role in saving lives throughout the world.
- Environmental goals: Consumer interest in plant-based foods and cellular grown meat and seafood continues to expand. Life Sciences also offers opportunities to develop more sustainable materials and solutions in areas such as agriculture and manufacturing.
- Real estate developers: New projects are already under way in California with more expected as real estate developers see Life Sciences as an opportunity for growth. Existing office and retail space could also be converted to accommodate the sector's expansion.

Constraints and Risks

- Supply chain disruptions: Critical materials for the Life Science sector could face imbalances between demand and supply, leading to price spikes and production problems.
- Restrictions on foreign employees and students: COVID-19 border constraints and concerns about new variants could limit the number of foreign employee visas. As immigration policy is addressed, visa limits will also be in question. Foreign student enrollments could also be affected by virus concerns and changes in college admission objectives.



--Regulatory and legislative issues: The Life Sciences sector faces several regulatory challenges and possible tax changes in the year ahead.

- Patent uncertainty: The recommendation of a temporary waiver of patents or intellectual property protection for COVID-19 vaccines could dampen confidence in long-term investments for the sector.
- Price controls: Further efforts to limit prices for various pharmaceutical products could impair profits and growth.
- Merger constraints: Opposition to mergers or acquisitions on antitrust or national security grounds could prevent expansion and economies of scale.
- Tax rates: Higher tax rates could discourage investment by adversely affecting future profit expectations.

--Housing: Further sizable increases in California housing prices will make expansion difficult for current firms operating in the State and weigh on new firms considering locating and recruiting talent in/to California, unless regions commit to significant new housing construction. For the Life Sciences sector, the lack of affordable middle-income housing presents a particular problem.

--Transportation: Efficiently-run port operations, ground shipping, and airline facilities are vital for industry's supply chain. Employees, not working remotely, seek reduced commute times.

--Education: Long-term industry viability relies on an educated workforce and continued investments in STEM education for K-12, community colleges, state universities and the UC systems is imperative.

Conclusion: Despite policy and regulatory uncertainties along with other constraints, 2021 promises to be a strong year for the Life Science sector in California. The general economy, financial markets, and federal funding will all help drive the sector forward. The nation and the world will also increasingly look to the Life Science nucleus in California to provide the solutions for some of its most pressing issues involving the environment, medicine, and health care.



APPENDIX A

Comparison with Past Economic Impact Reports

The Biocom California 2021 Economic Impact Report was completed by the Fermanian Business & Economic Institute at Point Loma Nazarene University. In past years, the databook was completed by Clower & Associates. Some numbers may not be comparable to past reports due to the following factors:

1. The industry definitions differ from those of previous studies and new NAICS codes have been used in order to accurately reflect the Life Sciences industry as it continues to evolve.
2. The FBEI uses a different econometric modeling software, Implan. This is a widely accepted modeling software. While numbers should be somewhat comparable, the software change may present some discrepancies with past reports.

The Biocom California 2021 Economic Impact Report was altered from previous reports to include additional metrics and analysis of the drivers of the Life Science industry in California.

APPENDIX B

Industry Sub-sectors and NAICS Codes

1. Biotechnology
 - 325220 Cellulosic Fiber Manufacturing
 - 541713 Research and Development in Nanotechnology
 - 541714 Research and Development in Biotechnology (65%)
2. Biopharmaceuticals
 - 325411 Medicinal and Botanical Manufacturing
 - 325412 Pharmaceutical Preparation Manufacturing
 - 325413 In-Vitro Diagnostic Substance Manufacturing
 - 325414 Biological Product (except Diagnostic) Manufacturing
 - 424210 Drugs and Druggists' Sundries Merchant Wholesalers
3. Medical Devices and Equipment
 - 327215 Glass Product Manufacturing Made of Purchased Glass (15%)
 - 333314 Optical Instrument and Lens Manufacturing (15%)
 - 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
 - 334510 Electromedical and Electrotherapeutic Apparatus Manufacturing (25%)
 - 423450 Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers
4. Research and Manufacturing
 - 541380 Testing Laboratories (12%)
 - 541714 Research and Development in Biotechnology (35%)
 - 541715 R & D in the Physical, Engineering, and Life Sciences (except Biotechnology, includes genomics) (46%)



- 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%)
- 5. Scientific/Research Tools
 - 325199 All Other Basic Organic Chemical Manufacturing
 - 334516 Analytical Laboratory Instrument Manufacturing
 - 334510 Electromedical and Electrotherapeutic Apparatus Manufacturing (75%)
 - 334513 Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables (20%)
- 6. Food and Agriculture Biotech
 - 325193 Ethyl Alcohol Manufacturing
 - 311999 All Other Miscellaneous Food Manufacturing (10%) (includes plant-based and cellular grown meats/seafoods)
 - 325311 Nitrogenous Fertilizer Manufacturing (15%)
 - 325312 Phosphatic Fertilizer Manufacturing (15%)
 - 325314 Fertilizer (Mixing Only) Manufacturing (15%)
 - 325320 Pesticide and Other Agricultural Chemical Manufacturing (15%)

APPENDIX C

Glossary of Terms

Average compensation:	Average annual salary and benefits
Direct employment:	Total number of people employed In Life Sciences enterprises
Total jobs:	Total number of jobs created after multiplier effects due to spending in supply chains and consumer spending by all employees
Labor income:	Wages, salaries, and earnings of business proprietors
Total business sales:	Total gross receipts of entities
GDP:	Gross national product
GRP:	Gross regional product (total value added)
DOD:	U.S. Department of Defense
FDA:	U.S. Food and Drug Administration
NIH:	U.S. National Institutes of Health
NSF:	U.S. National Science Foundation



APPENDIX D

Methodology

Data Collection

Data collection was performed using two distinct methods. For some sources that did not provide search by NAICS codes, keyword searches were used. The keywords used across all platforms were biorenewable, biofuel, biopharmaceutical, biotechnology, nano-technology, bio-agriculture, and bioagriculture. The following sources used keyword searches:

- National Institutes of Health
- National Science Foundation
- PriceWaterhouseCoopers Venture Capital Data
- US Patent and Trademark Office

NAICS Code searches were performed to collect data from the following sources:

- California EDD
- USASpending.gov

Data was collected from the U.S. Census Bureau American Community Surveys not specific to Life Sciences companies.

Implan

Implan, a widely used econometric forecasting tool, uses unique industry codes. A majority of these codes for the Life Sciences map directly to NAICS codes. For those that were not direct matches, an intensive analysis was completed to ensure accuracy of the Implan codes in relation to the Life Sciences industry. Implan models were run to generate the overall economic impacts (direct, indirect, and induced) for California and all 12 regions. These models were run using 2020 employment numbers by industry category.

Biocom California Index

The Index was developed based on key metrics of the performance of the Life Sciences sector in California over time and in consultation with Biocom California.

The Index components and weights encompass the following:

<u>Component</u>	<u>Weight</u>
NIH, number	0.02
NIH, \$ value	0.08
NSF, number	0.02
NSF, \$ value	0.08
Patents, number	0.20
Payroll jobs, no.	0.35
Establishments, no.	0.05



Venture Capital,
\$ 0.20

Annual data was collected from 2000 through 2020 and each series was indexed to its 2000 value, with the base set at 2000. The Biocom California Index was calculated as a weighted average of the sub-indices.

Econometric Model

The model developed to explain the behavior of Life Sciences used annual data spanning 2000 through 2021. Different economic, financial, and industry indicators were analyzed based on theoretical and empirical relationships. The final regression model was developed based on various statistical tests. Nonfarm payroll employment in California’s nonfarm sector was used as the dependent variable. Explanatory variables used included total NIH and NSF funding, real GDP, the Nasdaq Index, and the federal funds target. To make the series stationary and enable the coefficients to quantify elasticities, natural logs were used for all variables except for the federal funds rate. Model results were tested by analyzing the statistical significance of the coefficients and residual performance over time.

APPENDIX E

Regression Model for Life Sciences in California

Dependent Variable: LOG(BIOCOM)
Method: Least Squares
Date: 05/06/21 Time: 10:57
Sample: 2000 2020
Included observations: 21

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.684533	0.883106	4.172243	0.0007
LOG(NSFNIH)	0.070985	0.038151	1.860635	0.0813
LOG(RGDP)	0.692033	0.145805	4.746307	0.0002
FEDFUNDS	-0.006357	0.003636	-1.748376	0.0996
LOG(NASDAQ)	0.088774	0.024436	3.632958	0.0022
R-squared	0.977095	Mean dependent var	12.55189	
Adjusted R-squared	0.971369	S.D. dependent var	0.138986	
S.E. of regression	0.023517	Akaike info criterion	4.457902	
Sum squared resid	0.008849	Schwarz criterion	4.209207	
Log likelihood	51.80798	Hannan-Quinn criter.	4.403929	
F-statistic	170.6372	Durbin-Watson stat	1.314174	



Prob(F-statistic) 0.000000

LOG(BIOCOM): Log (Life Sciences Employment in California)

LOG(NSFNIH): Log(NSF and NIH funding)

LOG(RGDP): Log(U.S. real GDP)

FEDFUNDS: (federal funds target)

LOG(NASDAQ): Log(NASDAQ Composite Index)