CALIFORNIA
LIFE SCIENCES

Empowering our life sciences community to deliver innovative solutions for healthier lives.

Sector Report

2021

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Contents

Letter from the **Governor**

Gavin Newsom
Governor of California

California's life sciences ecosystem has set California apart from the rest of the nation with major scientific discoveries and therapies that have been born in the state. These scientific therapies have had a life-changing impact on patients around the world.

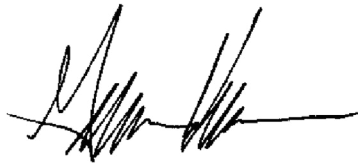
As we found ourselves facing a global pandemic, it was the life sciences sector that met the moment to develop rapid tests, vaccines, and anti-viral therapies to restore the world's public health. In fact, each major treatment to fight against COVID-19 came from a company with a major presence in California.

Not only have the life sciences delivered life-saving solutions to people in every corner of the world — they have continued to make tremendous investments in scientific research and development to enhance agriculture, foster the production of clean energy, and combat climate change.

The Golden State has long embodied the values of innovation and entrepreneurialism, driving change in the world we live in — the life sciences sector is no exception. Our leading university system and well-educated workforce has allowed our homegrown life sciences ecosystem to flourish, catalyzing both scientific discovery and economic prosperity throughout the state.

The 2021 California Life Sciences Sector Report highlights the cutting-edge solutions the life sciences ecosystem brings to patients around the globe and its relentless pursuit of scientific innovation to create a healthier world. We are proud of these contributions and foresee California's continued leadership in the life sciences.

Sincerely,



Gavin Newsom
Governor of California

Letter to **Stakeholders**

Mike Guerra
President & CEO,
California Life Sciences (CLS)

One of the most impactful moments I've witnessed working in the life sciences sector happened on the campus of Edwards Lifesciences last year.

Just months after having surgery, a patient met face to face with the team behind her heart valve replacement. She got to thank the people who built and inspected the very device now helping her heart function properly. They hugged, they clapped. For many of the Edwards team, it was the first time they were able to meet a patient whose life they changed.

It's not often we see these moments up close – the ones where it's so clear why we do what we do in the life sciences. This is what we do—deliver innovative solutions for healthier lives.

In the heart of a devastating pandemic, it was the researchers and scientists from our member companies that led the global response. A CLS member was the first to provide a COVID-19 therapeutic, while others raced to develop vaccines, testing capabilities, additional patient monitoring devices, and countless other contributions to our collective fight against this pandemic.

Again, it was one of those moments in our history where it became clear—California's life sciences sector profoundly impacts all of us. And as a globe, we depend on it.

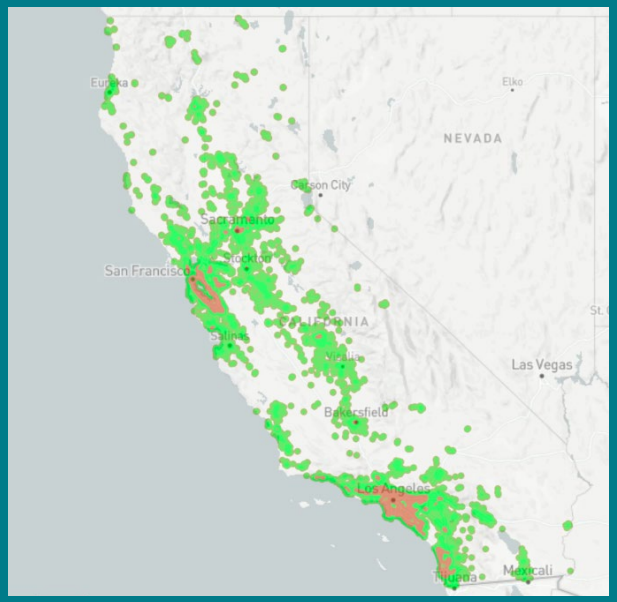
Life sciences companies and organizations don't just provide medical breakthroughs. They also develop tools to improve agriculture, increase clean energy production, mitigate climate change, and more. The world increasingly looks to California for solutions to global challenges and we could not be prouder of the work they do.

The desire to live healthier lives in a healthier world is something we all share. My hope is that through this sector report, you can see how much we rely on and benefit from California's life sciences industry.

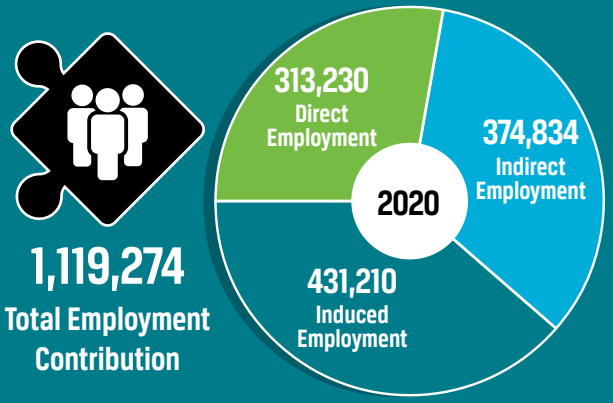
Sincerely,

Mike Guerra
President & CEO, California Life Sciences (CLS)

Heat Map of Life Sciences Concentration of Establishments by Number of Employees[1]



Total Direct, Indirect and Induced Employment in the California Life Sciences[2]



1,119,274
Total Employment Contribution

1 Source: KPMG's analysis of Q1 2021 Dun & Bradstreet Data
2 Source: KPMG's analysis using IMPLAN

California Life Sciences **Industry at a Glance**

The life sciences ecosystem played a vital role contributing to California's economy during the recent global pandemic demonstrating resilience while advancing innovation and human health.

- In 2019, California had the largest Life Sciences research and development (R&D) expenditures of any state, accounting for **13.9% of total life sciences R&D in the U.S.**
- **The number of life sciences establishments in the state increased by 3% from 2019**[3], primarily driven by gains in the Research, Testing, and Medical Laboratories subsector.
- **In both 2020 and 2021, California universities and research institutions received almost $5.0 billion from NIH, an increase over the $4.6 billion in 2019.** This is critical to the life sciences industry, as NIH is the largest public funder of biomedical research in the world, contributing substantially to the biomedical knowledge base and economic growth when that foundational research is commercialized by the private sector through investments and partnerships.
- California's life sciences sector contributed significantly to COVID-19 vaccine research and development. As of January 2022, out of all 79 COVID-19 vaccine developments in the United States, **more than a quarter have been sponsored by or primarily supported by organizations in California** and over half of them (i.e., 43) have clinical trials taking place in California.
- The amount of funding received from National Institutes of Health (NIH) increased to $5.0 billion in FY 2021. **In addition, the amount of funding received from the National Science Foundation (NSF) increased by 13% to $108.5 million in 2021 from the previous year.**
- **Biomedical exports decreased slightly from $26.4 billion in 2020 to $25.8 billion in 2021.** This slight decrease may be in part due to the impact of the COVID-19 pandemic, as worldwide quarantines, stay at home orders, and closed travel borders weighted on trade nationwide.
- The industry and its supply chain together contributed **$411 billion in economic output and an estimated $42 billion in total tax revenues to the state economy in 2019** while directly or indirectly supporting more than one million jobs across the state.

The last year saw widespread innovation across various subsectors of life sciences, making it a top focus for many investors. Initial public offerings (IPO) and mergers and acquisition (M&A) activity in California's life sciences sector continued to lead the nation in terms of numbers of deals and transaction volume, due in large part to activities in the Biotechnology and Health Care Equipment and Services markets.

Venture capital investment in the healthcare industry in California increased by more than 50 percent from $7.9 billion in 2019 to $12.5 billion in 2020.[2]

3 Based on KPMG's analysis of 2020 Quarterly Census of Employment and Wages ("QCEW") data from Bureau of Labor Statistics ("BLS").

Economic Contributions of the California Life Sciences Sector 2020 (estimated)[4]

Overview[5]

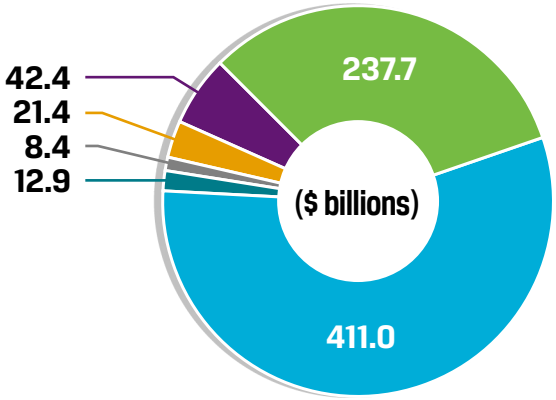
313,230
Total Estimated Life Sciences Employment

49.7
Total Estimated Wages Paid to Life Sciences Employees ($ billions)

158,555
Average Life Sciences Sector Salary ($)

12,914
Number of Life Sciences Establishments

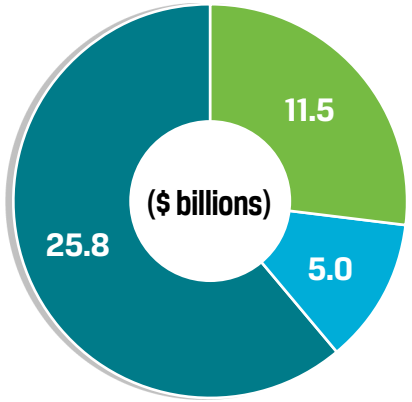
Economic & Fiscal Contributions[6]



1,119,274
Total Employment Contribution

- Total Estimated Direct Economic Output
- Total Estimated Economic Output, including Indirect and Induced
- Estimated Direct Federal Taxes
- Estimated Direct State and Local Taxes
- Total Estimated Direct Tax Contribution
- Total Estimated Tax Contribution, including Indirect and Induced

Investments and Exports[7]



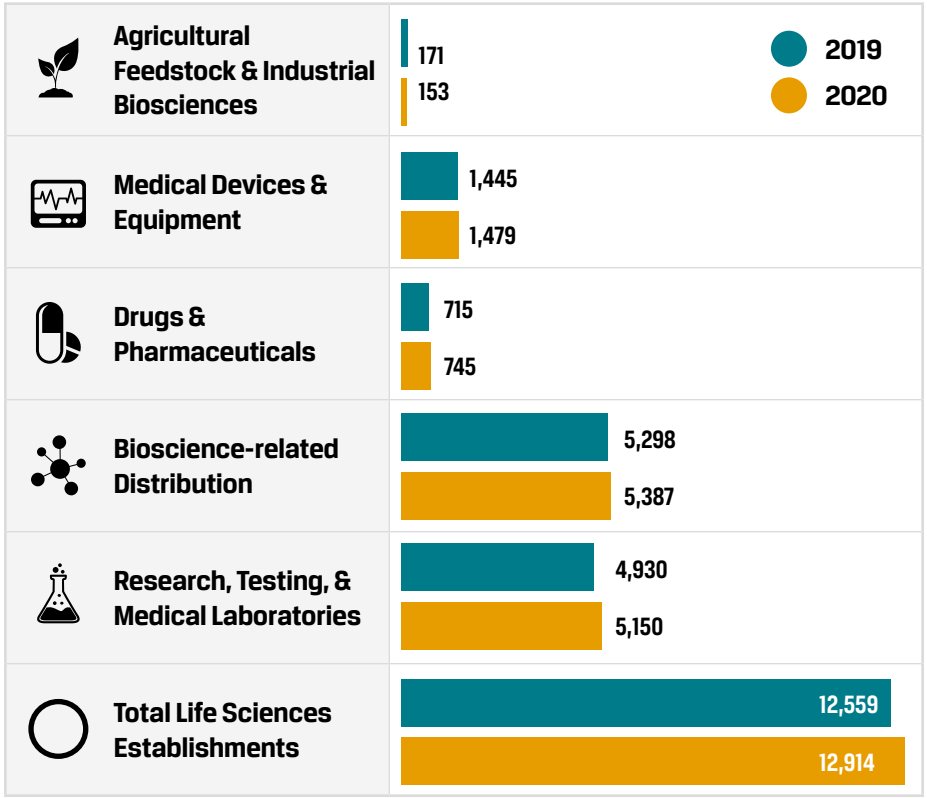
1,001
Total Biodiesel Production (thousand barrels)

4,632
Total Ethanol Production (thousand barrels)

- Total Healthcare Venture Capital Investments, 2020
- Total NIH Grants Awarded, FY 2021
- Total Biomedical Exports

4 Financial contribution estimates reported in 2021 USD equivalent values.
5 Source: KPMG's analysis of BLS QCEW Data.
6 KPMG's analysis using Economic Impact Analysis for Planning ("IMPLAN"). All economic contributions presented are in 2021 dollars.
7 Sources: (1) PwC/CB Insights Money Tree Quarterly Reports; (4) National Institute of Health ("NIH"); (5) US Census Bureau USA Trade® Online.

Total Establishments by Life Sciences sector in California: 2019 vs. 2020[8]



Growth in Agricultural Feedstock & Industrial Biosciences, Drugs & Pharmaceuticals, and Medical Devices & Equipment Employees by State 2015 – 2020[9]

Rank	State	2015	2020	Percent Growth
1	California	110,332	124,356	12.7%
2	Illinois	39,388	39,895	1.3%
3	Indiana	37,501	38,955	3.9%
4	Pennsylvania	34,113	37,445	9.8%
5	Minnesota	31,804	36,737	15.5%
6	New Jersey	32,762	35,728	9.1%
7	New York	32,102	35,154	9.5%
8	North Carolina	31,058	32,163	3.6%
9	Massachusetts	31,972	31,578	-1.2%
10	Texas	26,512	31,374	18.3%

8 Source: KPMG's analysis of BLS QCEW Data.
9 Source: KPMG's analysis of BLS QCEW Data.

Economic **Powerhouse**

Employment, Establishments & Wages[10]

The life sciences sector historically has been a strong contributor to California's economy. In 2020, the life sciences sector directly employed 313,230 Californians and was responsible for paying $158,555 in average wages and salary during the year, which is above the average for all industries considered together for the state.

Thanks to the great diversity of activities impacted by biological science and the rapidly growing application of biotechnology and medical technology, the term "life sciences" as used in this report encompasses a variety of industries and can be split into the following broad subsectors: Research, Testing, & Medical Laboratories, Drugs & Pharmaceuticals, Medical Devices & Equipment, Bioscience-related Distribution, and Agricultural Feedstock & Industrial Biosciences.[11] Among these subsectors, Research, Testing, & Medical Laboratories was the top contributor to the life sciences sector in California with the largest number of employees and highest average wages. This subsector saw strong growth in average earnings, which increased by 18 percent from 2019 to 2020. In addition, this subsector also saw strong growth in number of establishments, which primarily drove the growth in total number of life sciences establishments in the state. This is not surprising due to the pandemic, which led to rapid research on the novel coronavirus, intensive testing to identify cases, greatly increased testing capacity, and simultaneous development of COVID-19 vaccines.

Measuring by Metropolitan Statistical Areas (MSAs), the largest share of the jobs supported in California was in the Los Angeles-Long Beach-Anaheim MSA, followed by the San Diego-Carlsbad MSA, the San Francisco-Oakland-Hayward MSA, then the San Jose-Sunnyvale-Santa Clara MSA. For the entire state of California, the average life sciences salary in 2020 was around $159,000, increasing from about $142,000 in 2019. Even though it has the lowest employment level of the four MSAs analyzed, the San Jose-Sunnyvale-Santa Clara MSA has the highest average wages. The MSA with the highest employment, Los Angeles-Long Beach-Anaheim has the lowest average wages at about $107,000.

Life Sciences Average Wage and Employment by Top Ten Counties, 2020[12]

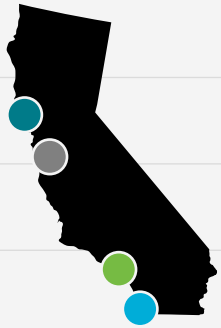
County	Employees	Average Wages ($)
San Diego	52,952	164,425
Los Angeles	45,828	98,276
Orange	44,031	115,918
Alameda	26,633	150,688
Santa Clara	25,894	198,213
San Mateo	23,376	322,984
San Francisco	9,485	225,308
Riverside	5,789	80,448
San Bernardino	4,125	72,321
Ventura	3,757	131,529

For the entire state of California, the average life sciences salary in 2020 was around $159,000, increasing from about $142,000 in 2019.

10 Employee count, establishment count, and average wage are based upon Bureau of Labor Statistics QCEW data set.
11 KPMG relied on the definition and broad categorizations of life sciences industries from research conducted by the CLS partner organization, TEConomy.
12 Source: KPMG's analysis of BLS QCEW Data.

Life Sciences Employment and Average Wage by Top Four MSAs, 2020[13]

Metropolitan Statistical Area (MSA)	Employees	Average Wages ($)
Los Angeles-Long Beach-Anaheim	88,846	107,141
San Diego-Carlsbad	52,952	164,425
San Francisco-Oakland-Hayward	35,981	196,125
San Jose-Sunnyvale-Santa Clara	24,684	203,135



California Life Sciences Employment, Establishments, and Average Wage by Sector, 2020[14]

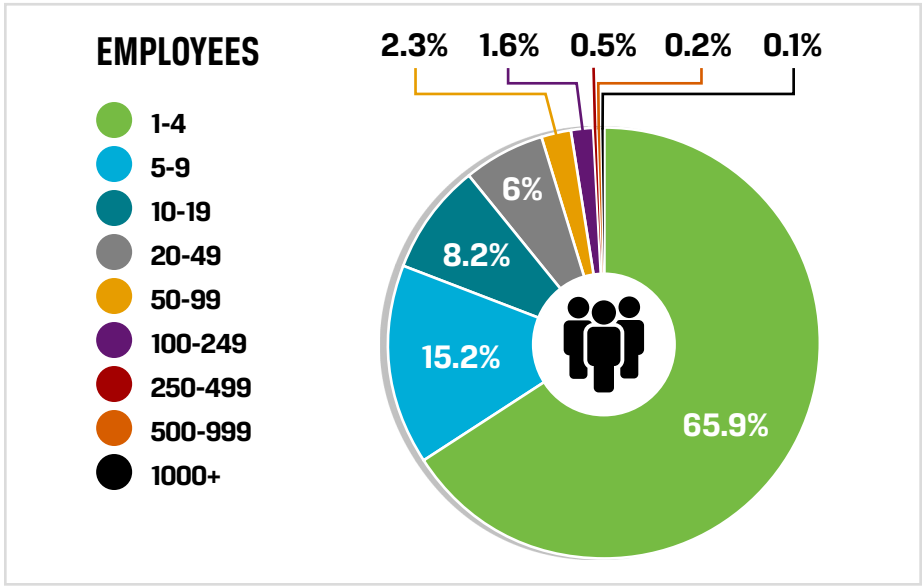
Life Sciences Category	Employees	Establishments	Average Wages ($)
Medical Devices & Equipment	75,069	1,479	127,923
Drugs & Pharmaceuticals	46,439	745	168,004
Agricultural Feedstock & Industrial Biosciences	2,848	153	81,723
Bioscience-related Distribution	65,794	5,387	121,761
Research, Testing, & Medical Laboratories	123,080	5,150	195,119
Total	313,230	12,914	158,555

13 Source: KPMG's analysis of BLS QCEW Data.
14 Source: KPMG's analysis of BLS QCEW Data.

Size and Distribution

The life sciences sector is often characterized as an ecosystem because of the essential collaboration that occurs between foundational research conducted in universities, research centers, and institutions and the progression of that innovation into the commercial market. **The transfer of innovation is fueled by financial investments from the private sector such as venture capital firms or through partnerships with larger more established companies.** Because of the very complex and challenging nature of new biomedical innovation, and the tremendous risks involved with taking research from the lab to the patient or other commercial user in a safe and highly regulated environment, the sector is built on a foundation of small businesses across the state. Life sciences establishments exist throughout the state; however, most of the establishments that employ large numbers of Californians are concentrated in the MSAs of Los Angeles-Long Beach-Anaheim, San Diego-Carlsbad, San Francisco-Oakland-Hayward, and San Jose-Sunnyvale-Santa Clara. **The major clusters of life sciences activity are often found near academic or other research centers.**

Life Sciences Establishments by Number of Employees[15]



More than eighty percent of the life sciences establishments operating in California in 2020 are comprised of fewer than 10 employees.

15 Source: KPMG analysis of Q1 2021 Dun & Bradstreet Data.

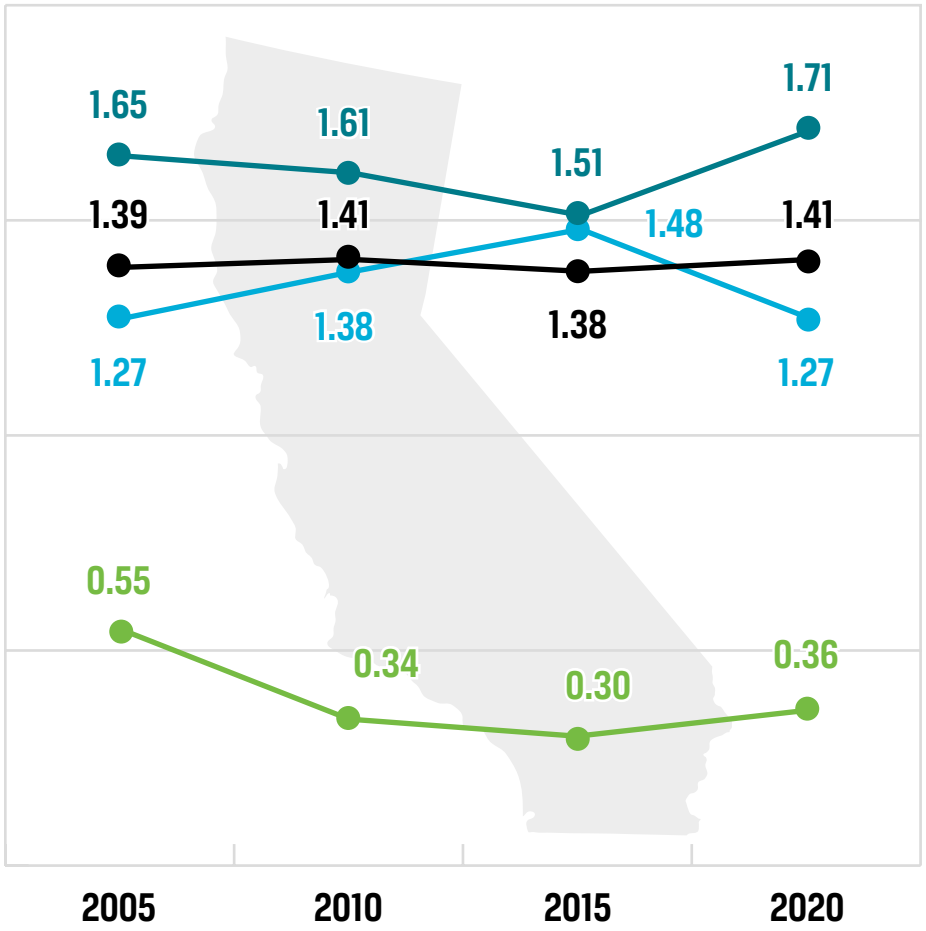
Competitiveness of the **Sector in California**

A common measure of a region's competitiveness in a particular sector is its relative concentration of the sector within its territory. The "location quotient" ratio is a simple measure of the relative concentration of a sector compared to the national average.

Compared to the U.S., California has historically had higher concentrations of drug and pharmaceutical suppliers and medical device and equipment manufacturers and a lower concentration of agricultural feedstock and industrial biosciences suppliers. Since 2005, the relative higher concentration of medical devices and equipment in California has been steadily growing with a slight drop from 2010 to 2015. When looking at the location quotient for all subsectors combined, California's overall relative concentration of life sciences sector has been remarkably steady over the last fifteen years. **By this measure, the life sciences sector in California is maintaining its competitive position relative to the rest of the United States.** This stability highlights the vital economic partnership provided to the state of California by the sector and is often the focus of initiatives and incentives that seek to maintain and grow this competitive leadership.

For the life sciences sector in California, the location quotients were calculated by first dividing the life sciences employment in the state of California by the total employment across all industries in the state, which derives the local industry concentration. Second, the resulting ratio is then compared to the national industry concentration—life sciences employment for the entire U.S. divided by the total employment across all industries in the U.S. **A location quotient above 1.0 implies that there is a greater concentration of life sciences sector in California compared to the rest of the U.S. or that the relative share of the industry is "above average."**

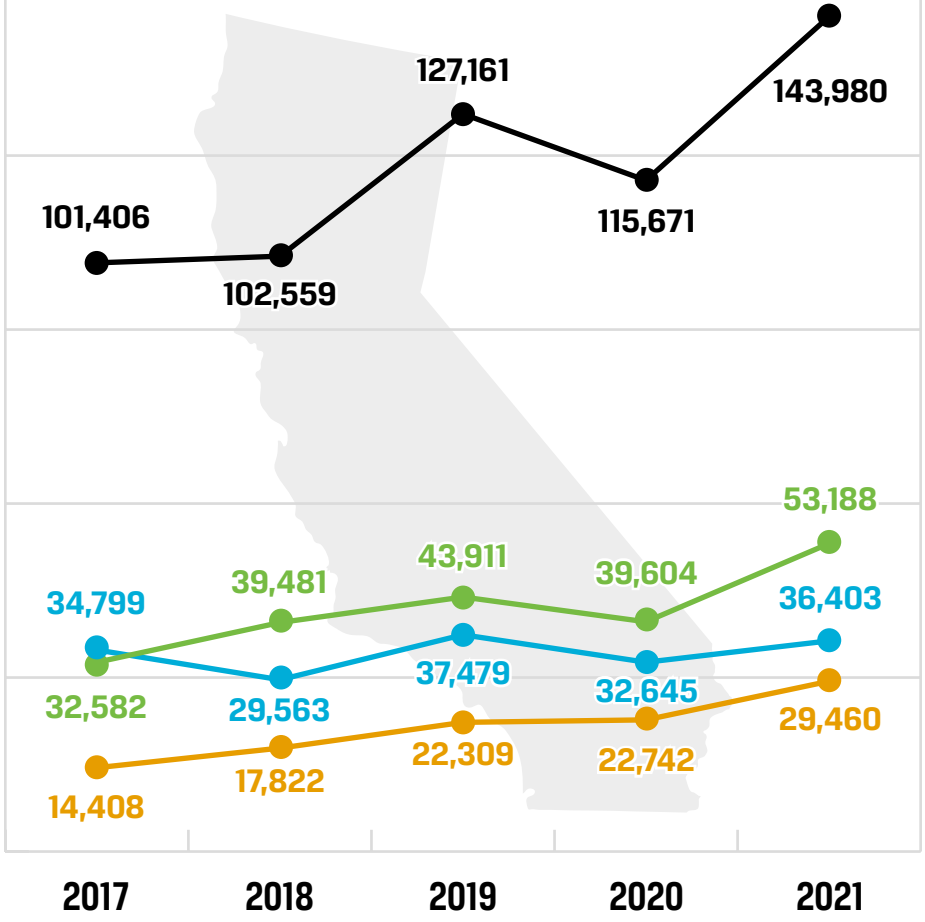
Location Quotient for Selected Life Sciences subsectors in California, 2005-2020[16]



16 Source: KPMG's analysis of BLS QCEW Data.

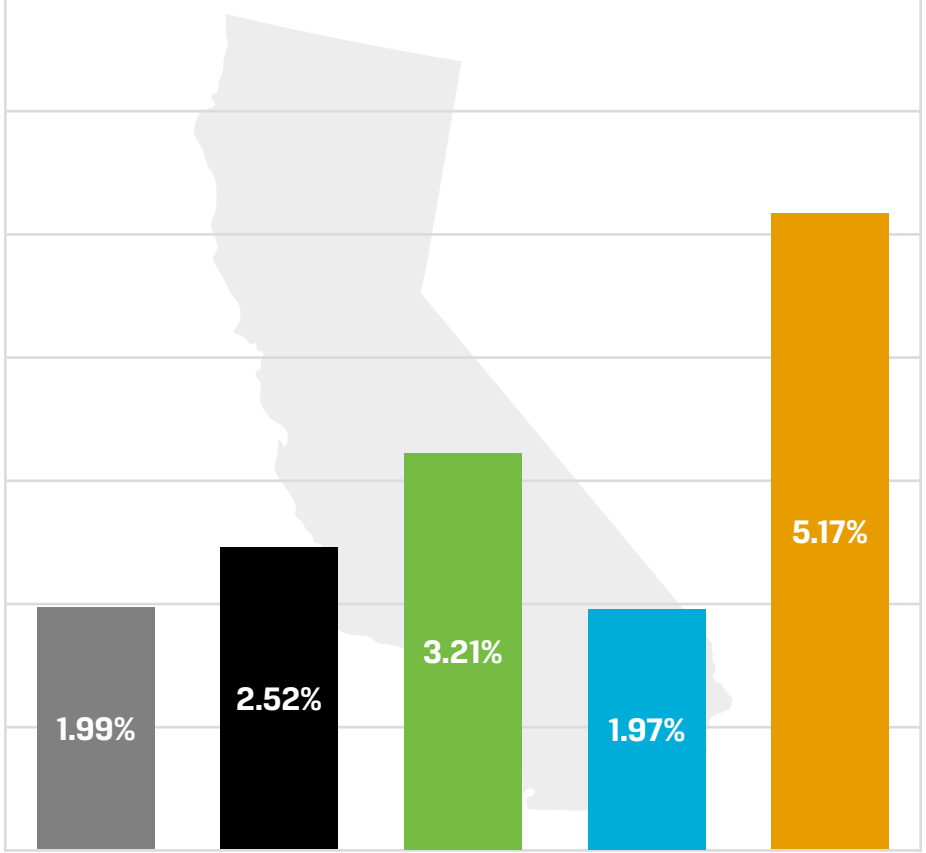
Job Postings

Trend in Total Unique Job Postings From 2017 to 2021



- California
- Bay Area
- LA + Orange Counties
- San Diego County

Life Sciences Share of Total Unique Job Postings in 2021 (vs U.S.)

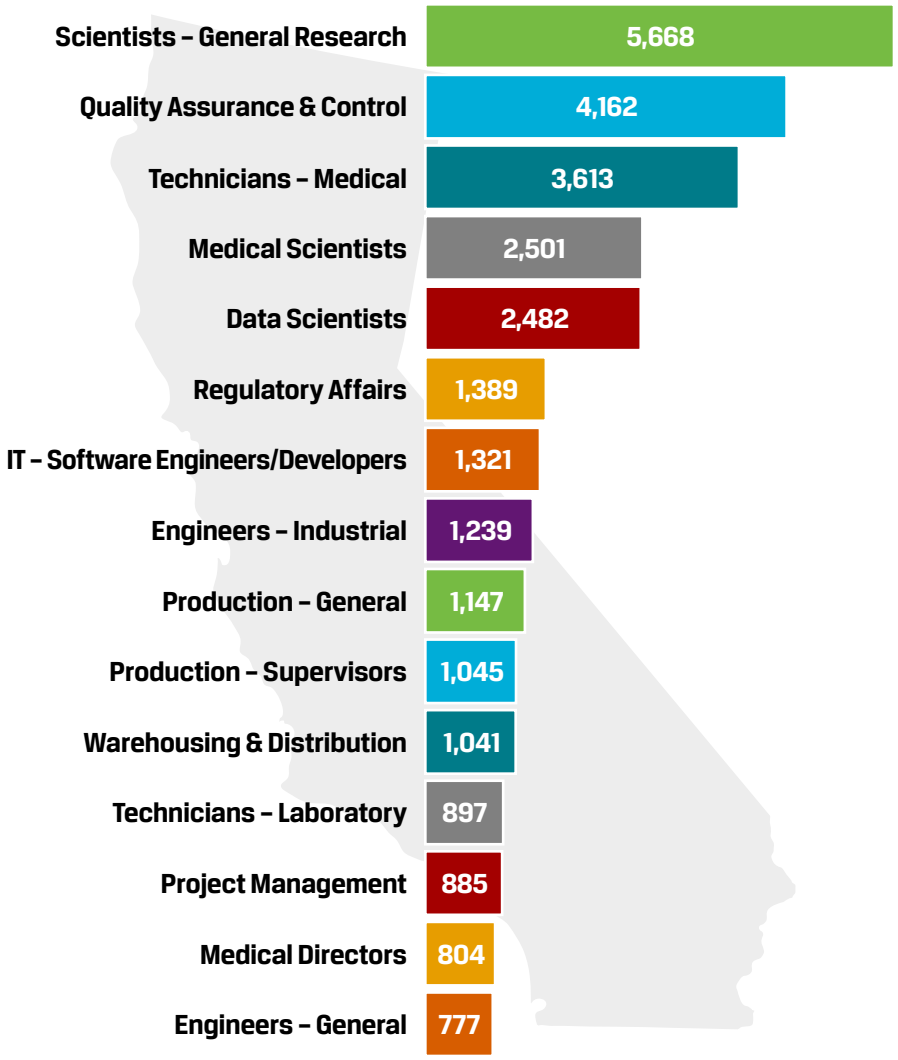


- California
- Bay Area
- LA + Orange Counties
- San Diego County

Job Postings

DEGREE AND EXPERIENCE REQUIREMENTS AND SHARE OF INDUSTRY JOBS BY SUBSECTOR [CALIFORNIA ONLY]

Top 15 Job Titles/Groups for Life Sciences Hiring in 2021: California



Top 10 CLS Members by Unique Job Posting Totals in Descending Order

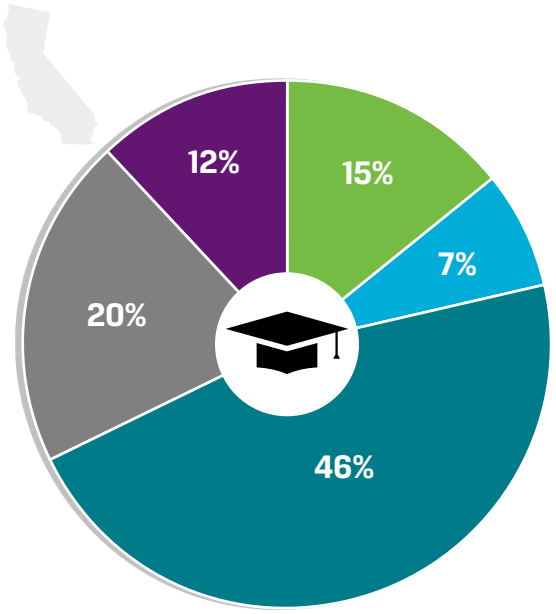
Who's Hiring?

JOHNSON & JOHNSON	ABBOTT LABORATORIES
GILEAD SCIENCES	AMGEN
MEDTRONIC	ABBVIE
LABCORP	GENENTECH
BD	EDWARDS LIFESCIENCES

Job Postings

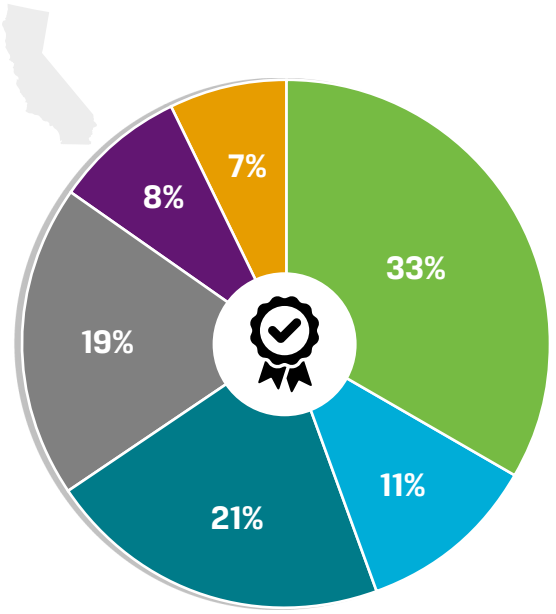
DEGREE AND EXPERIENCE REQUIREMENTS AND SHARE OF INDUSTRY JOBS BY SUBSECTOR [CALIFORNIA ONLY]

Degree Requirements



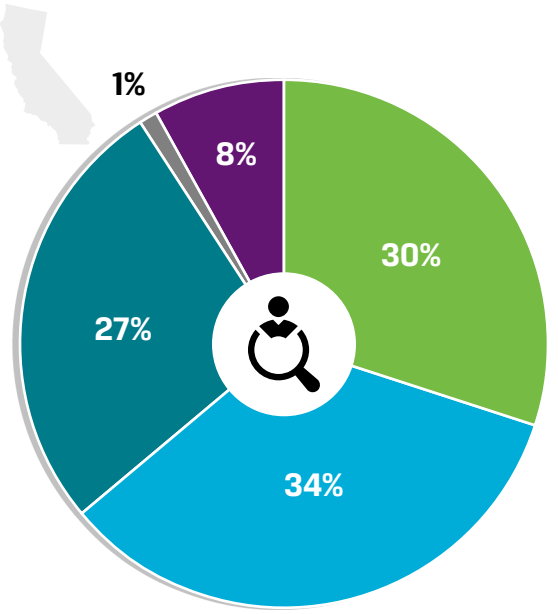
- High school or GED
- Associate's degree
- Bachelor's degree
- Master's degree
- Ph.D. or professional degree

Experience Requirements



- No Experience Listed
- 0 – 1 Years
- 2 – 3 Years
- 4 – 6 Years
- 7 – 9 Years
- 10+ Years

Share of Industry Job Postings by Major Life Sciences Subsectors, 2021 in California



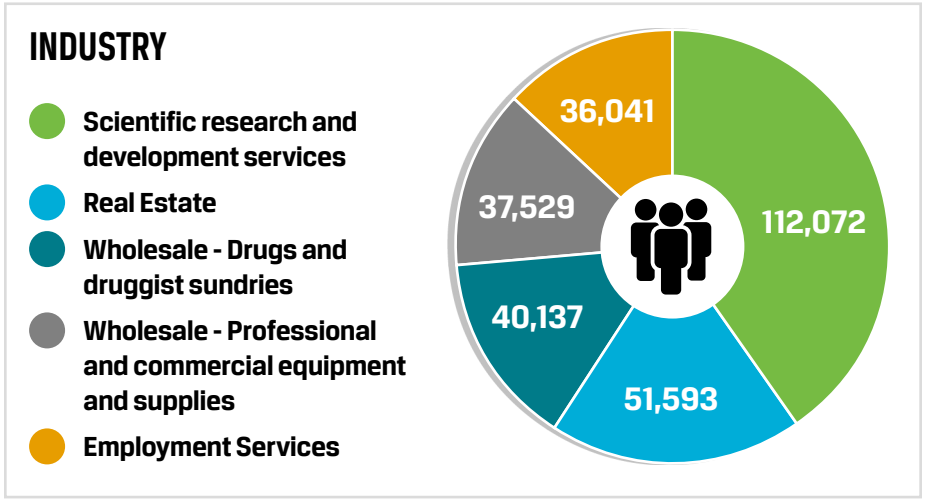
- Ag Feedstock & Industrial Bio
- Bio-Related Distribution
- Research, Testing & Medical Labs
- Medical Devices & Equipment
- Drugs & Pharmaceuticals

Economic Contribution

The presence of the life sciences sector in California generates total economic impact that is substantially larger than its own activities. The life sciences sector contributes through a variety of channels to the California economy. While the sector directly employed over 313,000 people in the state, an additional 806,000 indirect and induced jobs were generated by firms in the supply chain providing goods and services to the life sciences sector, as well as jobs created by the spending of life sciences and supporting industry employees. For this sector in California, its impact may be represented by its "employment multiplier" as explained below.

- **The employment multiplier[17] in California is 3.6**
  - This means that a total of 3.6 jobs were created in the State of California for every job employed by the life sciences sector – **each direct job generates another 2.6 additional jobs[18].**
  - This is also commonly known as the "ripple effect."
- In addition, the sector's significant contribution to the state economy can be captured by economic output and tax revenue.
  - In 2020, the life sciences sector directly contributed **over $230 billion in state economic output**, with an additional $173 billion in economic output generated via its supply chain.
  - **More than an estimated $20 billion in federal, state, and local taxes are attributable to the direct economic activity in the sector.** The indirect and induced economic activities generated an additional $21 billion in taxes.

Top Five Subsectors by Total Employment in California



Real estate is among the top five sectors most prominently impacted by the contributions of the life sciences sector. This is unsurprising, as many life sciences companies, such as those in the research & development or laboratory testing sectors need commercial lab space.

17 The multiplier captures the ratio between the overall economic contributions and the direct economic contributions.
18 Note that the definition of a job is equal to a person-year of employment.

Contributions by Region in California[19]

Geography	California Statewide	Los Angeles – Long Beach – Anaheim MSA	San Diego – Chula Vista – Carlsbad MSA	San Francisco – Oakland – Berkeley MSA	San Jose – Sunnyvale – Santa Clara MSA
Employment					
Direct	313,230	88,846	52,952	35,981	24,684
Indirect & Induced	806,044	189,282	118,958	59,429	22,501
Total	1,119,274	278,128	171,911	95,410	47,185
Multiplier	*3.6*	*3.1*	*3.2*	*2.7*	*1.9*
Labor Income ($B)					
Direct	65.0	12.7	11.5	9.4	6.2
Indirect & Induced	64.7	14.5	8.3	6.7	2.8
Total	129.7	27.2	19.8	16.1	9.0
Multiplier	*2.0*	*2.1*	*1.7*	*1.7*	*1.4*
Output ($B)					
Direct	237.7	52.1	34.0	54.3	17.7
Indirect & Induced	173.3	38.6	22.6	16.8	6.4
Total	411.0	90.7	56.6	71.1	24.1
Multiplier	*1.7*	*1.7*	*1.7*	*1.3*	*1.4*
Taxes ($B)					
Direct	21.4	4.2	3.2	3.6	1.5
Indirect & Induced	21.0	4.7	2.7	2.0	0.7
Total	42.4	8.9	5.8	5.6	2.2

19 All economic contributions presented are in 2021 dollars.

Academic and Research **Excellence**

Academic Excellence

Academic excellence is crucial to the life sciences sector as an engine for scientific research and innovation. California is a leader in education not only across the U.S., but also across the world.

- **In 2021, California boasted the greatest number of universities listed on the World Top 100 Universities according to the Shanghai Index compared to the rest of the states in the U.S.** The second is New York with four universities in the ranking, followed by three states with three universities.
- Over the five-year period from 2015 to 2019, the number of degrees (i.e., Bachelor's degree or higher) awarded in the life sciences discipline by institutions in the state has **increased by 18.3%.**
- Doctoral degrees support the continuation of research and clinical trials, not only as research leads and investigators, but also as members of Institutional Review Boards and Data and Safety Monitoring Committees, which are crucial to the strict monitoring standards of trials and the safety of participants.[20]

In 2020, institutions in the state awarded about 1,200 doctoral degrees in the life sciences discipline.

Number of Universities by State in the World Top 100[21]

S. No.	States	No. of Universities
1	California	10
2	New York	4
3	Illinois	3
4	Massachusetts	3
5	Texas	3
6	Maryland	2
7	North Carolina	2
8	Pennsylvania	2
9	Colorado	1
10	Connecticut	1

20 Source: NIH, "Clinical Trials: Benefits, Risks, and Safety", Accessed February 2022.
21 Academic Ranking of World Universities (ARWU), Shanghai Ranking Consultancy. "2021 Academic Ranking of World Universities". Accessed December 2021.

Doctorate Recipients

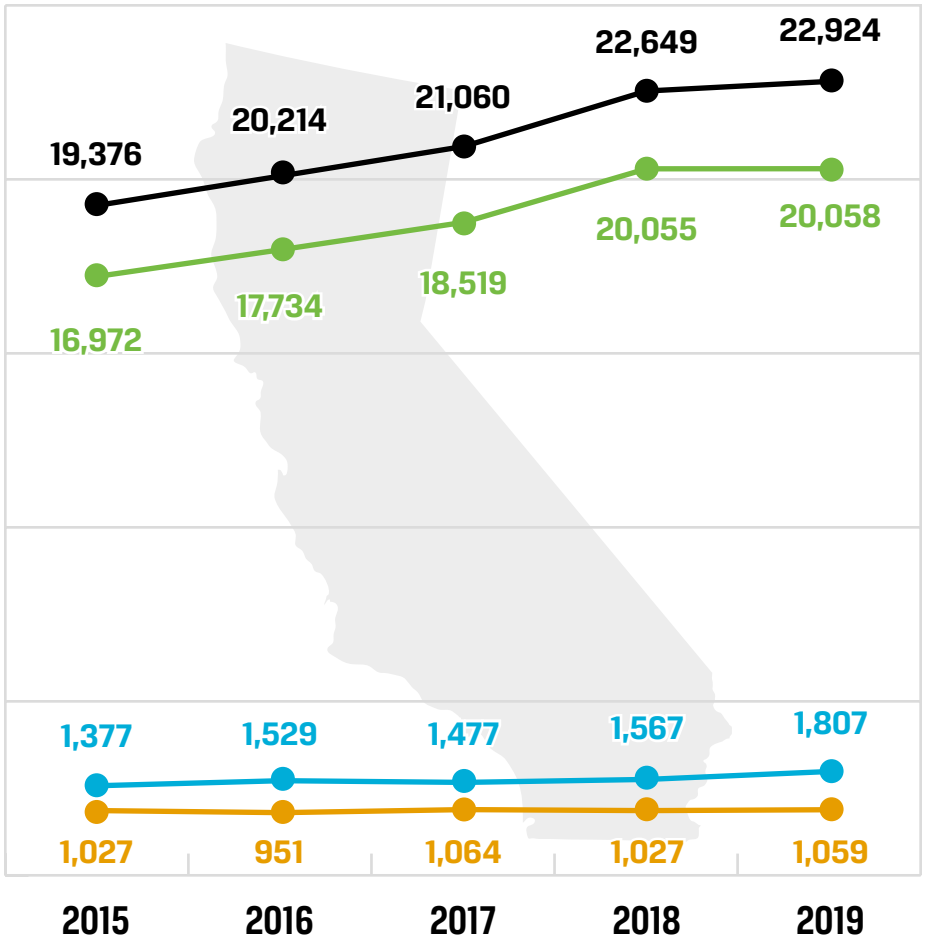
In 2020, California had the single greatest number of life sciences doctorate recipients in the United States, with 1,189 in total. California's life sciences doctorate recipients account for 9.5% of the total life sciences doctorate recipients in the United States, 300 above the next state of Texas. The vast majority of these graduates were in biological and biomedical sciences; however, increased growth also spans agricultural sciences and natural resources and health sciences.

Top 10 States for Doctorate Recipients in Life Sciences, 2020[22]

State	Total Life Sciences	Agricultural Sciences and Natural Resources	Biological and Biomedical Sciences	Health Sciences
California	1,189	83	953	153
New York	904	68	731	105
Texas	889	119	582	188
Massachusetts	676	37	529	110
Pennsylvania	559	27	412	120
North Carolina	522	53	347	122
Florida	503	77	275	151
Ohio	458	35	317	106
Illinois	449	48	306	95
Michigan	386	55	250	81

22 Source: NSF, National Center for Science and Engineering Statistics, Survey of Earned Doctorates. Data as of November 30, 2021.

Life Sciences Degrees in California by Year[23]



Research Excellence

California continues to be a world-class leader for life sciences research. The amount of funding received from NIH continues to increase.

- **The total NIH funding received by California in 2021 accounted for 15.0% of the total NIH funding in the United States.** In FY 2021, California's institutions[24] received $108.5 million in funding from the Department of Biological Sciences of NSF, an increase of $12.5 million from FY 2020.
- **Total life sciences related R&D expenditures have also increased in recent years, with $6.5 billion in 2018 and $6.7 billion in 2019**, well above the $5.2 billion in 2015. In 2019, California was the top state for life sciences R&D.
- **The state's life sciences related R&D expenditure in 2019 made up 13.9% of the total U.S. life sciences related R&D expenditures the same year of $48.2 billion.** Compared to the rest of the U.S., California spent the most on health sciences and natural resources and conservation R&D and came in second with the highest biological and biomedical sciences and agricultural sciences R&D expenditures.

23 Source: NSF, IPEDS Completions Survey from Department of Education, accessed December 9, 2021.
24 Institutions reported by NSF include "university", "federal", "small business", and "other".

Top 5 States Receiving NIH Grants, 2021[25]

2021			
S. No.	Location	Awards	Funding ($b)
1	California	8,938	5.0
2	New York	5,984	3.6
3	Massachusetts	5,674	3.2
4	Pennsylvania	4,065	2.0
5	North Carolina	2,635	1.9

Top 5 States by Total NSF Funding, Fiscal Year 2021[26,27]

State	Total	
	Funding ($M)	Count
California	108.5	288
Ohio	78.4	61
New York	50.3	149
Massachusetts	40.0	119
Pennsylvania	32.7	83

Top 5 States Receiving NIH Grants, 2020

2020			
S. No.	Location	Awards	Funding ($b)
1	California	8,900	5.0
2	Massachusetts	5,654	3.3
3	New York	6,081	3.2
4	Maryland	2,678	2.3
5	North Carolina	2,650	2.2

Top 5 States by Number of NSF Awards, Fiscal Year 2021[28]

State	Number of Awards	Funding Rate
United States	1,175	30%
California	169	35%
New York	77	28%
Massachusetts	64	34%
Texas	53	23%
Pennsylvania	51	34%

25 Source: NIH. Data as of 10/04/2021.
26 Source: Data reflects awards by Department of Biological Sciences. Award Summary: by State/Institution. Last modified October 2020.
27 NSF Direct for Biologicals funding in California is specifically for research support. According to NSF, "Research Support supports activities that enable the United States to uphold world leadership in all aspects of science and engineering, by maintaining the overall health of science and engineering across all disciplines. Moreover, research activities support areas of inquiry that are criterial for long-term U.S. economic strength and security."
28 Source: Data reflects awards by Department of Biological Sciences. Award Summary: by State/Institution. Last modified October 2020.

CALIFORNIA: FUNDING BY ORGANIZATIONS AND CONGRESSIONAL DISTRICTS

The following tables present a ranking of the top California organizations and Congressional Districts that received NIH and NSF funding in recent years.

Top 10 California Organizations Receiving NIH Funding by Year ($ million)[29]

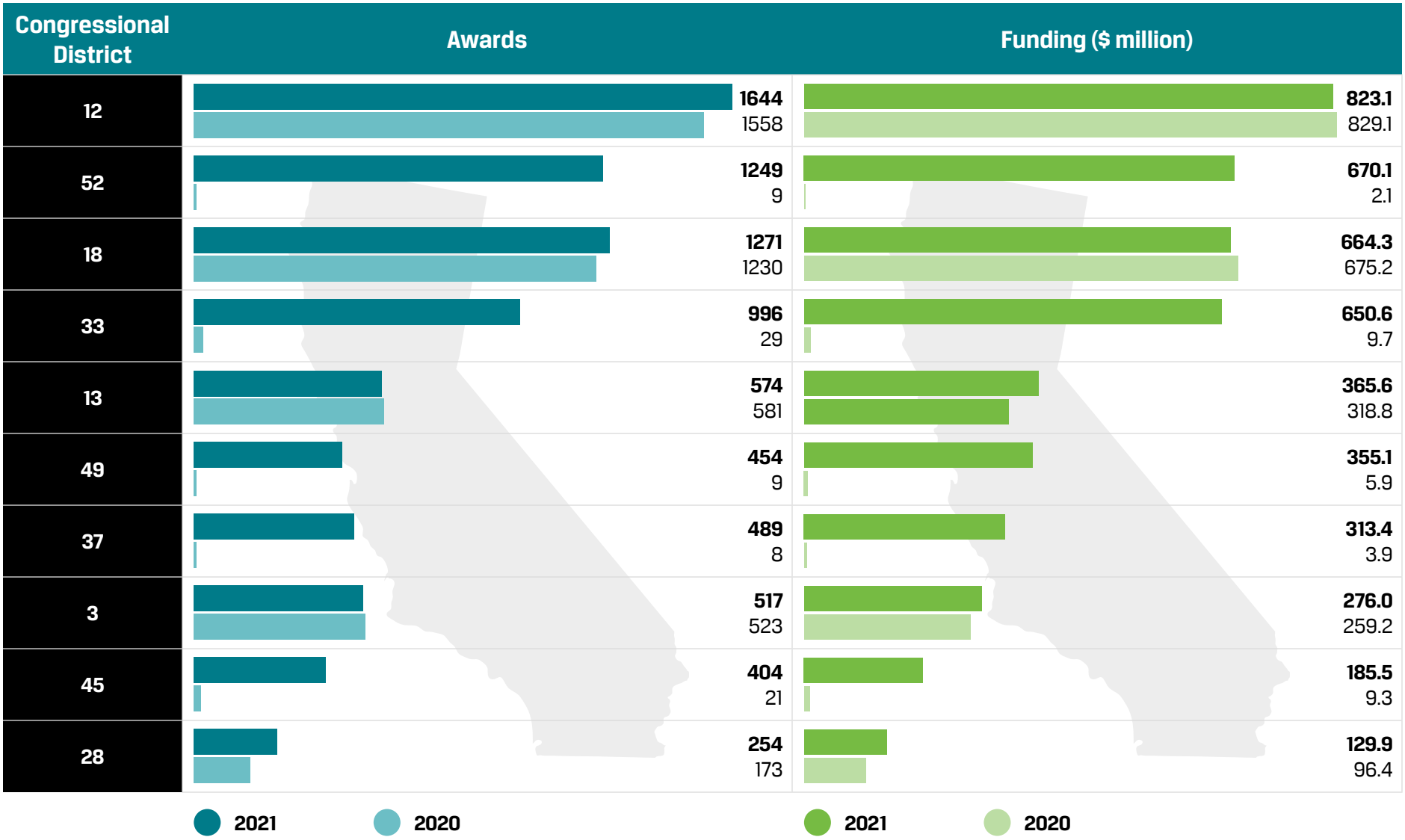
Organization	2021	2020
University of California, San Francisco	**703.8**	685.6
Stanford University	**599.6**	673.2
University of California, Los Angeles	**581.5**	560.6
University of California, San Diego	**547.4**	525.0
University of Southern California	**311.7**	324.6
University of California, Davis	**271.7**	254.6
Scripps Research Institute	**207.3**	177.0
University of California, Irvine	**172.1**	167.7
University of California, Berkeley	**151.1**	148.2
Kaiser Foundation Research Institute	**111.0**	111.2

Top California Organizations Receiving NSF Funding ($ million)[30]

Organization	Total[31]	
	Funding	Awards
University of California, Davis	15.4	31
University of California, Riverside	9.5	21
University of California, Berkeley	9.3	26
Stanford University	9.3	9
University of California, Los Angeles	8.5	18
University of California, San Francisco	7.3	6
University of California, Santa Barbara	6.3	15
Individual Award(s)	6.0	56
University of Southern California	5.8	8
University of California, San Diego	4.5	13

29 Source: NIH. Data as of 10/04/2021.
30 Source: Data reflects awards by Department of Biological Sciences. Data as of October 2020.
31 Reimbursables excluded. Total includes Academic Research Infrastructure prior to 1998.

Top 10 Congressional Districts to Receive NIH Funding by Year[32]



32 Source: NIH. Data as of 10/04/2021 per 2020 congressional maps.

R&D EXPENDITURES

Top 5 States with Largest Life Sciences R&D Expenditures, 2019 ($ million)[33]

State	Agricultural sciences	Biological and biomedical sciences	Health sciences	Natural resources and conservation	Other life sciences	Total
California	203.9	1,574.2	4,756.7	87.2	58.2	6,680.2
New York	123.8	1,932.1	2,482.2	40.3	26.1	4,604.5
Texas	250.2	1,339.5	1,840.6	24.4	152.3	3,607.0
Pennsylvania	97.6	1,317.0	1,285.2	3.7	155.5	2,858.8
North Carolina	126.9	555.2	1,701.0	12.3	34.8	2,430.2

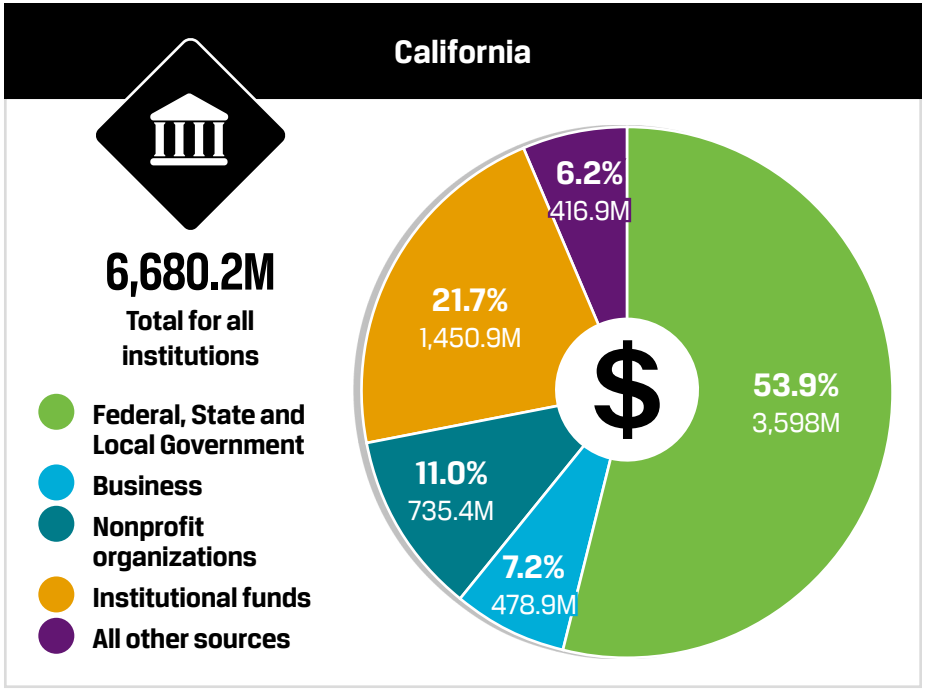
Life Sciences R&D by Funding Source (Who Funds R&D)

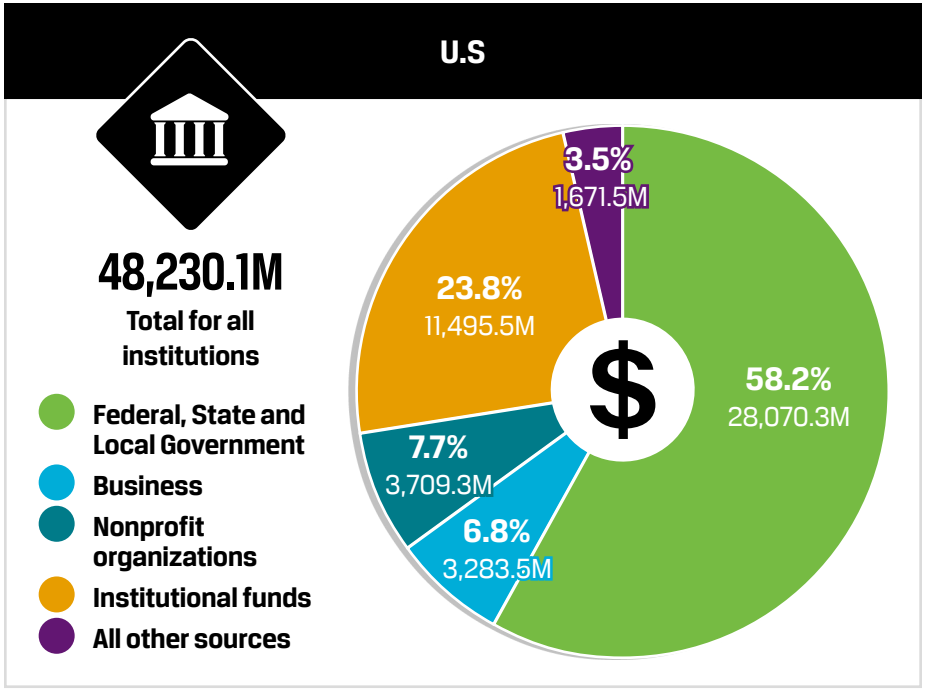
Scientific knowledge serves as the wellspring of innovation and investments into early-stage research that fuels the growth of our understanding and ability to tackle challenges. Modern economic growth is often the result of advances in science and the U.S life sciences sector has been a leader in domestic research investment. Developing new drugs, devices, and diagnostic tools is a costly and uncertain process, with failure often being the most likely outcome given the challenges of successfully navigating the so called "valley of death" between initial idea and successful approval by the FDA or other regulatory agency. Life sciences R&D requires a significant number of financial investments as the process to test and create new therapies and treatments can take years from conception to implementation to results. **The expected cost to develop a new drug has been estimated to range from $1 to $2 billion according to an April 2021 Congressional Budget Office (CBO) report on research and development in the Pharmaceutical Industry.**[34] This has become even more apparent throughout the latest public health crisis due to the emergence of COVID-19. Industry, government, and nonprofit organizations are all vital sources of funding that enable new and innovative ideas to develop. The same CBO report indicates that in 2019, the pharmaceutical industry spent 10 times more on R&D than it had per year in the 1980s after adjustment for inflation.

The total life sciences related R&D investment in California was $6.7 billion in 2019, representing a 30% increase from $5.2 billion in 2015. Out of all of the funding sources for R&D expenditures in California, the largest percentage comes from institutional funds, making up 23.8% in 2019.

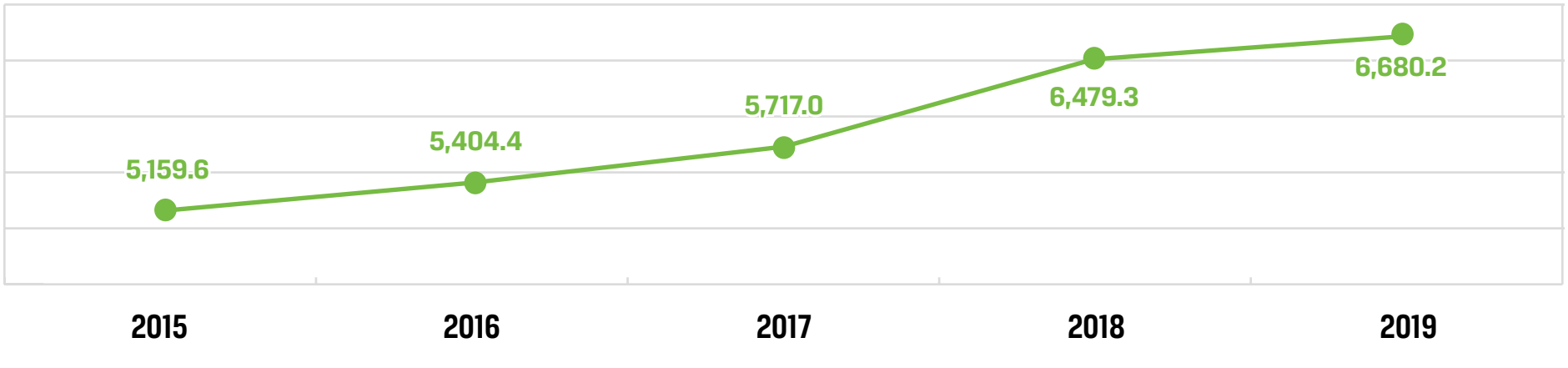
33 Source: NSF National Center for Science and Engineering Statistics (NCSES). Higher Education Research and Development Survey. Accessed December 2021.
34 Source: CBO "Research and development in the pharmaceutical Industry, April 8 2021 https://www.cbo.gov/publication/57126.

California Life Sciences-related[35] R&D Expenditures by Funding Source in 2019 ($ million)[36]





Total Life Sciences-related R&D expenditures in California from 2015-2019 ($ million)[37]



35 Data reflects the life sciences as defined by the National Center for Science and Engineering Statistics (NCSES); the principal statistical agency located within the National Science Foundation (NSF).
36 Source: NSF. Higher Education Research and Development Survey. Accessed December 2021.
37 Source: Research America, 2019 Report: https://www.researchamerica.org/sites/default/files/Publications/InvestmentReport2019 Fnl.pdf.

Life Sciences- related R&D Investment in California by Funding Source, 2019 ($ million)

Sources of Funds	Agricultural sciences	Biological and biomedical sciences	Health sciences	Natural resources and conservation	Other life sciences
Total for all institutions	203.9	1,574.2	4,756.7	87.2	58.2
Federal, State and Local government	66.8	1,034	2,420	37.8	39.4
Business	7.0	67.5	395.3	7.7	1.4
Nonprofit organizations	8.8	144.5	565.4	10.2	6.5
Institutional funds	101.6	271.0	1,041.0	28.1	9.3
All other sources	19.8	57.3	335.0	3.4	1.5

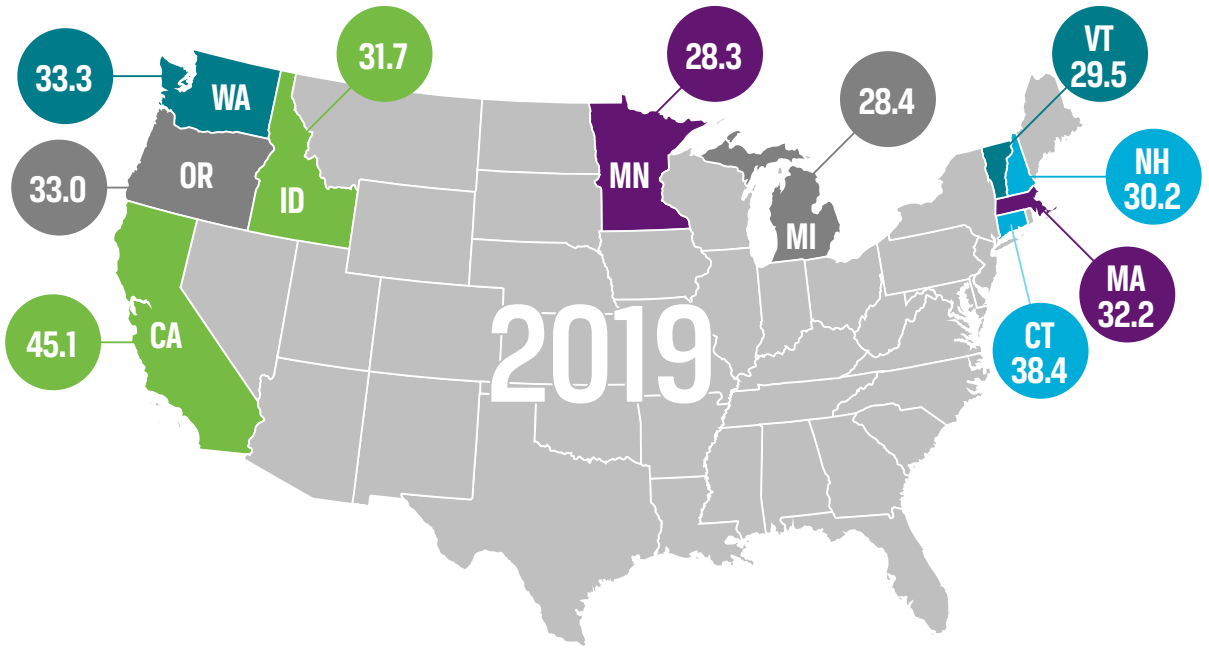
Patents by State

California has been the top leader in innovation within the life sciences sector. Companies in the state have been issued a substantial number of science and engineering patents.

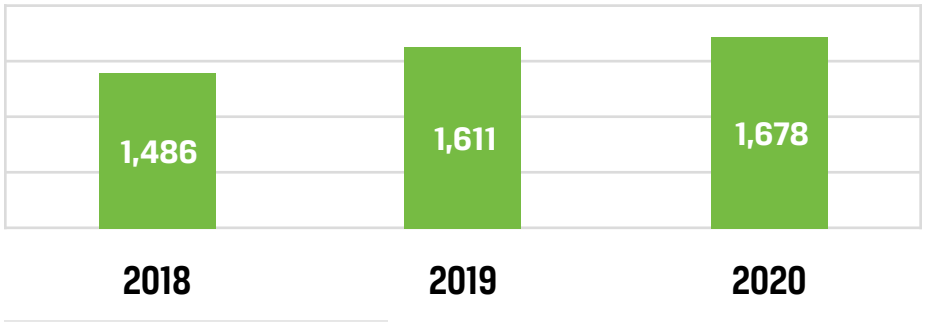
- When looking at the patents awarded per 1,000 individuals, California is well above the rest of the states in the U.S. with **45.1 patents awarded per 1,000 individuals in science and engineering occupations in 2019** (a measure to standardize patent issuance across states of different sizes). This is also well above the national average of 22.8 patents in the same year.
- The number of patents issued by life sciences companies in the state has **increased by 13% from 2018 to 2020.**

Top 10 States with Highest Patents Awarded per 1,000 Individuals in Science and Engineering Occupation[38]

Geography	2019
California	45.1
Connecticut	38.4
Washington	33.3
Oregon	33.0
Massachusetts	32.2
Idaho	31.7
New Hampshire	30.2
Vermont	29.5
Michigan	28.4
Minnesota	28.3



Number of Life Sciences Patents issued by California-based Companies[39]



38 Source: NSF, Patents Awarded per 1,000 Individuals in Science and Engineering Occupations, data available as of May 2021.
39 Source: Biocom, California Economic Impact Report 2021.

Attracting **Capital**

VC INVESTMENT

There are several ways in which life sciences companies can acquire funding. Venture Capital (VC) investment is a commonly utilized method by early-stage companies.

- In the U.S., venture capital investment in the life sciences sector continued to gain momentum during the pandemic. Comparing to 2018, the volume of life sciences-related VC deals **increased by 218 in 2020, translating into a $13 billion increase in total capital invested.**
- In California, venture capital investment in life sciences also rose significantly from **4.6 billion in 2018 to 11.5 in 2020.** This is especially important for innovation and startups that rely on these funds in order to continue development and growth.

VENTURE CAPITAL IN THE UNITED STATES

U.S. VC in the Life Sciences ($ billion)[40]

US Life Sciences VC Deal Flow	2018	2019	2020	2021[41]
Deal value ($B)	**$25.8**	**$23.1**	**$35.6**	**$25.3**
Deal count	1,632	1,697	1,812	999
Angel & Seed	535	569	592	298
Early VC	562	613	587	301
Later VC	535	515	633	400

40 Source: NVCA.org, Q2 2021 Venture Monitor Summary, Accessed February 2022.
41 As of 6/30/2021.

U.S. Life Sciences VC Capital Invested and Deal Count by Sector ($ billion)[42]

Sector	2018		2020	
	Capital	Deal Count	Capital	Deal Count
Biotechnology and Pharmaceuticals[43]	9.6	457	10.0	456
Medical Devices and Equipment[44]	6.0	742	8.5	794
Drug Delivery and Discovery[45]	10.1	386	17.6	552

Top 10 States for Total Healthcare VC Investment in 2020 – ($ million)[46]

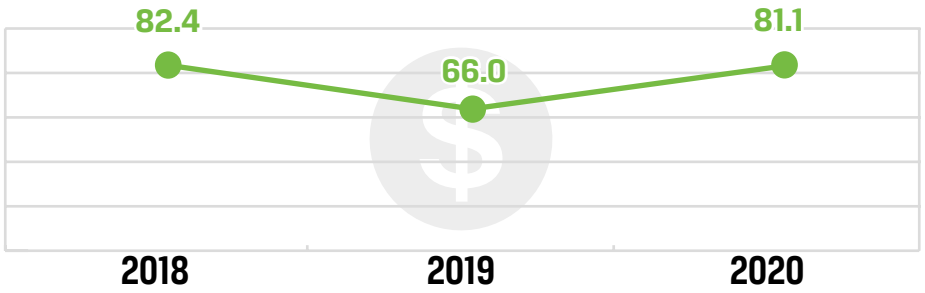
State	Capital Invested	Count
California	11,497	296
Massachusetts	6,781	168
New York	1,676	53
Washington	1,073	25
Illinois	874	12
Minnesota	813	21
Texas	796	35
Pennsylvania	622	26
Maryland	528	30
Colorado	495	17

42 Source: NVCA.org, NCVA 2021 Yearbook, Accessed January 2022.
43 Includes biotechnology, pharmaceuticals, and other pharmaceuticals and biotechnology.
44 Includes diagnostic equipment, discovery tools (healthcare), medical supplies, monitoring equipment, surgical devices, therapeutic devices, and other devices and supplies.
45 Includes drug delivery and drug discovery.
46 Source: PwC/CB Insights Money Tree Quarterly Reports, Q3 2018 to Q4 2020. Most recent data available was used for each quarter. Accessed December 2021.

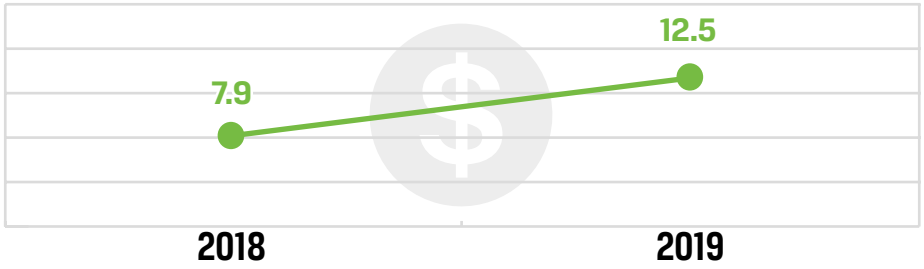
Venture Capital in California

California's venture capital investment has been on the rise in recent years, with $81.1 billion in 2020, up $15.1 billion from 2019. Specifically, total healthcare venture capital investment in California was $12.5 billion in 2020. Looking at the top 5 healthcare regions in the world, California boasts two out of five, with Silicon Valley and San Diego in the top 5 regions for healthcare deal value across the United States.

Total Venture Capital (VC) Investment in California – all Sector ($ million)[47]



Total Healthcare VC Investment in California - $ billion[48]



Top 5 Regions by Healthcare Deal Value, 2020 ($ billion)[49]

Rank	Region	Dollars Invested	# Deals	Average Deal Size
1	Silicon Valley	7.9	177	44
2	New England	7.2	188	38
3	San Diego	3.6	74	49
4	New York Metro	2.0	65	31
5	Midwest	0.8	20	40

47 Source: NVCA.org. "California's Entrepreneurial Ecosystem". Accessed January 2022.
48 Source: PwC/CB Insights Money Tree Report.
49 Source: PwC/CB Insights Money Tree Report.

Initial Public **Offerings**, Mergers and **Acquisitions**, and Private **Placements**

Initial Public Offerings

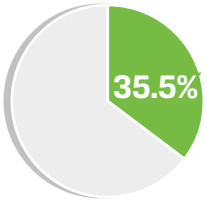
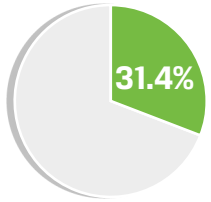
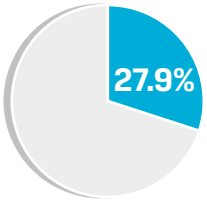
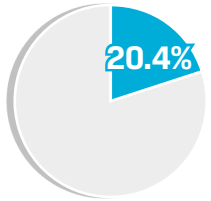
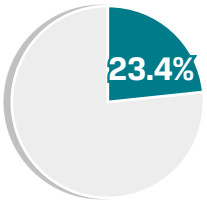
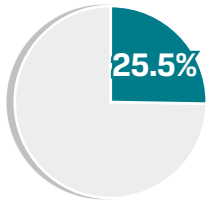
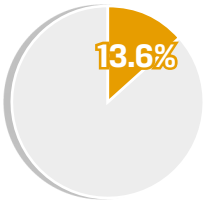
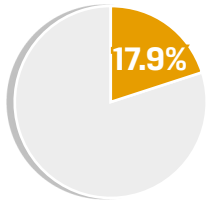
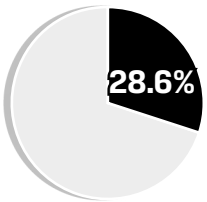
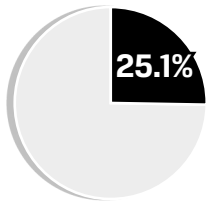
IPOs are a financing source commonly utilized by late-stage start-up companies. In California, there was a decrease in IPO activities in the healthcare industry from 2020 to 2021. In 2020, there were 236 deals valued at $53.6 billion. In 2021, there were 165 transaction valued at $31.2 billion. However, California continued to lead the charge in number of IPOs and transaction value, with 55 more life sciences related IPOs than the next highest state in 2021 alone.

Top 5 States by Number of IPO Transactions ($ million)[50,51]

State	2020		2021	
	Number of Transactions	Transactional Value ($ million)	Number of Transitions	Transactional Value ($ million)
California	236	53,576	165	31,208
Massachusetts	130	26,415	110	26,523
New Jersey	71	25,029	47	13,463
New York	88	71,536	42	4,966
Pennsylvania	28	7,766	35	7,761

50 Source: CapIQ. Accessed December 2021.
51 States sorted by number of transactions in 2021.

Number of IPO Transactions by Sector in California and the United States, 2020 and 2021[52]

Primary Sector	2020			2021		
	CA	US	% CA	CA	US	% CA
Biotechnology	136	383		90 ↓	287 ↓	
Health Care Equipment and Services[53]	69	247		40 ↓	196 ↓	
Life Sciences Tools and Services	11	47		13 ↑	51 ↑	
Pharmaceuticals	20	147		22 ↑	123 ↓	
Total U.S. Market	236	824		165 ↓	657 ↓	

52 Source: CapIQ. Accessed December 2021.
53 Health Care Equipment and Services is comprised of the three topics of Healthcare Equipment and Supplies, Providers and Services, and Technology.

Mergers & Acquisitions

M&A within the life sciences industry are sometimes a signal of consolidation but often serve as mechanisms for expansion and reducing risk. Life Sciences M&A activity is fundamentally different than in other sectors because the purpose of acquisition is seldom driven by the desire to eliminate competition. A vast majority of life sciences M&A is aimed at bringing new products to market, either as an expansion of a company's pipeline, or as a partnership deal that allows smaller companies to utilize manufacturing and commercialization know how without incurring redundant costs. As medicine and technology continue to intersect more frequently, life sciences companies are also expanding acquisitions of nontraditional partners such as smaller tech companies with an eye on the evolving use of artificial intelligence to augment R&D or digital biomarkers to validate clinical efficacy. The pandemic has also accelerated the need to acquire expertise with virtual patient engagement tools and the talent to develop the patient-centered health care delivery tools of tomorrow.

Among the top 10 M&A transactions in the healthcare industry across the U.S., two were based in California in 2021. The two top transactions for California in 2021 accounted for a total value of $25.2 billion, primarily driven by a M&A deal in a health care equipment and services company valued at $17.2 billion.

The state has seen an increase in the number of M&A deals in the healthcare industry from 2020 to 2021, but the aggregate transaction amount for these deals dropped slightly to $60.0 billion in 2021 from $61 billion.

Summary of Top 10 M&A Transactions ($ million)[54]

State	Sum Total Transaction Value ($ million)	Number of Transactions
Massachusetts	59,454.5	3
North Carolina	34,493.1	2
United States[55]	26,541.6	1
California	25,160.0	2
Illinois	12,268.8	1
North Dakota	9,563.0	1
Grand Total	**167,480.9**	**10**

The two top transactions for California in 2021 accounted for a total value of $25.2 billion.

54 Source: CapIQ. Accessed December 2021.
55 A specific state is not specified for this transaction.

Top 5 States by Number of M&A Transactions ($ million)[56,57]

State	2020		2021	
	Number of Transactions	Transaction Value ($ million)	Number of Transitions	Transaction Value ($ million)
California	188	61,021	249	60,017
Florida	87	18,694	98	4,234
Texas	98	3,069	94	8,278
Massachusetts	65	43,812	87	78,822
Pennsylvania	61	2,629	77	4,619

Number of M&A Transactions by Sector in California and the United States, 2020 and 2021[58]

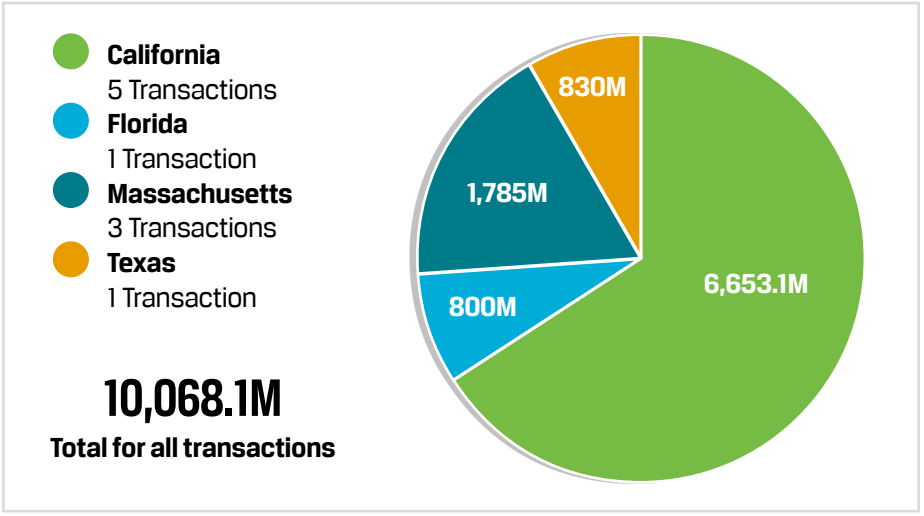
Primary Sector	2020			2021		
	CA	US	% CA	CA	US	% CA
Biotechnology	33	141	**23.4%**	36	137	**26.3%**
Health Care Equipment and Services[59]	119	1,210	**9.8%**	162	1,469	**11.0%**
Life Sciences Tools and Services	8	48	**16.7%**	22	101	**21.8%**
Pharmaceuticals	28	156	**17.9%**	29	166	**17.5%**
Total	**188**	**1,555**	**12.1%**	**249**	**1,873**	**13.3%**

56 Source: CapIQ. Accessed December 2021.
57 States sorted by number of transactions in 2021.
58 Source: CapIQ. Accessed December 2021.
59 Health Care Equipment and Services is comprised of the three topics of Healthcare Equipment and Supplies, Providers and Services, and Technology.

Private Placements

In 2021, five out of the top 10 private placement transactions in the healthcare industry took place in California. The five top transactions for California in 2021 accounted for a total value of $6,653.1 million and were spread across healthcare equipment and services, biotechnology, and life sciences tools and services.

Summary of Top 10 M&A Transactions ($ million)[60]

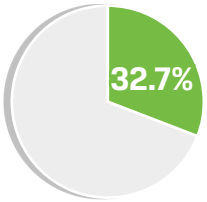
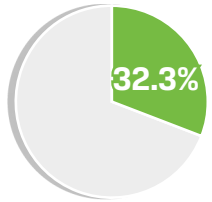
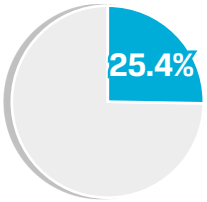
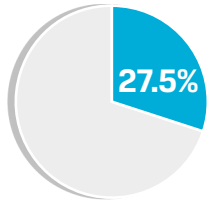
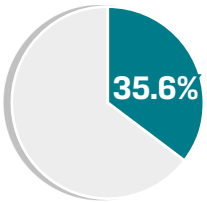
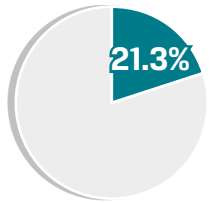
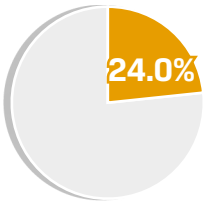
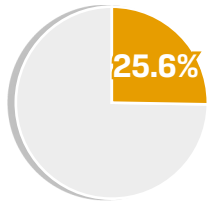
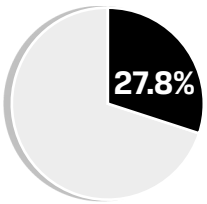
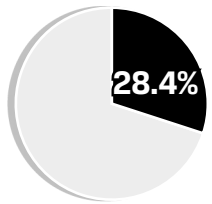


Top 5 States by Number of Private Placement Transactions ($ million)[61,62]

State	2020		2021	
	Number of Transactions	Transaction Value ($ million)	Number of Tranactions	Transaction Value ($ million)
California	746	21,834.4	737	33,237.3
Massachusetts	361	11,714.4	338	17,511.2
New York	233	3,885.5	230	7,604.1
Texas	133	2,033.8	127	3,000.6
Florida	94	466.9	103	2,818.9

60 Source: S&P Capital IQ. Industry classification based on S&P Capital IQ. Accessed December 2021.
61 Source: S&P Capital IQ. Industry classification based on S&P Capital IQ. Accessed December 2021.
62 States sorted by number of transactions in 2021.

Number of Private Placement Transactions by Sector in California and the United States, 2020 and 2021[63]

Primary Sector	2020			2021		
	CA	US	% CA	CA	US	% CA
Biotechnology	255	779		238 ↓	737 ↓	
Health Care Equipment and Services[64]	374	1,472		405 ↑	1,472 =	
Life Sciences Tools and Services	42	118		23 ↓	108 ↓	
Pharmaceuticals	75	312		71 ↓	277 ↓	
Total U.S. Market	746	2,681		737 ↓	2,594 ↓	

63 Source: S&P Capital IQ. Industry classification based on S&P Capital IQ. Accessed December 2021.
64 Health Care Equipment and Services is comprised of the three topics of Healthcare Equipment and Supplies, Providers and Services, and Technology.

Impact of **COVID-19**

Ongoing vaccine development will continue to be important with the inevitability of new strains and the necessity of the COVID-19 vaccines.

COVID-19 VACCINE DEVELOPMENT AND CLINICAL TRIALS

Background

The COVID-19 pandemic brought unprecedented challenges to public health. It quickly became crucial to devote immense resources to healthcare and coordinated global and regional research in ways never seen before.

Vaccines, like other medicines and therapies, undergo years of experimental design, testing, and analysis. mRNA type vaccine research had been underway for years prior to the pandemic, but with the pressing safety concerns and rapid transmission of the virus, additional funds and resource efforts were directed towards treatments that utilized the technology. In a matter of months, new trials were funded, recruited, and adapted to the new challenges of safety and remote options, resulting in a fast-changing environment for clinical trials.

Working closely with regulators and government agencies, in a spirit of collaboration that many believe will be the new model for public private partnerships in a post COVID world, science triumphed. The flexibility and creative desire to identify, address, and overcome challenges created by this global pandemic (such as the need for remote inspections of manufacturing facilities by the FDA) allowed for patients to access diagnostics, testing, and ultimately care in an expedited manner that ultimately brought the world back from the brink of economic collapse.

The pandemic not only altered the research and clinical trial space, but it also drastically changed healthcare as a whole – From how patients are diagnosed and treated, added safety protocols in hospitals such as mask mandates, to telemedicine, at home visits, and more. These changes were brought about by the pressing need for safety measures, allowing for a rapid increase in funding, resources, and widespread adoption that would not have otherwise been possible.

While these changes were a result of the COVID-19 pandemic, they have been proven beneficial to healthcare as a whole and are likely to become permanent widespread adoptions. For instance, telemedicine platforms that have since been rolled out, have proven useful and efficient for when patients are unable or unwilling to come into a physical location, even beyond the necessity for this during the pandemic.[65]

COVID-19 Vaccine Development

As of January 4, 2022, 22 out of 79 COVID-19 vaccine developments in the United States have been sponsored by or primarily supported by organizations in California. This accounts for 27.8% of the vaccine developments run or sponsored by an organization in the United States as a whole, followed by Alabama with 15 vaccine developments accounting for 19.0% of the United States vaccine developments. Out of all 79 COVID-19 vaccine developments, over half of them have clinical trials taking place in California.

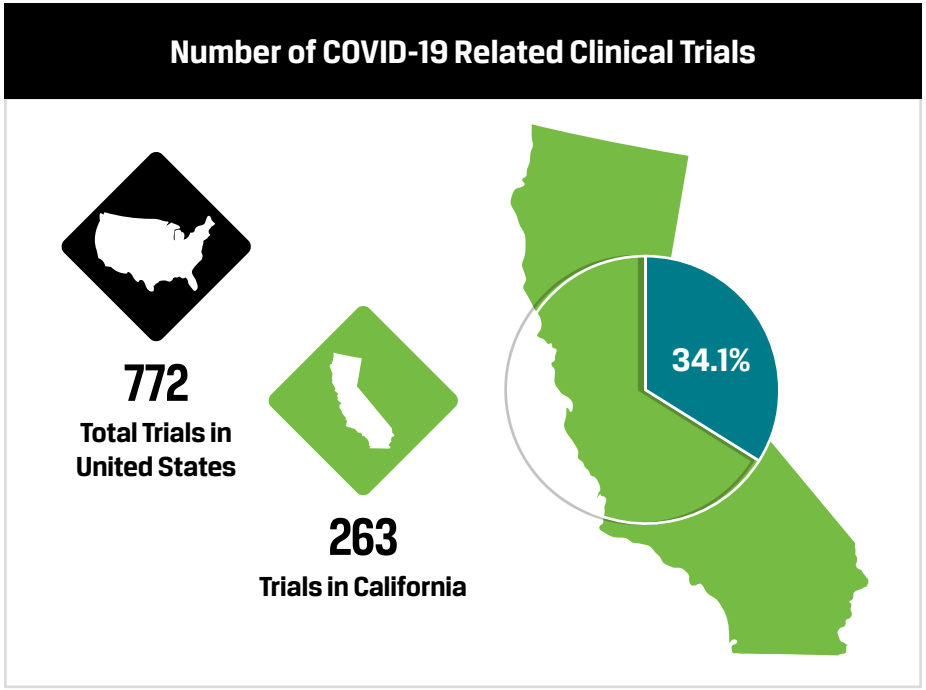
65 Source: IQVIA: "Addressing COVID-19 Impact. Ensuring Progress", Accessed January 2022, https://www.iqvia.com/solutions/research-and-development/covid-19-trial-continuity-and-risk-mitigation-strategies.

COVID-19 Vaccine Developments in the US by State[66]

State	Number of Vaccine Developments[67]
California	22
Alabama	15
Arizona	10
Georgia	8
Maryland	7
Florida	3
New York	2
Kansas	2
Arkansas	2
Kentucky	2
Oregon	1
Phoenix	1
Pennsylvania	1
Illinois	1
Minnesota	1
Michigan	1
United States (Total)	**79**

Looking more broadly at COVID-19 related clinical trials, California accounted for approximately 34% of all clinical trials in the United States related to COVID-19.[68] Unlike the vaccine development data, this includes all studies related to COVID-19, such as studies to test the safety and efficacy of drugs ranging from blood thinners to broad-spectrum antiviral medications for treatment of COVID-19.[69] Out of the total number of COVID-19 related clinical trials in the United States (totaling 783), 264 took place in California.

COVID-19 Related Clinical Trials, 2020-2022[70,71,72]



66 Source: Cochrane Vaccine Mapping Tool: https://covid-nma.com/vaccines/mapping/; Clinicaltrials.gov, data pulled December 2021.
67 This includes vaccine developments that are either sponsored by a US company or provided primary support by a US company. This does not include vaccine developments sponsored or provided primary support from another country that have plans to do clinical testing in the United States.
68 COVID-19 related trials were determined by sorting for the pre-sorted topic area of "COVID-19" in the ClinicalTrials.gov platform.
69 Source: FDA, "FDA Approves First Treatment for COVID-19", released October 22, 2020, https://www.fda.gov/news-events/press-announcements/fda-approves-first-treatment-covid-19
70 This time period signifies the start date of the trials.
71 Source: ClinicalTrials.gov, data pulled January 2022.
72 COVID-19 related Clinical Trials were determined by sorting for the predefined topic of "COVID-19" within the ClinicalTrials.gov tool. COVID-19 Clinical Trials start dates range from 2020 to 2022.

Topical: **Diversity, Equity, and Inclusion**

As part of the annual study this year, CLS sponsored a series of interviews with life sciences sector stakeholders from a variety of organizations, backgrounds, and diverse groups in order to begin to better understand the sector's efforts in 2021 to advance diversity, equity, and inclusion (DE&I) through recruiting, retention, and other means. The organizations included medium and large companies, biotech firms, and consulting firms that maintain programs or initiatives that advance DE&I at their organizations. This topical section catalogues common themes from the stakeholder interviews and presents data from National Science Foundation and Bureau of Labor Statistics that summarize California graduation and workforce statistics by race, ethnicity, and gender, as available.

Thematic Interviews with Stakeholders

The themes that emerged from the stakeholder interviews touched upon multiple aspects of recruiting and retention, as well as broader initiatives to promote employee wellbeing and belonging[73]. Key themes include:

- **The life sciences industry in California is actively working to advance DE&I.** It is widely recognized by all of the interviewees who participated in the exercise that this is an imperative for the industry to thrive and to be a welcoming place for employees, investors and current or future leaders.
- **Most stakeholders noted expansion in employee resource groups at their firm.** Several referenced the establishment of mentoring programs and development programs that focused on developing leaders of diverse backgrounds.
- **Interviewees stressed that advancing DE&I needs to be occurring through various channels**, including its talent acquisition and human resources business processes, employee engagement and wellbeing functions, supply chain management, and core business practices including the conduct of clinical trials.
- Multiple employers report expanding and actively promoting employee resource groups, including groups related to **Black/African American networks, the LGBTQ community, women, and the Hispanic/Latinx community.**
- In some regions of California, high labor costs, long commute times and the expense of relocating employees present challenges to talent attraction in general but also to recruitment from historically excluded communities in particular.
- Following in part from the increase in remote work arrangements during the pandemic, there has been a convergence of workforce flexibility and the opportunity to increase diversity and hiring by recruiting from a larger geographic region.

73 The interviews included a limited set of interviewees across life sciences with extensive involvement in both the industry and its various initiatives in DE&I. As such, the interviews are neither random nor do they seek to suggest the statistical significance associated with large samples. Rather they should be seen as thematic interviews with knowledgeable experts recruited into the interview process for their insights and experience with this important topic.

- **Respondents indicated that early-stage companies do not maintain the same degree of focus on DE&I issues as larger companies.** There may be less diversity among management teams and employees of startups compared with larger companies in life sciences.
- **There is a need to improve disparities in access to capital**, including access to federal grants and awards that are important sources of funding for early stage and mid-stage life sciences companies.
- In addition, there is a need to establish mentor networks among historically excluded communities in order to foster career development for the historically excluded life sciences workforce.
- **With respect to recruitment, companies are increasingly focusing on building their talent pipeline early by developing internships focused on recruiting from a diverse slate of candidates.** The interview process is becoming more representative of diverse candidates by including at least one interviewer from a diverse background in panel interviews.
- With respect to retention, life sciences companies employ a range of approaches, including (i) funding employee resource groups, (ii) providing incentives to foster a sense of belonging at the company, (iii) creating leadership mentoring programs focused on mentoring a diverse pool of future leaders, (iv) sponsoring employee training programs such as implicit bias training, leadership training programs geared towards diverse candidates, and promoting understanding of cultural holidays.
- Interviewees generally noted that the following resources would be helpful in advancing DE&I within the industry:
    - **At the industry level**, promote greater access to capital (e.g., industry capital, publicly funded programs) to companies with a diverse talent pool through encouraging broader education and awareness
    - **At the company level**, appropriate a sufficient budget and commitment to DE&I advancement efforts
    - **At the leadership level**, provide incentives to management teams to motivate and advance DE&I initiatives and aspirations
    - **At the industry level**, a forum for broader conversations about advancing DE&I in order to provide collective options for advancing DE&I.

Education

Graduates in California with degrees in life sciences-related fields self-identify across a variety of race, ethnicity, gender, and citizenship categories. Over the last five years from 2015 to 2019, there has been significant growth in the total number of graduates in life sciences-related fields of study in California. In particular, Hispanic and Latino graduates in California increased by 64.5%, well above the percentage increase in Hispanic and Latino graduates in the U.S.

In 2019, female life sciences graduates made up 62.7% across all degree levels in California (i.e., Bachelor's degree and higher) and 61.7% across all degree levels in the United States as a whole. Graduates who identified as either Hispanic/Latino or non-white non-Hispanic made up 68.4% of California graduates in the life sciences, compared to 43.5% in the United States as a whole. This is mainly driven by the higher percentage of Asian, non-Hispanic graduates, with 26.7% in California, which is 14.9% higher than the United States percentage of 11.8%.

Race and Ethnicity of Life Sciences Graduates, Bachelors and Above, in California and the United States[74]

Race and Ethnicity	California			United States		
	2015	2019	Pct Growth	2015	2019	Pct Growth
Total	**19,376**	**22,924**	18.3%	**172,000**	**192,592**	12.0%
Hispanic or Latino (all races)	3,204	5,271	64.5%	15,037	22,727	51.1%
American Indian or Alaska Native, non-Hispanic	50	56	12.0%	756	751	-0.7%
Asian, non-Hispanic	5,907	6,120	3.6%	20,403	22,733	11.4%
Black or African American, non-Hispanic	416	521	25.2%	10,376	12,868	24.0%
Native Hawaiian or Other Pacific Islander, non-Hispanic	79	63	-20.3%	408	321	-21.3%
White, non-Hispanic	6,882	7,252	5.4%	103,623	108,849	5.0%
Two or more races, non-Hispanic	972	1,284	32.1%	5,292	7,516	42.0%
Other or unknown race or ethnicity, non-Hispanic	1,000	837	-16.3%	6,663	5,534	-16.9%
Temporary visa holder[75]	866	1,520	75.5%	9,442	11,293	19.6%

Gender of Life Sciences Graduates, Bachelors and Above, in California and the United States[76]

Sex	California			United States		
	2015	2019	Pct Growth	2015	2019	Pct Growth
Total	**19,376**	**22,924**	18.3%	**172,000**	**192,592**	12.0%
Female	11,394	14,378	26.2%	99,886	118,775	18.9%
Male	7,982	8,546	7.1%	72,114	73,817	2.4%

74 Source: NSF, National Center for Science and Engineering Statistics, IPEDS Completions Survey from Department of Education. Accessed December 2021. Figures represent number of degrees awarded by year.

75 Temporary visa holder falls into the category of "Other descriptive categories" within the race and ethnicity category for demographic characteristics, as they are broken out from the other race and ethnicity categories. Nonresident alien (temporary visa holder) is defined as "A person who is not a citizen or national of the United States and who is in this country on a visa or temporary basis and does not have the right to remain indefinitely."

76 Source: NSF, National Center for Science and Engineering Statistics, IPEDS Completions Survey from Department of Education. Accessed December 2021.

California **Workforce**

California Health and Life Sciences Workforce[77]

Over the 6-year period from 2015 to 2020, the proportion of total California health and life sciences employees that identify as other than non-white and non-Hispanic has increased 1.8 percentage points to make up about 34.6% of the workforce; conversely, the proportion of white employees decreased by 1.8 percentage points over the same period. The proportion of Asian life sciences workforce in California saw the greatest percentage point increase in employment over the 2015 to 2020 time period.

Progress in diversity measured by gender and ethnicity has also been made over the 2015 to 2020 period. **The proportion of female life sciences[78] employees increased by about 1.3% relative to males. Similarly, the proportion of Hispanic or Latino employees increased by about 1.8% relative to non-Hispanic or Latino.**

Compared to the total workforce across all industries in California, the proportion of other than non-white, non-Hispanic employees in the health and life sciences sector is 7.0 percentage points lower. The proportion of male employees in the health and life sciences industries is about 60%, whereas the proportion of male vs. female employees in the total workforce are approximately evenly split. Additionally, the proportion of the other than non-white, non-Hispanic workforce in the health and life sciences industries is about 13.2 percentage points lower than that of the total workforce.

Health and Life Sciences Workforce by Race in California, 2015-2020

	2015	2018	2019	2020
American Indian or Alaska Native Alone	0.8%	0.9%	0.9%	0.9%
Asian Alone	26.9%	27.4%	27.6%	27.9%
Black or African American Alone	3.7%	3.9%	4.0%	4.0%
Native Hawaiian or Other Pacific Islander Alone	0.4%	0.4%	0.5%	0.5%
Two or More Race Groups	2.7%	3.0%	3.0%	3.1%
White Alone	65.4%	64.4%	64.1%	63.6%
Total	100.0%	100.0%	100.0%	100.0%

77 Source: U.S. Census Quarterly Workforce Indicators (QWI) Data.
78 Data for the life sciences industry is available at 4-digit NAICS level only and may include sectors that do not appear in the life sciences definition presented in the Appendix of this report.

Health and Life Sciences Workforce by Sex in California, 2015-2020

	2015	2018	2019	2020
Female	38.4%	39.1%	39.4%	39.6%
Male	61.6%	60.9%	60.6%	60.4%
Total	100.0%	100.0%	100.0%	100.0%

Health and Life Sciences Workforce by Ethnicity in California, 2015-2020

	2015	2018	2019	2020
Hispanic or Latino	20.2%	21.3%	21.9%	22.0%
Not Hispanic or Latino	79.8%	78.7%	78.1%	78.0%
Total	100.0%	100.0%	100.0%	100.0%

Total Workforce by Race in California, 2015-2020

	2015	2018	2019	2020
American Indian or Alaska Native Alone	1.5%	1.5%	1.5%	1.5%
Asian Alone	16.0%	16.4%	16.6%	16.8%
Black or African American Alone	6.9%	7.1%	7.2%	7.1%
Native Hawaiian or Other Pacific Islander Alone	0.6%	0.6%	0.6%	0.6%
Two or More Race Groups	3.1%	3.3%	3.3%	3.3%
White Alone	72.0%	71.1%	70.8%	70.7%
Total	100.0%	100.0%	100.0%	100.0%

Total Workforce by Sex in California, 2015-2020

	2015	2018	2019	2020
Female	48.4%	48.6%	48.8%	48.6%
Male	51.6%	51.4%	51.2%	51.4%
Total	100.0%	100.0%	100.0%	100.0%

Total Workforce by Ethnicity in California, 2015-2020

	2015	2018	2019	2020
Hispanic or Latino	33.6%	34.7%	35.0%	35.2%
Not Hispanic or Latino	66.4%	65.3%	65.0%	64.8%
Total	100.0%	100.0%	100.0%	100.0%

Top Five Industry by **Employment for MSAs**

Los Angeles-Long Beach-Anaheim MSA

Industry	Total Employment
Wholesale - Drugs and druggists sundries	16,446
Scientific research and development services	14,215
Wholesale - Professional and commercial equipment and supplies	13,294
Medical and diagnostic laboratories	12,797
Surgical and medical instrument manufacturing	12,652

San Francisco-Oakland-Hayward MSA

Industry	Total Employment
Pharmaceutical preparation manufacturing	11,418
Surgical and medical instrument manufacturing	6,615
Medical and diagnostic laboratories	5,574
Management of companies and enterprises	5,106
Wholesale - Drugs and druggists sundries	4,307

San Diego-Carlsbad MSA

Industry	Total Employment
Scientific research and development services	30,492
Other real estate	9,931
Employment services	5,796
Management of companies and enterprises	5,437
Electromedical and electrotherapeutic apparatus manufacturing	4,511

San Jose-Sunnyvale-Santa Clara MSA

Industry	Total Employment
Scientific research and development services	12,100
Electromedical and electrotherapeutic apparatus manufacturing	4,033
Surgical and medical instrument manufacturing	2,134
Analytical laboratory instrument manufacturing	2,079
In-vitro diagnostic substance manufacturing	2,000

Appendix

Life Sciences Definition

CLS instructed KPMG to use the definition of life sciences sector and employment sharing factors for industries that are partially attributable to life sciences based on research conducted by TEConomy. KPMG did not perform independent research to verify the completeness or accuracy of the definition, or the employment sharing factors provided by TEConomy.

TEConomy's definition of life sciences includes 25 six-digit North America Industry Classification System (NAICS) industry codes. Out of the 25 NAICS industry codes, six of them were classified as partially attributable to life sciences, with less than 100.0 percent of QCEW employment and wages attributable to the life sciences definition. The life sciences NAICS codes along with their respective "employment sharing" percentages are shown below.

TEConomy's Definition of Life Sciences Sector

NAICS Code	NAICS Description	Category
311221	Wet Corn Milling	Agricultural Feedstock & Industrial Biosciences
311224	Soybean and Other Oilseed Processing	Agricultural Feedstock & Industrial Biosciences
325193	Ethyl Alcohol Manufacturing	Agricultural Feedstock & Industrial Biosciences
325311	Nitrogenous Fertilizer Manufacturing	Agricultural Feedstock & Industrial Biosciences
325312	Phosphatic Fertilizer Manufacturing	Agricultural Feedstock & Industrial Biosciences
325314	Fertilizer (Mixing Only) Manufacturing	Agricultural Feedstock & Industrial Biosciences
325320	Pesticide and Other Agricultural Chemical Manufacturing	Agricultural Feedstock & Industrial Biosciences
325411	Medicinal and Botanical Manufacturing	Drugs & Pharmaceuticals
325412	Pharmaceutical Preparation Manufacturing	Drugs & Pharmaceuticals
325413	In-Vitro Diagnostic Substance Manufacturing	Drugs & Pharmaceuticals
325414	Biological Product (except Diagnostic) Manufacturing	Drugs & Pharmaceuticals
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing	Medical Devices & Equipment

NAICS Code	NAICS Description	Category
334516	Analytical Laboratory Instrument Manufacturing	Medical Devices & Equipment
334517	Irradiation Apparatus Manufacturing	Medical Devices & Equipment
339112	Surgical and Medical Instrument Manufacturing	Medical Devices & Equipment
339113	Surgical Appliance and Supplies Manufacturing	Medical Devices & Equipment
339114	Dental Equipment and Supplies Manufacturing	Medical Devices & Equipment
423450	Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers	Bioscience-related Distribution
424210	Drugs and Druggists' Sundries Merchant Wholesalers	Bioscience-related Distribution
424910	Farm Supplies Merchant Wholesalers	Bioscience-related Distribution
541380	Testing Laboratories	Research, Testing, & Medical Laboratories
541713	Research and Development in Nanotechnology	Research, Testing, & Medical Laboratories
541714	Research and Development in Biotechnology (except Nanobiotechnology)	Research, Testing, & Medical Laboratories
541715	Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)	Research, Testing, & Medical Laboratories
621511	Medical Laboratories	Research, Testing, & Medical Laboratories

Employment and **Wage Data**

The model used to estimate the economic contribution of the life sciences sector on the California economy relied on data from a variety of sources. The direct employment and wage data for the life sciences in California were used to inform the model. This data was primarily derived from the Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages (QCEW). QCEW data shows employment and wages as reported by employers and covers more than 95.0 percent of U.S. jobs at the national, state, metropolitan statistical area, and county level. Data is aggregated starting at the 6-digit NAICS industry level.

It is important to note that BLS suppresses certain individually identifiable information under the Confidential Information Protection and Statistical Efficiency Act of 2002 (CIPSEA). As a result, **up to 12% of employee data and 14% of wage data is suppressed at the data's most granular level.** As a result, analyses that are concluded for very specific industries or geographies are potentially underestimated.

Economic Contribution **Analysis Methodology**

This section provides a high-level summary of the methodology used to analyze the economic contribution of the life sciences sector in California. It covers the models used, data, and the assumptions used for analysis.

The IMPLAN model was used to assess the economic and fiscal contributions of the life sciences sector. IMPLAN, a proprietary model maintained by the IMPLAN Group LLC, is a widely accepted framework for analyzing the effects of an economic stimulus on a region. IMPLAN's data is partly based on the Bureau of Economic Analysis input-output tables. The input-output tables show relationships among different industries in the production of goods and services. They also display connections between consumers (including households and governments) and the various producing industries. This study analyzes the state of California as well as four major California MSAs including Los Angeles-Long Beach-Anaheim MSA, San Diego-Carlsbad MSA, San Francisco-Oakland-Hayward MSA, and San Jose-Sunnyvale-Santa Clara MSA. The analyses of the aforementioned four geographic areas relies on the IMPLAN 546-industry sector model.

The analysis involves the following steps:

- Obtained wage and employment data for six-digit life sciences NAICS code from the Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages (QCEW).[79]
- Adjust QCEW's wage to include benefits and contributions using methodology suggested by IMPLAN.
- Configure the model inputs and run them through IMPLAN.

79 Additional information about the acquisition of employment and wage data is included in the Appendix section "Employment and Wage Data" above.

Additional **Analysis Data**

Location Quotient by NAICS Codes[80]

NAICS	NAICS Description	Category	2005	2010	2015	2020
311221	Wet Corn Milling	Agricultural Feedstock & Industrial Biosciences	0.36	0.26	n/a	n/a
311224	Soybean and Other Oilseed Processing	Agricultural Feedstock & Industrial Biosciences	n/a	n/a	n/a	n/a
325193	Ethyl Alcohol Manufacturing	Agricultural Feedstock & Industrial Biosciences	n/a	n/a	0.15	0.16
325311	Nitrogenous Fertilizer Manufacturing	Agricultural Feedstock & Industrial Biosciences	1.38	0.37	0.44	0.65
325312	Phosphatic Fertilizer Manufacturing	Agricultural Feedstock & Industrial Biosciences	0.36	0.37	0.42	0.48
325314	Fertilizer (Mixing Only) Manufacturing	Agricultural Feedstock & Industrial Biosciences	0.91	0.94	1.04	1.09
325320	Pesticide and Other Agricultural Chemical Manufacturing	Agricultural Feedstock & Industrial Biosciences	0.33	0.26	0.27	0.35
325411	Medicinal and Botanical Manufacturing	Drugs & Pharmaceuticals	0.95	1.06	1.59	1.46
325412	Pharmaceutical Preparation Manufacturing	Drugs & Pharmaceuticals	1.22	1.36	1.47	1.18
325413	In-Vitro Diagnostic Substance Manufacturing	Drugs & Pharmaceuticals	2.67	2.67	2.33	2.58
325414	Biological Product (except Diagnostic) Manufacturing	Drugs & Pharmaceuticals	1.16	0.89	0.77	0.62
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing	Medical Devices & Equipment	1.91	1.62	1.67	2.48
334516	Analytical Laboratory Instrument Manufacturing	Medical Devices & Equipment	3.00	2.72	2.19	2.07
334517	Irradiation Apparatus Manufacturing	Medical Devices & Equipment	0.77	0.88	1.37	1.51
339112	Surgical and Medical Instrument Manufacturing	Medical Devices & Equipment	1.63	1.80	1.70	1.80
339113	Surgical Appliance and Supplies Manufacturing	Medical Devices & Equipment	1.03	1.02	0.91	0.90
339114	Dental Equipment and Supplies Manufacturing	Medical Devices & Equipment	2.22	2.24	2.04	1.85
541714	Research and Development in Biotechnology (except Nanobiotechnology)	Research, Testing, & Medical Laboratories	n/a	n/a	n/a	2.05
621511	Medical Laboratories	Research, Testing, & Medical Laboratories	1.16	1.27	1.13	1.18

80 Certain data in the Agricultural Feedstock & Industrial Biosciences industry is unavailable due to data suppression. Data for "Research and Development in Biotechnology (except Nanobiotechnology)" is unavailable prior to 2017 since it is a new NAICS code.

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About California Life Sciences (CLS)

California Life Sciences (CLS) is the state's most influential and impactful life sciences membership organization, advocating for the sector and its diverse innovation pipeline. For more than 30 years, CLS has served the community by supporting companies of all sizes, from early-stage innovators and startups to established industry leaders in the fields of biotechnology, pharmaceuticals, and medical technology. As integral components of a healthy and collaborative ecosystem, CLS also works closely with universities, academic and research institutions, the investment community, and other critical partners that promote this vibrant sector. With offices in South San Francisco, San Diego, Sacramento, Los Angeles, and Washington DC, CLS works to shape public policy, improve access to breakthrough technologies, educate lawmakers, and advance equity within our ecosystem by championing innovative solutions for some of the most pressing challenges of our times. In doing so, CLS fulfills its mission to protect and nurture California's life sciences industry, empowering discoveries that lead to healthier lives around the world. #WeAreCaliforniaLifeSciences

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