CALIFORNIA
LIFE SCIENCES

# SECTOR REPORT 2023

## FOREWORD

California Life Sciences (CLS) engaged KPMG LLP (KPMG) to complete an economic contribution analysis of the life sciences sector in the State of California during the calendar years 2021 and 2022 based on the recency of available data. As contained in this report, KPMG's work includes an assessment of the sector's contributions to California as a whole as well as major metropolitan area economies within the state. The economic contribution analysis not only summarizes the direct contributions of life sciences firms but also the indirect and induced effect on supplying industries, as well as the economic contribution from wages and salaries of life sciences employees and employees along the industry's supply chain spent throughout the state economy.

This assessment also provides an overview of indicators of the life sciences sector's competitive position in California relative to peer states. In preparing the overview, KPMG reviewed the current levels of life sciences activity in historically prevalent states and finds that the sector's size in California has increased (relative to the US average of life sciences activity), as has the number of patents, venture capital activity, and other indicators of relative competitiveness and output. The report also finds that California remains a center of educational and technical training for the next generation of life sciences entrepreneurs and employees.

Finally, this report includes a special focus on the state of diversity, equity, and inclusion (DEI) in life sciences. DEI is an issue of primary importance to the future of the life sciences sector because it impacts future workforce, growth, and career advancement for its workers while also important for equitable access to healthcare for current and future generations. On behalf of CLS, KPMG gathered insights regarding the sector's DEI journey and remaining challenges from a broad sample of participants, including executives, nonprofits, founders, mentors, and DEI leaders. The DEI section presents an overview of the themes, perspectives, and feedback gathered through a series of in-depth interviews with these industry stakeholders with the goal of contributing a deeper and more nuanced understanding of the status of DEI within the sector.

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# Contents


Letter to Stakeholders ..... 1

California Life Sciences Sector At A Glance ..... 2

Heart Of The Economy ..... 5

Size And Distribution ..... 11

Economic Contribution ..... 12

Research And Academic Excellence ..... 14

Research Excellence ..... 17

California: Funding By Organizations And Congressional Districts ..... 19

Economic Impact Of NIH Research ..... 21

R&D Expenditures ..... 23

Patents By State ..... 27

Attracting Capital ..... 28

Diversity, Equity, And Inclusion ..... 32

Education ..... 35

California Workforce ..... 37

Workforce Trends ..... 39

Impact Of The Inflation Reduction Act (IRA) On Life Sciences Innovation ..... 41

Appendix ..... 47


# Letter to **Stakeholders**

Dear Stakeholders,

Left to right: Julie Boyd, Isabele Bueso, Mike Guerra

Early last year, I was moved by a patient's testimony shared at the State Capitol in Sacramento. CLS worked in partnership with the Rare Disease Caucus to put together a hearing for lawmakers to hear from rare disease patients and their families throughout the state about the policy priorities around rare disease treatments. Isabele Bueso began to share her journey getting diagnosed with Maroteaux-Lamy Syndrome as a baby–a rare disease that causes a buildup of complex sugar that damages the heart, skeleton, and other organs. This diagnosis was the beginning of a long journey for her family, searching for care and a treatment that did not yet exist.

Eventually, Isabele and her family found a clinical trial in California with CLS member company, Ultragenyx. When predicted outcomes were bleak, they found hope. The trial was successful, and the treatment was approved by the FDA. Now, Isabele is a patient advocate for Ultragenyx, bravely sharing her story at hospitals, schools, companies, and with lawmakers to advocate for legislation that provides better access to innovative cures and treatment for people living with rare diseases.

Isabele's story is one of many–people who've had their lives changed or saved by the scientific advancements happening in our state. California remains the best in the nation for scientific innovation–with the brightest scientists, researchers, developers. Our life sciences' sector doesn't just provide medical breakthroughs, it develops tools to improve agriculture, increase clean energy production, mitigate climate change, and much more. When new challenges arise, the world looks to the life sciences sector to solve them.

That's why we must foster an environment where innovation can thrive. In a year when our sector supported more than a million jobs and produced nearly $472 billion, our work also faced serious headwinds from harmful policies like the Inflation Reduction Act. In this sector report, you'll see just how much is at risk if we do not protect innovation. These challenging times have not curbed our sector's desire and drive to innovate. We will not stop. More needs to be done to improve patients' access to therapies, and that is a focus of our advocacy and mission.

California's life sciences legacy is long—the birthplace of biotech, the creation of COVID-19 vaccines—and the findings in this report point to that legacy and leadership growing further.

Sincerely,

Mike Guerra
*President & CEO, California Life Sciences*

# California Life Sciences
# Sector At A Glance

## California's life sciences sector contributed significantly to the growth of the state economy, advancing innovation and human health, and training the future generations of life sciences workforce and leadership.

- **The life sciences sector and its supply chain produced an estimated $472 billion in economic output for the California economy during 2021.** This is an increase of $61 billion from last year's report. The sector also contributed $58 billion in total tax revenues while supporting more than one million jobs.[1] For every one employee within the life sciences sector during 2021, 2.3 additional jobs were created or supported in other California industries.
- **The number of life sciences establishments has grown 6 percent since 2020**[2]
- **California increased its lead as a center for the nation's research activities.** In 2021, research and development (R&D) expenditures totaled $7.1 billion, making up almost 14.0 percent of the total US life sciences R&D expenditures. Over the five-year period from 2017 to 2021, California experienced tremendous growth in R&D expenditures, with a total increase of nearly 25 percent, exceeding the national growth rate over that period by 3.5 percent.
- **In 2022, California was the top state in funding awarded by the National Institutes of Health (NIH) and National Science Foundation (NSF), receiving $5.5 billion and $97.3 million, respectively.** California's NSF funding represented approximately 13.0 percent of total NSF awards in the US, double the number of awards of the next-most-awarded state, New York.
- **Venture capital investment increased more than 50 percent from $11.4 billion in 2019 to $17.3 billion in 2022.**
- **California had the largest number of patents awarded per 1,000 individuals,** which indicates that new goods and services are entering the market, driving innovation and competition in the healthcare industry.


1 All economic contributions are presented in 2022 dollars.
2 Source: KPMG's analysis of The Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW) Data

**The following tables show summary statistics for the main points summarized above.** The tables include results regarding the California life sciences economic and fiscal contribution, investments and exports, establishment count, subsector breakdown, and peer state comparison.

## Estimated Economic Contribution Of The California Life Sciences Sector In 2021

### Overview[3]

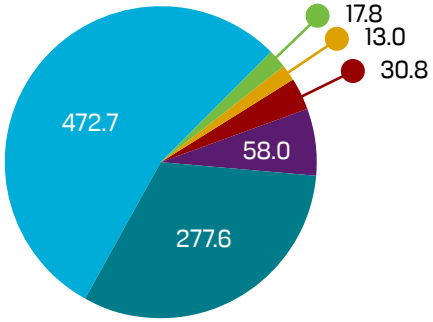
**335,231**
Total Estimated Direct Life Sciences Employment[4]

**54.6**
Total Estimated Wages Paid To Life Sciences Employees ($ billions)

**162,869**
Average Life Sciences Sector Wage ($)

**13,689**
Number of Life Sciences Establishments

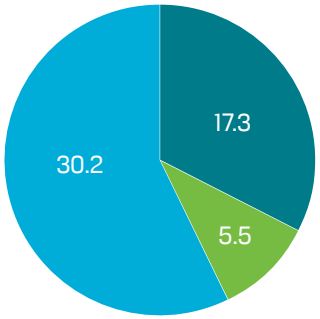
### Economic & Fiscal Contributions[5]




**1,105,525**
Total Estimated Direct, Indirect, and Induced Employment [6]

- Total estimated direct economic output ($ billions)
- Total estimated direct, indirect, and induced economic output ($ billions)
- Estimated direct federal taxes ($ billions)
- Estimated direct state and local taxes ($ billions)
- Total estimated direct tax contribution ($ billions)
- Total estimated direct, indirect, and induced tax contribution ($ billions)

### Investments and Exports[7]



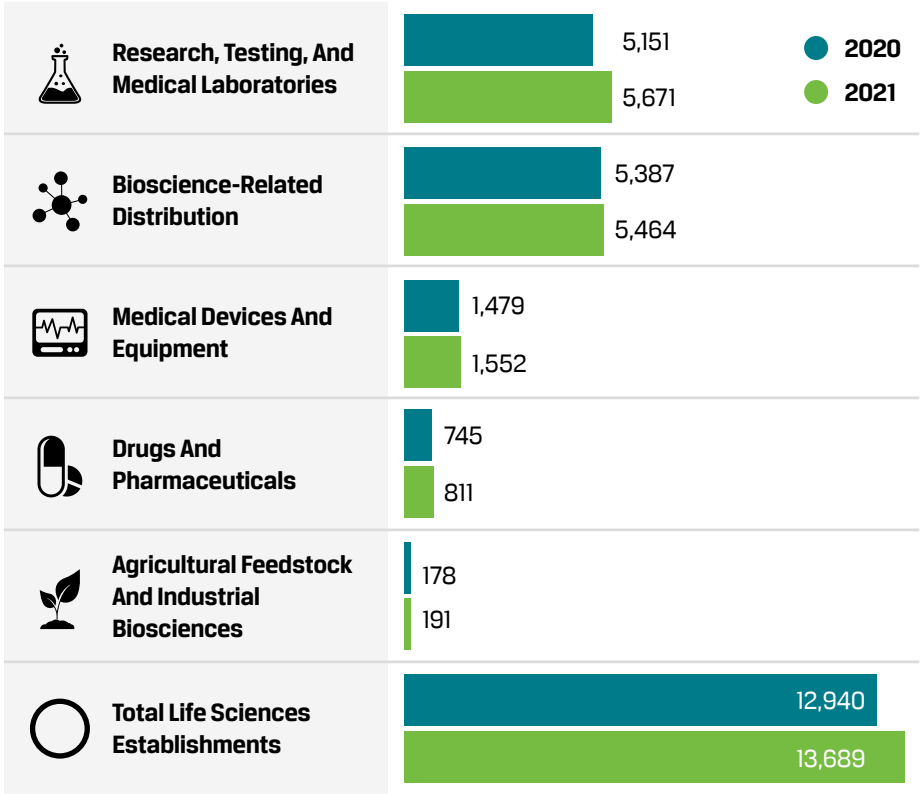

**896**
Total Biodiesel Production (thousand barrels)

**2,710**
Total Ethanol Production (thousand barrels)

- Total life sciences venture capital investments, 2022 ($ billions)
- Total NIH grants awarded, FY 2022 ($ billions)
- Total biomedical exports ($ billions)

3 Source: KPMG's analysis of The Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW) Data
4 Employment does not include FTEs.
5 IMPLAN model, 2021 Data, using inputs provided by the user and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Drive, Suite 120, Huntersville, NC 28078, www.IMPLAN.com
6 Values not additive
7 Sources: (4) National Institute of Health (NIH) and (5) US Census Bureau USA Trade Online

## Total Establishments By Life Sciences Sector In California: 2020 Versus 2021[8]




## Employee Growth by State, 2016 and 2021[9, 10]

| Rank | State | 2016 | 2021 | Percent Change |
|---|---|---|---|---|
| 1 | California | 115,673 | 130,911 | 13.2% |
| 2 | Indiana | 37,005 | 40,676 | 9.9% |
| 3 | Illinois | 39,556 | 40,077 | 1.3% |
| 4 | New Jersey | 33,595 | 38,669 | 15.1% |
| 5 | Pennsylvania | 34,750 | 38,228 | 10.0% |
| 6 | Minnesota | 32,561 | 36,864 | 13.2% |
| 7 | New York | 32,926 | 36,406 | 10.6% |
| 8 | North Carolina | 29,705 | 33,371 | 12.3% |
| 9 | Massachusetts | 31,732 | 32,772 | 3.3% |
| 10 | Texas | 27,041 | 31,982 | 18.3% |

8 Source: KPMG's analysis of The Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW) Data
9 Source: KPMG's analysis of The Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW) Data
10 Not all sectors are shown due to different data source disclosure requirements over the five-year span

# Heart Of **The Economy**

## Employment, Establishments, and Wages[11]

**The life sciences[12] sector is a central piece of California's economy and a major contributor to the state's economic growth. In 2021, it directly employed 335,000 workers with an average wage of $162,869. The average wage was more than double the average for the life sciences sector in the US ($67,609) and significantly higher than the average for all other industries in California ($85,126).**

**Consistent with California's leading role as a R&D hub, the largest life sciences subsector was research, testing, and medical laboratories, making up 41 percent of total employment.** Research, testing, and medical laboratories, which require highly specialized workers, generated the highest average wages and the largest number of employees in 2021. The subsector saw a 15 percent growth in average wage and 11.4 percent growth in employment from 2020 to 2021, compared to a 3 percent in average wage and 7 percent growth in employment for the entire sector. This is most likely associated with the 24 percent surge in research and development funding in California.

Strong growth was also recorded for a number of establishments in the life sciences sector. The largest increase was a 10 percent growth in the research, testing, and medical laboratories subsector. This subsector also makes up 41 percent of the total life sciences establishments in the state.

### California Life Sciences Employment, Establishments, And Average Wages By Sector, 2020–2021

| Life Sciences Category | 2020 | | | 2021 | | |
|---|---|---|---|---|---|---|
| | Employees | Establishments | Average Wages ($) | Employees | Establishments | Average Wages ($) |
| Research, Testing, & Medical Laboratories | 123,080 | 5,151 | 195,119 | 137,133 | 5,671 | 201,139 |
| Medical Devices & Equipment | 75,069 | 1,479 | 127,923 | 77,613 | 1,552 | 132,200 |
| Bioscience-related Distribution | 65,794 | 5,387 | 121,761 | 67,187 | 5,464 | 125,401 |
| Drugs & Pharmaceuticals | 46,439 | 745 | 168,004 | 49,204 | 811 | 162,825 |
| Agricultural Feedstock & Industrial Biosciences | 2,848 | 178 | 81,723 | 4,094 | 191 | 77,839 |
| **Total** | **313,230** | **12,940** | **$ 158,555** | **335,231** | **13,689** | **$ 162,869** |

11 Source: KPMG's analysis of The Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW) Data

12 KPMG relied on the definition and broad categorizations of life sciences industries from research conducted by the CLS partner organization, TEConomy. The definition includes industries of research, testing, and medical laboratories; drugs and pharmaceuticals; medical devices and equipment; bioscience-related distribution; and agricultural feedstock and industrial biosciences.

## California Growth In Life Sciences Category Employees, 2016–2021[13]

| Rank | Life Sciences Category | 2020 | | 2021 | | Percent Change | |
|---|---|---|---|---|---|---|---|
| | | Employees | Average Wages ($) | Employees | Average Wages ($) | Employees | Average Wages ($) |
| 1 | Agricultural Feedstock & Industrial Biosciences | 2,461 | 72,092 | 4,094 | 77,839 | 66.36% | 79.62% |
| 2 | Medical Devices & Equipment | 62,792 | 104,010 | 77,613 | 132,200 | 23.60% | 57.10% |
| 3 | Drugs & Pharmaceuticals | 50,420 | 152,769 | 49,204 | 162,825 | -2.41% | 4.01% |

# Employment, Establishments, And Wages By California MSA[14]

**Comparing the sector in different metropolitan standard areas (MSAs) is instructive and shows that life sciences has different functions by location.** Out of the California MSAs, Los Angeles – Long Beach – Anaheim MSA had the largest workforce of about 89,000 employees, yet it had the lowest average wage among the top five MSAs. This implies that the Los Angeles MSA is characterized by relatively lower-paying jobs within the life sciences sector. Although the San Francisco – Oakland – Hayward MSA has much lower employment, it paid the highest average wage of $240,539, representing a 23 percent increase from 2020. This was primarily driven by a surge in the research, testing, and medical laboratories subsector's employment.

## Life Sciences Employment And Average Wages By Top Four MSAs, 2020–2021[15]

| Metropolitan Statistical Area (MSA) | 2020 | | 2021 | |
|---|---|---|---|---|
| | Employees | Average Wages ($) | Employees | Average Wages ($) |
| Los Angeles-Long Beach-Anaheim | 88,846 | 107,141 | 88,915 | 105,360 |
| San Francisco-Oakland-Hayward | 35,981 | 196,125 | 67,482 | 240,539 |
| San Diego-Carlsbad | 52,952 | 164,425 | 58,516 | 170,408 |
| San Jose-Sunnyvale-Santa Clara | 24,684 | 203,135 | 19,070 | 165,116 |

13 Not all sectors are shown due to different data source disclosure requirements over the five-year span
14 Source: KPMG's analysis of The Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW) Data
15 Table does not include all MSAs within California.

**The life sciences workforce in the Los Angeles MSA mostly comprises the manufacturing and wholesale subsectors.** Although these sub-sectors have the most employees, they consist of a low establishment count compared to other life sciences subsectors. This indicates that although the Los Angeles MSA is mostly employed by medical devices and equipment workers, most of the life sciences presence is made up of smaller research, testing, and medical laboratories and bioscience-related distribution establishments with very few employees.

## Los Angeles MSA Employment, Establishments, And Average Wages By Life Sciences Subsector

| Life Sciences Category | Employment | Establishments | Average Wages ($) |
|---|---|---|---|
| Research, Testing, And Medical Laboratories | 22,802 | 1,218 | 99,904 |
| Medical Devices And Equipment | 30,298 | 475 | 120,659 |
| Bioscience-Related Distribution | 24,813 | 1,942 | 101,676 |
| Drugs And Pharmaceuticals | 11,002 | 273 | 82,849 |
| Agricultural Feedstock And Industrial Biosciences | – | 18 | – |

**In the San Diego MSA, more than half of the life sciences workforce is in the research, testing, and medical laboratories subsector, with the main type of work including research and development in biotechnology.** Although research, testing, and medical laboratories subsector contains more than 50 percent of life sciences employment, the drugs and pharmaceuticals and medical devices and equipment subsectors have very strong concentrations within the San Diego MSA compared to the United States as well.

## San Diego MSA Employment, Establishments, And Average Wages By Life Sciences Subsector

| Life Sciences Category | Employment | Establishments | Average Wages ($) |
|---|---|---|---|
| Research, Testing, And Medical Laboratories | 32,704 | 978 | 187,436 |
| Medical Devices And Equipment | 11,626 | 185 | 140,316 |
| Bioscience-Related Distribution | 5,483 | 429 | 162,229 |
| Drugs And Pharmaceuticals | 8,703 | 130 | 151,771 |
| Agricultural Feedstock And Industrial Biosciences | – | 5 | – |

**The San Francisco MSA is defined by a strong presence of medical research employees who receive high wages compared to employees in the rest of California.** This is primarily driven by the concentration of universities in the area. The presence of higher education universities creates an environment that is conducive to the growth of the research, testing, and medical laboratories sub-sector compared to other life sciences subsectors.

## San Francisco Employment, Establishments, And Average Wages By Life Sciences Subsector

| Life Sciences Category | Employment | Establishments | Average Wages ($) |
|---|---|---|---|
| Research, Testing, And Medical Laboratories | 48,372 | 1,197 | 271,570 |
| Medical Devices And Equipment | 11,198 | 248 | 140,206 |
| Bioscience-Related Distribution | 3,848 | 419 | 171,333 |
| Drugs And Pharmaceuticals | 4,065 | 117 | 213,189 |
| Agricultural Feedstock And Industrial Biosciences | – | 6 | – |

**The San Jose MSA life sciences employees are mostly in the laboratory instrument, surgical instrument, and electromedical apparatus manufacturing industries.** The medical devices and equipment subsector is the driving force of the life sciences sector within the San Jose MSA and is extremely concentrated in the region. Unlike the proximate region of San Francisco, the San Jose MSA differs in that the manufacturing of medical devices is the focus of the region rather than medical research and development.

## San Jose Employment, Establishments, And Average Wages By Life Sciences Subsector

| Life Sciences Category | Employment | Establishments | Average Wages ($) |
|---|---|---|---|
| Research, Testing, And Medical Laboratories | 3,857 | 520 | 203,985 |
| Medical Devices And Equipment | 9,501 | 183 | 160,837 |
| Bioscience-Related Distribution | 1,257 | 155 | 155,218 |
| Drugs And Pharmaceuticals | 4,454 | 34 | 143,379 |
| Agricultural Feedstock And Industrial Biosciences | – | 3 | – |

# Employment, Establishments, And Wages By California County[16]

**Different trends in the life sciences sector are also observed at the county level.** San Diego County had the largest number of employees out of all California counties, and San Mateo County, which ranked fourth in terms of number of employees, had the highest average wage at over $320,000. All top 10 counties by number of employees experienced employment growth from 2020, with the highest growth of 58 percent occurring in San Mateo County. Average wage growth was relatively stable for all counties, averaging 2 percent from 2020. Orange County, which boasts an outsize concentration of medical device companies, had the third most employees out of all the counties at 45,824.

**Over 50 percent of Orange County life sciences employees are employed within the medical instrument manufacturing, medical laboratories, and electromedical apparatus manufacturing sectors.** It is not surprising that Orange County has similar employment trends to the Los Angeles MSA, as it contributes to about half of the region's employment and is a main driver of the life sciences within the MSA. Orange County's life sciences employment level is also on par with other MSA regions within California, again indicating how important life sciences activity is in Orange County.

## Orange County Employment, Establishments, And Average Wages By Life Sciences Subsector

| Life Sciences Category | Employment | Establishments | Average Wages ($) |
|---|---|---|---|
| Research, Testing, And Medical Laboratories | 9,776 | 446 | 100,235 |
| Medical Devices And Equipment | 21,251 | 234 | 125,856 |
| Bioscience-Related Distribution | 10,370 | 686 | 122,938 |
| Drugs And Pharmaceuticals | 4,428 | 108 | 90,383 |
| Agricultural Feedstock And Industrial Biosciences | – | 7 | – |

16 Source: KPMG's analysis of The Bureau of Labor Statistics Quarterly Census of Employment and Wages (BLS QCEW) Data

## Life Sciences Average Wages And Employment By Top 10 Counties, 2020–2021

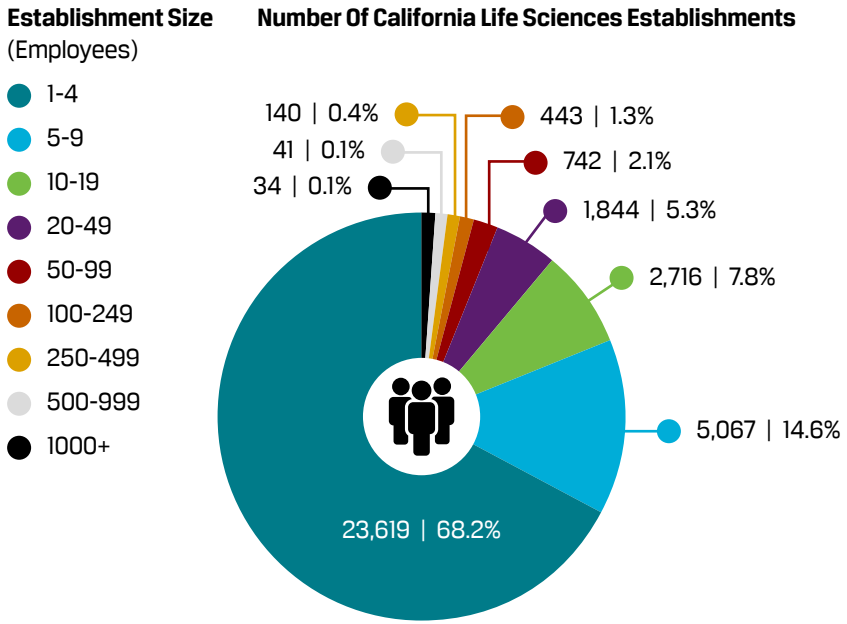
| Rank | County | 2020 Employees | 2020 Average Wages ($) | 2021 Employees | 2021 Average Wages ($) |
|---|---|---|---|---|---|
| 1 | San Diego | 52,952 | 164,425 | 58,516 | 170,408 |
| 2 | Los Angeles | 45,828 | 98,276 | 48,155 | 101,433 |
| 3 | Orange | 44,031 | 115,918 | 45,824 | 116,302 |
| 4 | San Mateo | 23,376 | 322,984 | 37,043 | 320,498 |
| 5 | Santa Clara | 25,894 | 198,213 | 29,306 | 197,612 |
| 6 | Alameda | 26,633 | 150,688 | 27,806 | 165,135 |
| 7 | San Francisco | 9,485 | 225,308 | 9,713 | 216,206 |
| 8 | Riverside | 5,789 | 80,448 | 6,010 | 80,792 |
| 9 | San Bernardino | 4,125 | 72,321 | 4,475 | 75,905 |
| 10 | Ventura | 3,757 | 131,529 | 3,875 | 134,072 |

# Size And **Distribution**

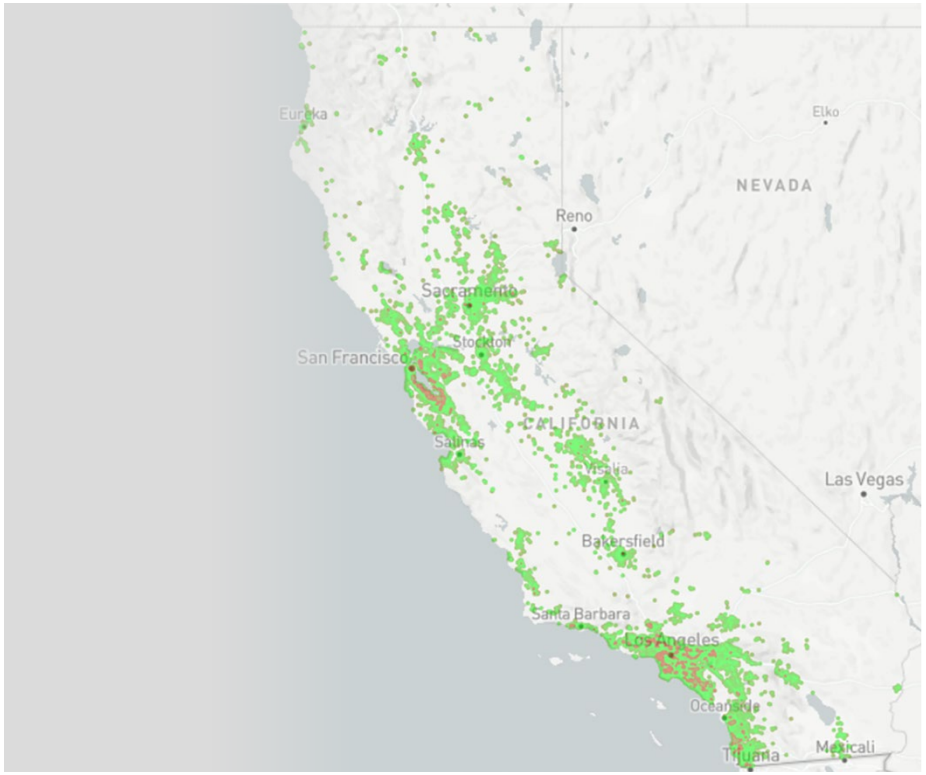
## The California life sciences sector consists of a wide range of establishments of various sizes.

**This reflects the diversity of activities within life sciences as well as the dynamism of the sector, with a steady stream of new firm start-ups characterizing the sector.** This creates a unique dynamic where smaller firms are the dominant establishment size within this sector. In California, more than 90 percent of establishments have below 20 employees, and most of these small firms have fewer than 5 employees. Compared to 2020, the share of smaller firms (under 20 employees) within the life sciences sector increased by 9 percent. This is consistent with an increase in Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grants, which are considered extremely important for early-stage and high-risk small establishments. Although the establishments are located throughout California, the primary locations include Los Angeles, San Diego, San Francisco, and San Jose. This is in line with the trend of life sciences establishments often found around universities and research centers.

**Life Sciences Establishments By Number Of Employees[17]**




## Heat Map Of Life Sciences Concentration Of Establishments By Number Of Employees[18]



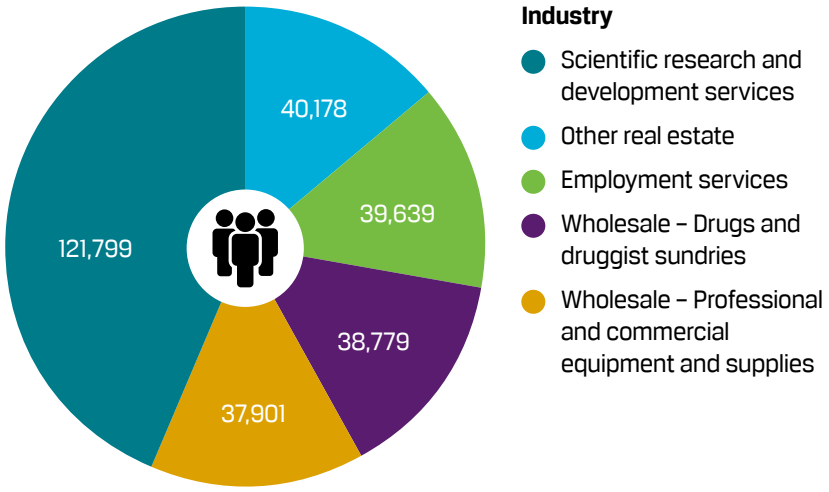

17 Source: KPMG analysis of Q1 2021 Dun & Bradstreet Data
18 Source: KPMG's analysis of Q1 2021 Dun & Bradstreet Data. Darker colors indicate greater levels of concentration.

# Economic **Contribution**

## The life sciences sector has consistently been a major contributor to the state's economic growth and prosperity. In 2021:

- **The life sciences sector directly employed or indirectly supported more than 1 million jobs in California.** Direct employment within the sector accounted for over 335,231 jobs, and the sector's activities during the year supported an additional 770,293 jobs. These additional jobs are a result of the supply chain of existing life sciences firms, as well as other jobs that are created through the spending of the life sciences sector and supporting industry employees.
- **The life sciences sector in the state supported an additional 2.3 jobs for every one job directly employed in the sector.** Similarly, each dollar of labor income generated by the life sciences sector results in a total labor income increase of two dollars within the state. [19]
- **Compared to last year's report, the contribution to total employment decreased slightly,** driven primarily by the decline in indirect and induced employment in the agricultural feedstock and industrial biosciences and drugs and pharmaceuticals subsectors.
- **The life sciences sector directly contributed over $277 billion in state economic output**, with an additional $195 billion in economic output generated via its supply chain.
- **It is estimated that more than $30 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 $27 billion in taxes.
- **Real estate is among the top five sectors most prominently impacted by the contributions of the life sciences sector.** This is unsurprising, as most life sciences firms require some form of office space and many of the life sciences companies, such as those in the research and development or laboratory testing sectors, need commercial lab space.

**Top Five Industries By Total Employment In California[20]**




**Direct employment within the sector accounted for over 335,231 jobs, and the sector's activities during the year supported an additional 770,293 jobs.**

19 The multiplier captures the ratio between the overall economic contributions and the direct economic contributions.
20 IMPLAN model, 2021 Data, using inputs provided by the user and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Drive, Suite 120, Huntersville, NC 28078, www.IMPLAN.com

## Overview Of Economic Contributions By Life Sciences Sector In California[21, 22]

| 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 | Orange County |
|---|---|---|---|---|---|---|
| **Employment[23]** | | | | | | |
| **Direct** | 335,231 | 88,915 | 58,516 | 67,482 | 19,070 | 45,824 |
| **Indirect and Induced** | 770,294 | 167,363 | 120,048 | 98,238 | 13,105 | 70,491 |
| **Total** | 1,105,525 | 256,278 | 178,565 | 165,720 | 32,175 | 116,315 |
| **Multiplier[24]** | *3.3* | *2.9* | *3.1* | *2.5* | *1.7* | *2.5* |
| **Labor Income[25] ($B)** | | | | | | |
| **Direct** | 75.2 | 13.2 | 13.9 | 22.6 | 4.2 | 7.4 |
| **Indirect and Induced** | 72.1 | 14.8 | 9.6 | 12.2 | 2.1 | 6.3 |
| **Total** | 147.3 | 28.0 | 23.5 | 34.9 | 6.3 | 13.8 |
| **Multiplier** | *2.0* | *2.1* | *1.7* | *1.5* | *1.5* | *1.9* |
| **Output[26] ($B)** | | | | | | |
| **Direct** | 277.6 | 56.3 | 42.8 | 50.9 | 15.2 | 29.3 |
| **Indirect and Induced** | 195.1 | 40.2 | 26.4 | 29.0 | 4.9 | 16.7 |
| **Total** | 472.7 | 96.5 | 69.2 | 79.9 | 20.0 | 46.0 |
| **Multiplier** | *1.7* | *1.7* | *1.6* | *1.6* | *1.3* | *1.6* |
| **Taxes[27] ($B)** | | | | | | |
| **Direct** | 30.8 | 5.8 | 4.8 | 6.3 | 1.3 | 2.9 |
| **Indirect and Induced** | 27.2 | 5.6 | 3.6 | 4.0 | 0.6 | 2.3 |
| **Total** | 58.0 | 11.4 | 8.4 | 10.2 | 2.0 | 5.2 |

21 All economic contributions presented are in 2022 dollars.
22 IMPLAN model, 2021 Data, using inputs provided by the user and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Drive, Suite 120, Huntersville, NC 28078, www.IMPLAN.com
23 Mix of full-time, part-time, and seasonal employment. Is not equal to full-time equivalents
24 Multipliers are the measure of an industry's connection to the wider economy. A multiplier describes the indirect and induced units generated from a one-unit contribution to the economy.
25 All forms of employment income, including employee compensation and proprietor income
26 The value of industry production, equal to sales plus net inventory change
27 A total of subcounty general, subcounty special district, county, state, and federal taxes

# Research And **Academic Excellence**

## Academic Excellence

### California remains a leader in providing a steady pipeline of life sciences talent. In 2021:

- **The state boasted the greatest number of universities listed on the World Top 100 Universities according to the Shanghai Index.** In the biological sciences, Stanford, UC–San Francisco, UC–Berkeley, UC–San Diego, and California Institute of Technology each fell within the top 20 universities globally.
- **The state produced the single greatest number of life sciences doctorate degrees across the US,** with 1,014 in total that accounts for 11.5 percent of the total life sciences doctorate degrees in the US.
- **California institutions awarded the largest number of life sciences degrees across the US, with 25,041 in total.** Over the five-year period from 2017 to 2021, the number of life sciences degrees (i.e., bachelor's degree or higher) in the state grew at an annual rate of 4.5 percent, third among the top 10 states in the United States, behind Texas and Florida.

**California institutions awarded the largest number of life sciences degrees across the US, with 25,041 in total.**

### Number Of Universities By State In The World Top 100[28]

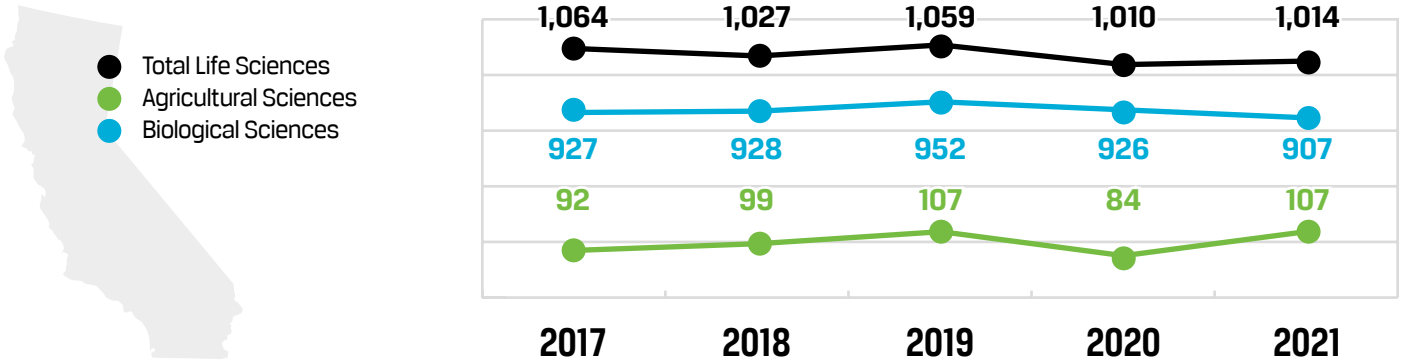
| Rank | States | Number of Universities |
|---|---|---|
| 1 | California | 9 |
| 2 | New York | 4 |
| 3 | Illinois | 3 |
| 4 | Texas | 3 |
| 5 | Massachusetts | 2 |
| 6 | Maryland | 2 |
| 7 | North Carolina | 2 |
| 8 | New Jersey | 1 |
| 9 | Connecticut | 1 |
| 10 | Pennsylvania | 1 |
| 11 | Washington | 1 |
| 12 | Missouri | 1 |
| 13 | Michigan | 1 |
| 14 | Wisconsin | 1 |
| 15 | Minnesota | 1 |
| 16 | Colorado | 1 |
| 17 | Tennessee | 1 |

28 Academic Ranking of World Universities (ARWU), Shanghai Ranking Consultancy. "2022 Academic Ranking of World Universities". Accessed April 2022

## Top 10 States For Doctorate Recipients In Life Sciences, 2021[29]

| State | Total Life Sciences | Agricultural Sciences And Natural Resources | Biological And Biomedical Sciences | Health Sciences | % Of Us Life Sciences Degrees |
|---|---|---|---|---|---|
| California | 1,237 | 81 | 979 | 177 | 10.3% |
| Texas | 906 | 87 | 605 | 214 | 7.5% |
| New York | 852 | 49 | 664 | 139 | 7.1% |
| Massachusetts | 610 | 20 | 458 | 132 | 5.1% |
| Pennsylvania | 542 | 19 | 396 | 127 | 4.5% |
| Florida | 508 | 66 | 305 | 137 | 4.2% |
| North Carolina | 483 | 47 | 312 | 124 | 4.0% |
| Illinois | 449 | 37 | 324 | 88 | 3.7% |
| Ohio | 420 | 36 | 298 | 86 | 3.5% |
| Georgia | 394 | 50 | 286 | 58 | 3.3% |

## Doctorate Recipients By Life Sciences Discipline In California, 2017–2021[30]



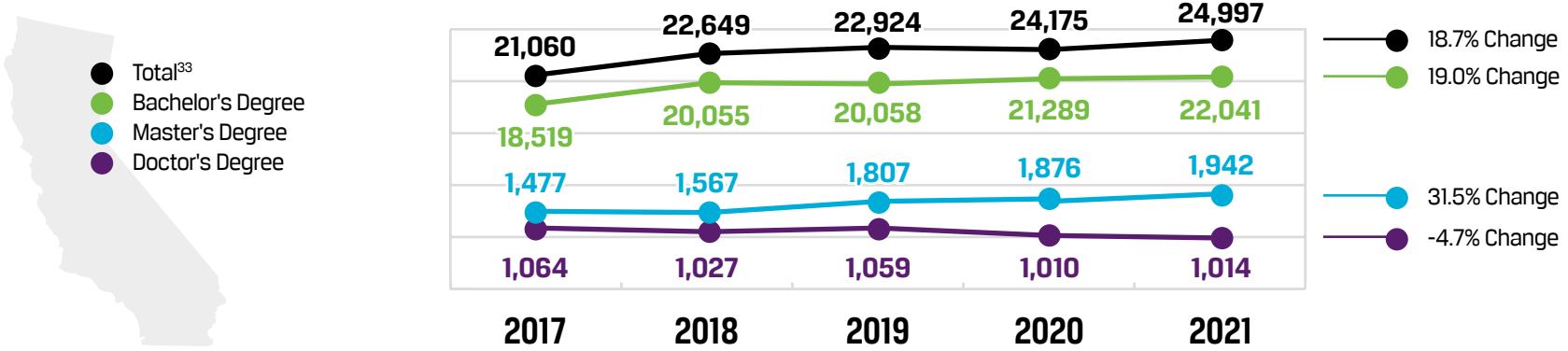

29 Source: NSF, Survey of Earned Doctorates

30 Source: NSF, IPEDS Completions Survey from Department of Education, accessed April 2023. The number of doctorate recipients from the IPEDS Completions Survey from Department of Education does not match with the Survey of Earned Doctorates due to different definition.

## Top 10 States For Life Sciences Bachelor's, Master's, And Doctor's Degrees, 2017–2021[31]

| State | 2017 | 2018 | 2019 | 2020 | 2021 | Average Annual Growth Rate |
|---|---|---|---|---|---|---|
| California | 21,060 | 22,649 | 22,924 | 24,175 | 24,997 | 4.4% |
| Texas | 12,431 | 13,160 | 13,480 | 13,908 | 15,340 | 5.4% |
| New York | 11,615 | 12,056 | 12,363 | 12,614 | 12,947 | 2.8% |
| Florida | 9,311 | 9,556 | 9,926 | 10,488 | 11,091 | 4.5% |
| Pennsylvania | 8,402 | 8,495 | 8,360 | 8,772 | 8,703 | 0.9% |
| Massachusetts | 6,955 | 7,260 | 7,283 | 7,368 | 7,427 | 1.7% |
| North Carolina | 6,578 | 6,395 | 6,694 | 6,802 | 7,072 | 1.9% |
| Michigan | 5,820 | 5,811 | 5,940 | 6,280 | 6,590 | 3.2% |
| Ohio | 6,167 | 6,247 | 6,230 | 6,463 | 6,504 | 1.3% |
| Illinois | 6,126 | 6,452 | 6,337 | 6,164 | 6,217 | 0.4% |

## Doctorate Recipients By Life Sciences Discipline In California, 2017–2021[32]




31 Source: NSF, IPEDS Completions Survey from Department of Education, accessed April 2023
32 Source: NSF, IPEDS Completions Survey from Department of Education, accessed April 2023
33 Total includes postbaccalaureate degrees; therefore, bachelor's, master's, and doctor's degrees don't add up to the total value.

# Research **Excellence**

**California maintains status as leading life sciences research hub in the nation. The state's large and highly respected biomedical research community, strong and diverse biotechnology industry, and long history of supporting scientific research and innovation have contributed to its position as the highest funded state with NIH and NSF grants.**

- **Total NIH and NSF funding received by California institutions in 2022 was $5.5 billion and $97.3 million, respectively.** This makes California the number one state in terms of number of awards and award amount, for both NIH and NSF.
- **NIH grants, which fund research on health-related devices and instruments, generate significant economic activity in the short and long run.** According to a study conducted by United for Medical Research, for each $1 million NIH funding awarded to California institutions, 14 jobs were generated in the state.[34]
- **Accounting for 13 percent of all NSF awards in 2022, California received twice as many awards as the second-most-awarded state, New York.** NSF funds generally support research in the basic sciences of health-related devices, instruments or processes, which can provide a leading indicator of future innovation.
- **In 2021, life sciences-related R&D expenditure in California totaled $7.1 billion and made up 13.7 percent of the US life sciences R&D expenditure.** This speaks to the preeminent role that many California institutions play in supporting innovation and development of new products or therapies that benefit human health.
- **In FY 2022, California was responsible for 2 of the top 10 organizations by NSF funding in the US.** These two organizations, University of California in Davis and University of California in Riverside, received 47 awards totaling $22.6 million.

## Top Five States Receiving NIH Grants By Funding Amount, 2021–2022[35]

| 2022 | | | | 2021 | | | |
|---|---|---|---|---|---|---|---|
| Rank | State | Awards | Funding ($ billion) | Rank | State | Awards | Funding ($ billion) |
| 1 | California | 9,096 | 5.5 | 1 | California | 9,103 | 5.1 |
| 2 | New York | 6,259 | 3.4 | 2 | New York | 6,061 | 3.7 |
| 3 | Massachusetts | 5,810 | 3.3 | 3 | Massachusetts | 5,758 | 3.3 |
| 4 | Maryland | 2,950 | 2.4 | 4 | North Carolina | 2,742 | 2.4 |
| 5 | Pennsylvania | 4,258 | 2.2 | 5 | Maryland | 2,701 | 2.4 |


34 Source: United for Medical Research, NIHs Role in Sustaining the U.S. Economy, 2023
35 Source: NIH. Data as of April 10, 2023

## Top Five States By Total NSF Funding, Fiscal Year 2021–2022[36, 37]

| State | 2022 | | 2021 | | Change In Funding Amount | |
|---|---|---|---|---|---|---|
| | Funding ($ million) | Count | Funding ($ million) | Count | $ Change | Percent Change |
| California | 97.3 | 254 | 108.5 | 288 | -11.2 | -10.3% |
| Ohio | 93.2 | 59 | 78.4 | 61 | 14.8 | 18.9% |
| New York | 62.2 | 123 | 50.3 | 149 | 11.9 | 23.7% |
| Texas | 46.0 | 89 | 32.6 | 88 | 13.4 | 41.1% |
| Massachusetts | 33.9 | 92 | 40.0 | 119 | -6.1 | -15.3% |

## Top Five States By Number Of NSF Awards, 2022[38]

| Rank | State | Number of proposals | Number of awards | Funding rate |
|---|---|---|---|---|
| | United States | 4,237 | 1,133 | 27% |
| 1 | California | 498 | 150 | 30% |
| 2 | New York | 271 | 70 | 26% |
| 3 | Texas | 273 | 65 | 24% |
| 4 | Massachusetts | 201 | 56 | 28% |
| 5 | North Carolina | 161 | 46 | 29% |
| 5 | Michigan | 145 | 46 | 32% |


36 Source: Data reflects awards by Department of Biological Sciences. Award Summary: by State/Institution

37 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 US economic strength and security."

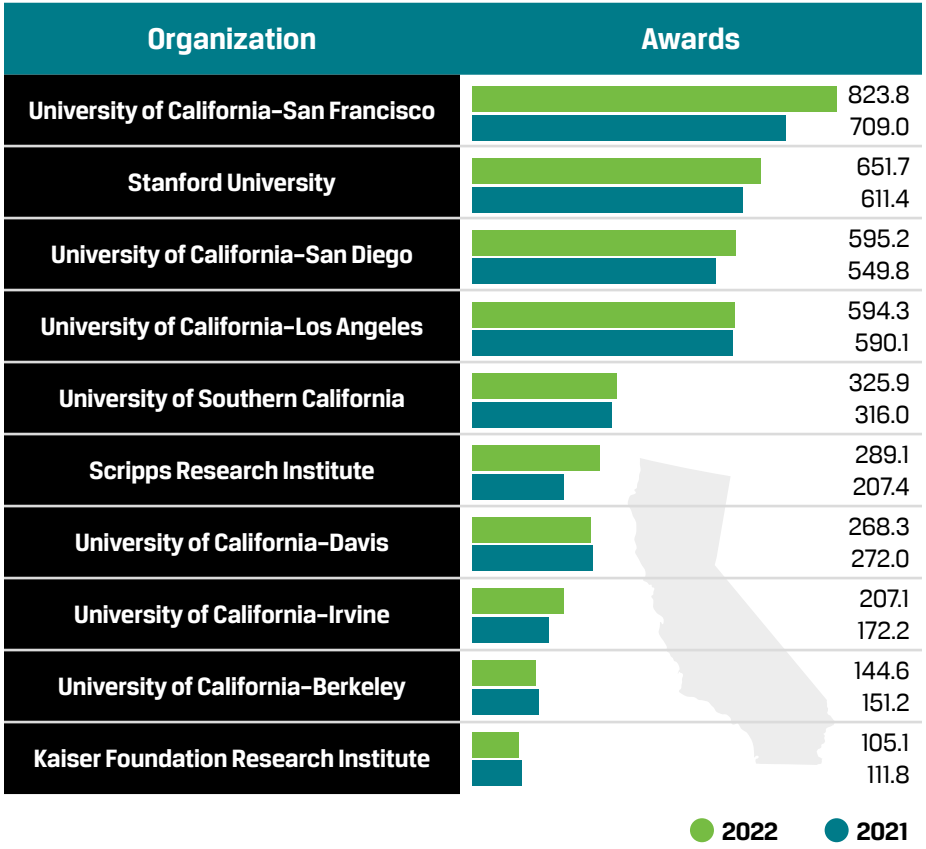
38 Source: Data reflects awards by Department of Biological Sciences. Award Summary: by State/Institution. Last modified October 2020

# California: Funding By **Organizations And Congressional Districts**

## The University of California school systems are among the top 10 organizations by NIH and NSF funding, showcasing the system's strength and excellence in research.

- **Of the top 10 organizations by NIH funding, 7 are part of the University of California system** and they received a total of $3.0 billion in 2022, accounting for over half of the total NIH funding received by the state.
- **Among the top 10 organizations by NSF funding, 9 are part of the University of California system** and these organizations received a total of $61.7 million in FY 2022.

### Top 10 California Organizations Receiving NIH Funding, 2021–2022 ($ million)[39]




### Top California Organizations Receiving NSF Funding In 2022[40]

| Organization | Total[41] Funding ($ million) | Total[41] Awards |
|---|---|---|
| University of California–Davis | 11.5 | 25 |
| University of California–Riverside | 11.1 | 22 |
| University of California–Berkeley | 8.5 | 25 |
| University of California–San Francisco | 7.7 | 8 |
| University of California–San Diego | 5.0 | 12 |
| University of California–Santa Barbara | 5.0 | 14 |
| University of California–Merced | 4.4 | 7 |
| University of California–Los Angeles | 4.3 | 15 |
| University of Southern California | 4.2 | 9 |
| Natural History Museum of Los Angeles | 4.0 | 4 |

39 Source: NIH. Data as of April 10, 2023
40 Source: Data reflects awards by Department of Biological Sciences. Data as of April 2023
41 Reimbursables excluded. Total includes Academic Research Infrastructure prior to 1998.

## Top 10 Congressional Districts To Receive NIH Funding, 2021–2022[42]

| Congressional District | 2022 | | 2021 | |
|---|---|---|---|---|
| | Awards | Funding ($ million) | Awards | Funding ($ million) |
| 12 | 1,686 | 989.7 | 1,644 | 832.7 |
| 18 | 1,275 | 746.0 | 1,279 | 686.7 |
| 52 | 1,268 | 713.0 | 1,333 | 708.4 |
| 33 | 980 | 667.0 | 1,008 | 659.7 |
| 49 | 441 | 471.3 | 581 | 371.8 |
| 13 | 572 | 352.8 | 452 | 352.7 |
| 37 | 488 | 327.6 | 493 | 317.8 |
| 3 | 541 | 272.5 | 521 | 276.3 |
| 45 | 456 | 217.5 | 409 | 187.6 |
| 28 | 264 | 142.6 | 255 | 130.0 |

42 Source: NIH. Data as of April 10, 2023

# Economic Impact Of **NIH Research**[43]

**The impact of NIH funding can be significant for states and regions. In the short term, it provides a direct injection of funds into the economy, supporting projects and related activities such as equipment purchases, laboratory renovations, and personal costs. In the long term, NIH-funded research can lead to the development of new treatments, therapies, and technologies that create new job opportunities and support growth. In addition, funded research often leads to publications and patents that can be licensed and commercialized, creating new revenue streams for universities and businesses.**

According to a study conducted by United for Medical Research, FY 2022 NIH funding has a significant economic contribution to the United States.

- **The NIH awarded $36.7 billion in extramural research funding to researchers in all 50 states and the District of Columbia, which supported over 568,000 jobs and generated $96.8 billion in economic activity across the nation.** This represents $2.64 of economic activity for every $1 of research funding.
- **It comes as no surprise that California had the highest economic activity related to NIH Research, considering that the state received the largest share of NIH funding in 2022.** The $5.5 billion in NIH funding supported over 86,000 jobs and generated $15.4 billion in economic activity in the state.
- **Compared to other top 10 states by largest NIH funding, California had the third-highest employment and economic activity multiplier per $1 million NIH funding.** Every research dollar injected into California supported 14 jobs and generated $2.8 of economic activity.

## Economic Impact Of NIH Research By Top 10 States Receiving Largest NIH Funding, 2022

| State | NIH Funding ($ million) | Employment | Economic Activity ($ million) | Jobs Created Per $M NIH Funding | Economic Activity Per $1 NIH Funding |
|---|---|---|---|---|---|
| United States | 36,683 | 568,585 | 96,846 | – | 2.6 |
| California | 5,478 | 86,470 | 15,366 | 14 | 2.8 |
| New York | 3,437 | 42,843 | 8,525 | 11 | 2.5 |
| Massachusetts | 3,282 | 39,957 | 7,743 | 12 | 2.4 |
| Maryland | 2,408 | 30,932 | 5,556 | 12 | 2.3 |
| Pennsylvania | 2,194 | 30,520 | 5,577 | 12 | 2.5 |
| North Carolina | 2,165 | 34,473 | 5,271 | 15 | 2.4 |
| Texas | 1,784 | 36,721 | 5,764 | 16 | 3.2 |
| Washington | 1,460 | 20,667 | 3,567 | 12 | 2.4 |
| Illinois | 1,198 | 20,973 | 3,608 | 14 | 3.0 |
| Ohio | 953 | 16,063 | 2,624 | 14 | 2.8 |

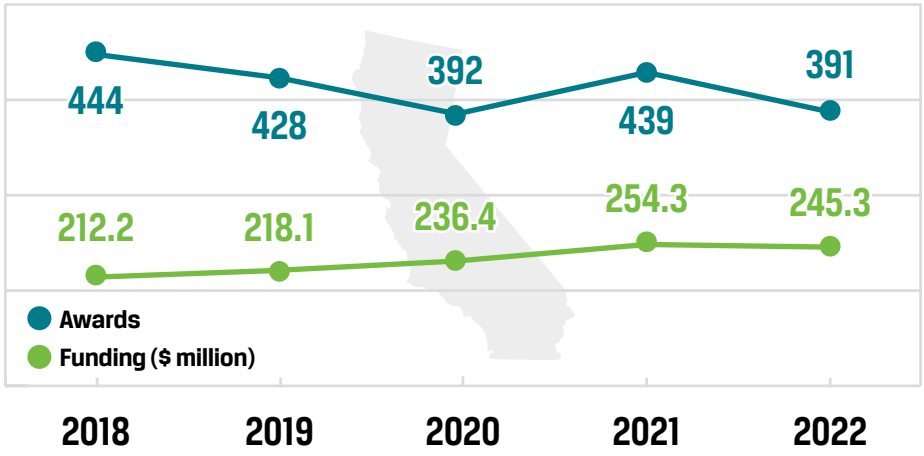
43 Source: United for Medical Research, NIHs Role in Sustaining the U.S. Economy, 2023

## SBIR/STTR Grants

**The SBIR and STTR programs are one of the largest sources of early-stage and high-risk funding for start-ups and small businesses in the US.** The programs fund a diverse portfolio of start-ups and small businesses across technology areas and markets to stimulate technological innovation, meet federal R&D needs, and increase commercialization to transition R&D into impact. For the life sciences sector, SBIR/STTR grants are oftentimes seen as the lifeblood of innovative start-ups and small businesses as such funds often aid in the de-risking of early-stage investments for venture capitalists or later-series investors.

- **California was the largest recipient of SBIR and STTR grants in 2022, receiving a total of $245.3 million**, almost twice the amount received by the second-most-awarded state, Massachusetts. California received over 20 percent of the total SBIT and STTR grants in the US.
- **Between 2018 and 2022, SBIR and STTR funding in California increased by 15.6 percent from $212.2 million to $245.3 million.**

### SBIR And STTR Funding In California, 2018–2022




### Top 10 States By SBIR And STTR Funding Amount, 2021–2022[44]

| States | 2022 | | 2021 | |
|---|---|---|---|---|
| | Awards | Funding ($ million) | Awards | Funding ($ million) |
| United States | 1,989 | 1,200.9 | 1,991 | 1,181.2 |
| California | 391 | 245.3 | 439 | 254.3 |
| Massachusetts | 206 | 140.1 | 207 | 138.3 |
| North Carolina | 135 | 81.7 | 156 | 94.1 |
| New York | 121 | 68.8 | 102 | 60.8 |
| Maryland | 106 | 65.5 | 117 | 74.5 |
| Texas | 91 | 50.0 | 78 | 43.0 |
| Pennsylvania | 86 | 45.9 | 79 | 48.2 |
| Washington | 62 | 38.4 | 74 | 42.7 |
| Illinois | 52 | 35.6 | 42 | 24.9 |
| Missouri | 45 | 34.6 | 40 | 28.8 |

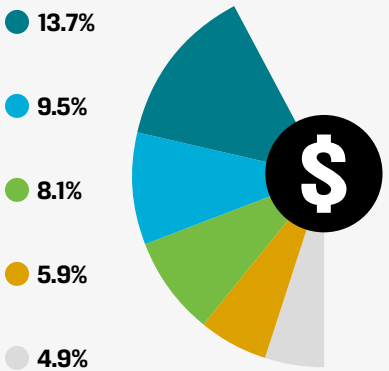
44 Source: NIH. Data as of April 10, 2023

# R&D **Expenditures**

- Over the five-year period from 2017 to 2021, California has experienced tremendous growth in R&D expenditures, at a **nearly 25 percent increase exceeding the national growth rate by 3.5 percentage points.**
- Federal, state, and local governments were the largest funding source in California, accounting for **over half (54 percent) of the state's total life sciences R&D in 2021, followed by institutional funds at 21.2 percent.**
- Compared to the other top four states with the largest life sciences R&D expenditure, California invested most of its resources in health sciences and biological and biomedical sciences. **In 2021, the health sciences and biological and biomedical sciences–related R&D expenditures combined totaled $6.8 billion.** Since 2017, the health sciences and biological and biomedical sciences sectors have grown 27 percent and 23.2 percent, respectively.
- Compared to other four states with largest R&D expenditure, the life sciences VC investment in California has historically surpassed its R&D expenditure, demonstrating that the state has been more successful in converting research efforts into commercialization activities. **In 2021, California spent approximately $7.1 billion in life sciences–related R&D and closed a total of $33.2 billion worth of VC deals.** New York, as the second largest R&D expenditure state, spent $4.0 billion in life sciences–related R&D and closed a total of $823 million worth of VC deals.

## Top Five States With Largest Life Sciences R&D Expenditures, 2021 ($ million)[45]

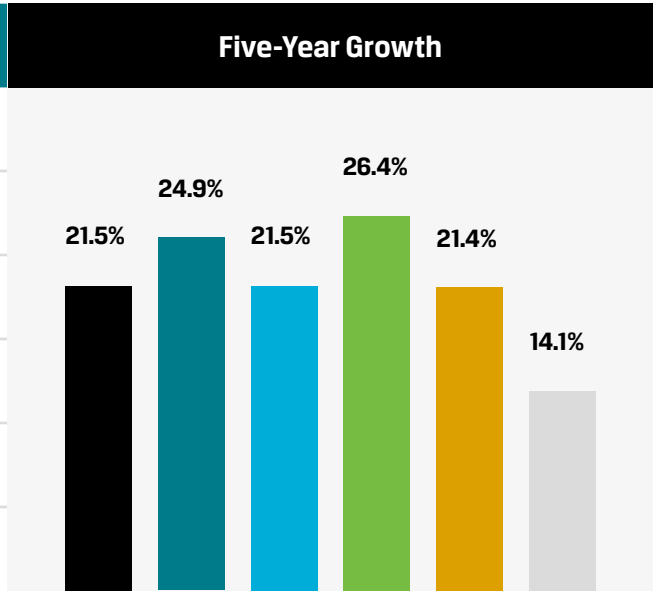
| State | Agricultural Sciences | Biological And Biomedical Sciences | Health Sciences | Natural Resources And Conservation | Other Life Sciences | Total Life Sciences | % of US Total |
|---|---|---|---|---|---|---|---|
| United States | 3,548 | 16,557.2 | 29,884.7 | 934.8 | 1,439.0 | 52,364.6 | |
| California | 188.0 | 1,684.8 | 5,123.0 | 88.0 | 55.1 | 7,138.0 | 13.7% |
| New York | 111.6 | 2,063.0 | 2,718.6 | 39.2 | 28.6 | 4,961.1 | 9.5% |
| Texas | 276.5 | 1,537.4 | 2,211.8 | 28.6 | 156.5 | 4,220.8 | 8.1% |
| Pennsylvania | 81.4 | 1,451.3 | 1,379.8 | 12.8 | 163.2 | 3,088.5 | 5.9% |
| North Carolina | 124.1 | 641.6 | 1,737.4 | 15.6 | 26.7 | 2,545.3 | 4.9% |




45 Source: NSF National Center for Science and Engineering Statistics (NCSES). Higher Education Research and Development Survey. Accessed April 2023

## Top Five States With Largest Life Sciences R&D Expenditures, 2017–2021 ($ million)[46]

| State | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| United States | 43,099.1 | 45,606.8 | 48,228.6 | 49,622.3 | 52,364.6 |
| California | 5,717.0 | 6,475.1 | 6,669.8 | 6,857.9 | 7,139.0 |
| New York | 4,084.5 | 4,330.7 | 4,605.1 | 4,648.8 | 4,961.1 |
| Texas | 3,339.5 | 3,446.3 | 3,610.2 | 4,003.2 | 4,220.8 |
| Pennsylvania | 2,544.4 | 2,707.9 | 2,858.8 | 2,956.1 | 3,088.6 |
| North Carolina | 2,230.4 | 2,293.2 | 2,430.2 | 2,422.2 | 2,545.3 |





46 Source: NSF National Center for Science and Engineering Statistics (NCSES). Higher Education Research and Development Survey. Accessed April 2023

# Life Sciences R&D By Funding Source (Who Funds R&D)

## California Life Sciences–Related[47] R&D Expenditures By Funding Source, 2017–2021[48]

| Source Of Funds | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Total For All Institutions ($ million) | 5,717.0 | 6,475.1 | 6,669.8 | 6,857.9 | 7,138 |
| Federal, State, And Local Governments ($ million) | 3,165.3 | 3,450.7 | 3,592.8 | 3,672.7 | 3,857.7 |
| Business ($ million) | 400.8 | 466.1 | 477.4 | 488.4 | 517.9 |
| Nonprofit Organizations ($ million) | 650.9 | 717.7 | 735.4 | 741.9 | 780.5 |
| Institutional Funds ($ million) | 1,146.2 | 1,449.2 | 1,447.3 | 1,515.7 | 1,510.2 |
| All Other Sources ($ million) | 353.7 | 391.4 | 417.0 | 439.1 | 472.7 |
| Federal, State, And Local Governments (% of total) | 55.4% | 53.3% | 53.9% | 53.6% | 54.0% |
| Business (% Of Total) | 7.0% | 7.2% | 7.2% | 7.1% | 7.3% |
| Nonprofit Organizations (% Of Total) | 11.4% | 11.1% | 11.0% | 10.8% | 10.9% |
| Institutional Funds (% Of Total) | 20.0% | 22.4% | 21.7% | 22.1% | 21.2% |
| All Other Sources (% Of Total) | 6.2% | 6.0% | 6.3% | 6.4% | 6.6% |

47 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).
48 Source: NSF. Higher Education Research and Development Survey. Accessed April 2023

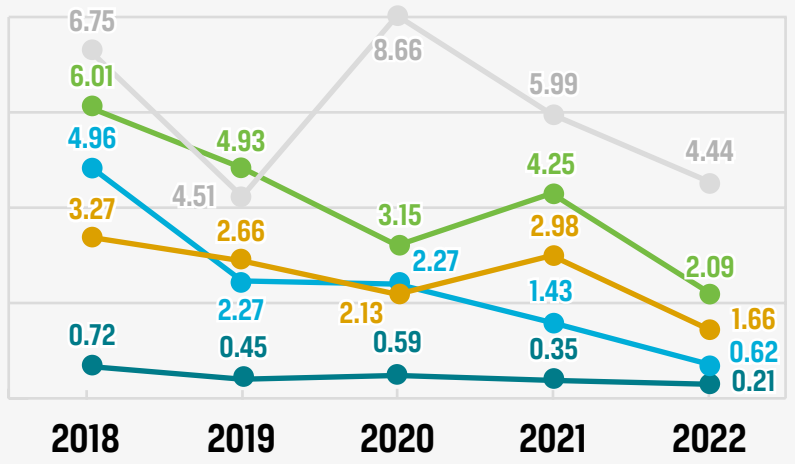
## California Life Sciences-Related R&D Expenditures By Life Sciences Discipline, 2017-2021($ Million)[49, 50]

| Life Sciences Discipline | 2017 | 2018 | 2019 | 2020 | 2021 | Percent Change |
|---|---|---|---|---|---|---|
| Agricultural Sciences ($) | 181.5 | 196.7 | 201.1 | 194.8 | 188.0 | 3.6% |
| Biological And Biomedical Sciences ($) | 1,367.8 | 1,485.8 | 1,572.7 | 1,647.8 | 1,684.8 | 23.2% |
| Health Sciences ($) | 4,032.8 | 4,650.0 | 4,751.0 | 4,867.0 | 5,123.0 | 27% |
| Natural Resources And Conservation ($) | 80.6 | 86.5 | 87.2 | 85.2 | 88.0 | 9.2% |
| Other Life Sciences ($) | 54.3 | 56.1 | 57.8 | 63.1 | 55.1 | 1.5% |
| Agricultural Sciences (% of total) | 3.2% | 3.0% | 3.0% | 2.8% | 2.6% | NA |
| Biological And Biomedical Sciences (% of total) | 23.9% | 22.9% | 23.6% | 24.0% | 23.6% | NA |
| Health Sciences (% of total) | 70.5% | 71.8% | 71.2% | 71.0% | 71.8% | NA |
| Natural Resources And Conservation (% Of Total) | 1.4% | 1.3% | 1.3% | 1.2% | 1.2% | NA |
| Other Life Sciences (% Of Total) | 1.0% | 0.9% | 0.9% | 0.9% | 0.8% | NA |

## California Life Sciences-Related R&D Expenditures To Vc Funding, 2017-2021[51]

| State | | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| California | R&D ($ million) | 5,717.0 | 6,475.1 | 6,669.8 | 6,857.9 | 7,139.0 |
| | VC funding ($ million) | 7,948.8 | 14,549.8 | 11,398.7 | 19,514.8 | 33,223.5 |
| New York | R&D ($ million) | 4,084.5 | 4,330.7 | 4,605.1 | 4,648.8 | 4,961.1 |
| | VC funding ($ million) | 823.7 | 1,903.9 | 2,030.3 | 3,261.1 | 7,975.0 |
| Texas | R&D ($ million) | 3,339.5 | 3,446.3 | 3,610.2 | 4,003.2 | 4,220.8 |
| | VC funding ($ million) | 555.6 | 698.4 | 1,144.7 | 942.3 | 2,021.6 |
| Pennsylvania | R&D ($ million) | 2,544.4 | 2,707.9 | 2,858.8 | 2,956.1 | 3,088.6 |
| | VC funding ($ million) | 779.0 | 1,017.8 | 1,339.4 | 990.7 | 1,865.2 |
| NorthCarolina | R&D ($ million) | 2,230.4 | 2,293.2 | 2,430.2 | 2,422.2 | 2,545.3 |
| | VC funding ($ million) | 330.4 | 508.3 | 280.6 | 404.3 | 573.9 |

R&D To VC Funding



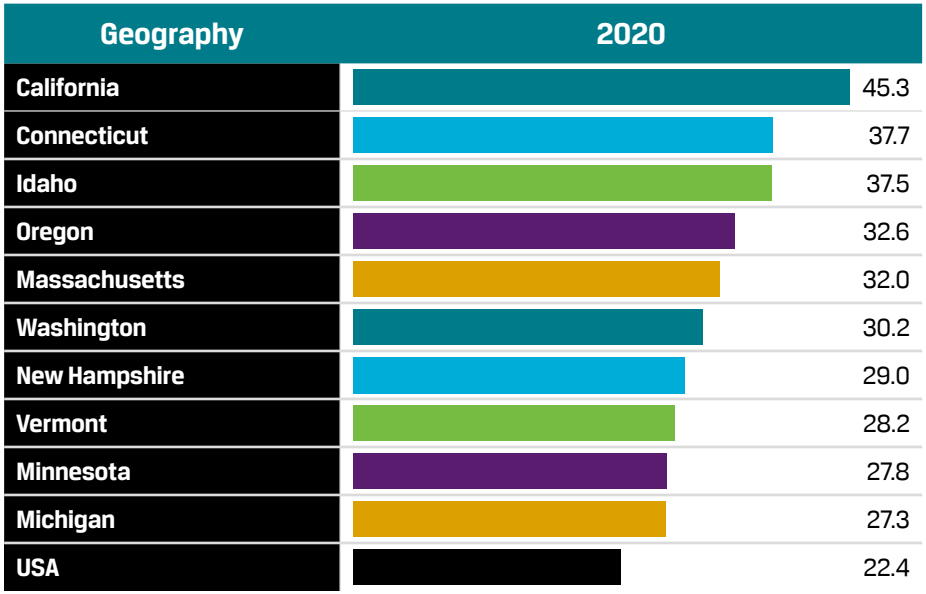

49 Data reflects the life sciences as defined by the National Center for Science and Engineering Statistics (NCSES), the principal statistical agency located within the National Science Foundation (NSF).
50 Source: NSF. Higher Education Research and Development Survey. Accessed April 2023
51 Source: VC funding data sourced from CapIQ. Accessed April 2023

# Patents By **State**

**The investments made in research are also evident in the state's high levels of commercialization activities. Patent issuance may signal a vibrant entrepreneurial ecosystem and portend the introduction of new goods or services that benefit human health.**

- In 2020, California had the highest number of patents awarded per 1,000 individuals. **With a value of 45.3, California had twice as many patents per person as the national average of 22.4.**
- There has been nearly a 10 percent increase in the number of life sciences patents issued by California-based companies, **increasing from 1,360 in 2016 to 1,495 in 2021.**

## Top 10 States With Highest Patents Awarded Per 1,000 Individuals In Science And Engineering Occupations[53]




## Number Of Life Sciences-Related Utility Patents Granted To California-Based Applicants[52]

| Patent Kind | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Analysis of Biological Materials** | **241** | 201 | 173 | 170 | 185 | 193 | 183 | 183 | 162 | 147 |
| **Medical Technology** | 3,841 | **4,073** | 3,624 | 3,433 | 3,502 | 3,219 | 4,021 | 3,917 | 3,629 | 3,515 |
| **Biotechnology** | 723 | 820 | 804 | 807 | 822 | 853 | 924 | **1,014** | 995 | 925 |
| **Pharmaceuticals** | 1,750 | **1,861** | 1,611 | 1,537 | 1,514 | 1,409 | 1,455 | 1,393 | 1,312 | 1,114 |

52 Source: NSF, Patents awarded per 1,000 individuals in science and engineering occupations, data available as of May 2021
53 Source: U.S. Patent and Trademark Office. "Data Download Tables." PatentsView. Accessed July 12, 2023. https://patentsview.org/ download/data-download-tables. Estimates created by KPMG based upon primary technology field.

# Attracting **Capital**

## Venture Capital Investment

**Venture capital (VC) investment, representing funds invested in early-stage life sciences companies with high growth potential, is essential for the growth and development of the life sciences sector. The VC sector provides capital that funds R&D efforts, creates jobs, drives innovation and growth, and creates overall positive impacts on human health.**

- **In 2022, life sciences VC investment in the US reached $47.3 billion**, down from the high watermark of a staggering $78.7 billion in 2021.
- **California received the largest amount of VC investment in life sciences, coming in at $17.3 billion.** This amount was more than 50 percent greater than the second-highest state, Massachusetts. These two states combined made up approximately 60 percent of the total life sciences VC investment in the US.
- **Eight cities in California, led by San Francisco and San Diego, were among the top 15 cities by life sciences VC deal value in 2022.**
- Life sciences VC investment in California has **increased by 19 percent from $14.5 billion in 2018 to $17.3 billion in 2022.**

## Venture Capital In The United States

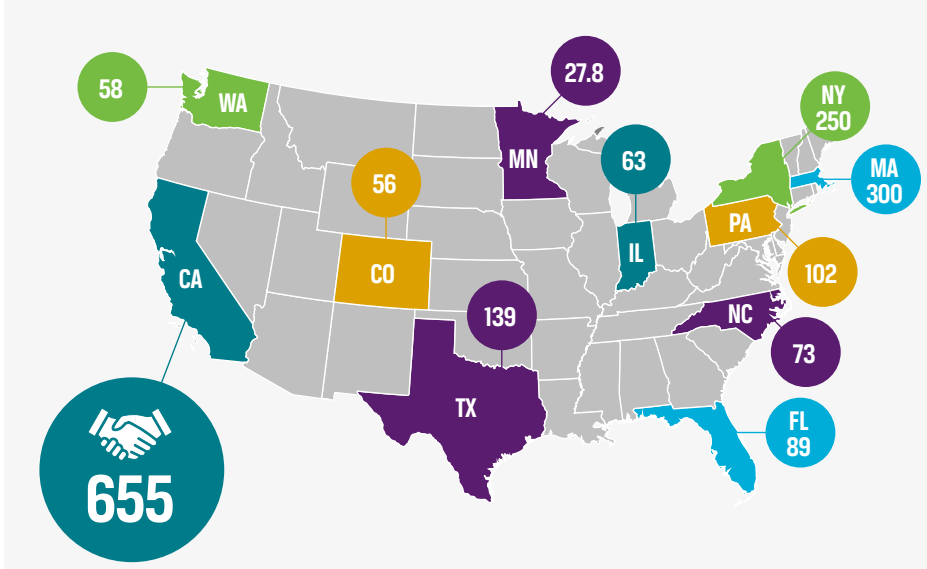
### US VC Investment In Life Sciences, 2018–2022 ($ million)

| Funding Stage | Rounds Of Funding | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| Deal Count | | 2,778 | 2,724 | 2,609 | **3,118** | 2,472 |
| Deal Value ($ million) | | $31,371.2 | $29,998.4 | $43,526.9 | **$78,726.5** | $47,344.0 |
| Early stage | Accelerator | 8.2 | 13.0 | 8.0 | 9.5 | **23.6** |
| | Angel | 40.4 | 37.9 | 10.8 | **84.8** | 11.8 |
| | Crowdfunding | 9.7 | 21.3 | 38.9 | 42.5 | **59.7** |
| | Pre-seed | 19.8 | 57.6 | 59.4 | **73.9** | 68.9 |
| | Seed | 1,181.0 | 1,170.7 | 1,576.0 | 2,478.5 | **2,858.7** |
| Growth | Series 5–7 years | 1,624.3 | 1,020.0 | 1,782.3 | **2,073.0** | 985.4 |
| | Series C | 5,111.9 | 3,974.4 | 8,753.9 | **13,380.6** | 7,167.2 |
| | Series D | 1,690.0 | 2,100.9 | 3,976.4 | **8,410.9** | 4,850.8 |
| | Series E | 1,256.9 | 882.8 | 1,284.2 | 3,107.9 | **2,444.9** |
| Venture | ⟨5 years | 4,831.1 | 6,196.7 | 3,902.9 | **9,996.9** | 3,517.9 |
| | Pre-Series A | 3.8 | 5.6 | 12.5 | 36.0 | **107.2** |
| | Pre-Series B | – | – | – | **20.0** | – |
| | Series A | 8,217.0 | 7,339.4 | 9,903.2 | **18,372.4** | 13,518.7 |
| | Series B | 7,377.2 | 7,177.8 | 12,218.4 | **20,639.5** | 11,729.1 |

## US Life Sciences VC Capital Invested And Deal Count By Sector, 2018–2022[54]

| Sector | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Capital ($ billion) | Deal Count | Capital ($ billion) | Deal Count | Capital ($ billion) | Deal Count | Capital ($ billion) | Deal Count | Capital ($ billion) | Deal Count |
| Biotechnology | 15.1 | 674 | 12.6 | 643 | 20.7 | 706 | 30.2 | 859 | 22.4 | 669 |
| Healthcare Equipment And Services[55] | 11.7 | 1,714 | 11.1 | 1,651 | 15.7 | 1,567 | 36.2 | 1,891 | 21.0 | 1,573 |
| Life Sciences Tools And Services | 0.8 | 102 | 2.1 | 104 | 3.0 | 101 | 7.1 | 107 | 1.4 | 66 |
| Pharmaceuticals | 3.8 | 288 | 4.2 | 326 | 4.2 | 235 | 5.3 | 261 | 2.5 | 164 |
| Grand Total | $ 31.4 | 2,778 | $ 78.7 | 47.3 | $ 43.5 | 2,609 | $ 78.7 | 3,118 | $ 47.3 | 2,472 |

## Top 10 States For Total Life Sciences VC Investment, 2022[56]




| Geography | Capital Invested ($ million) |
|---|---|
| California | 17,326.9 |
| Massachusetts | 11,231.3 |
| New York | 4,240.2 |
| Texas | 1,575.0 |
| Pennsylvania | 1,234.1 |
| Illinois | 1,006.1 |
| Florida | 993.2 |
| Washington | 969.6 |
| North Carolina | 936.9 |
| Colorado | 843.6 |

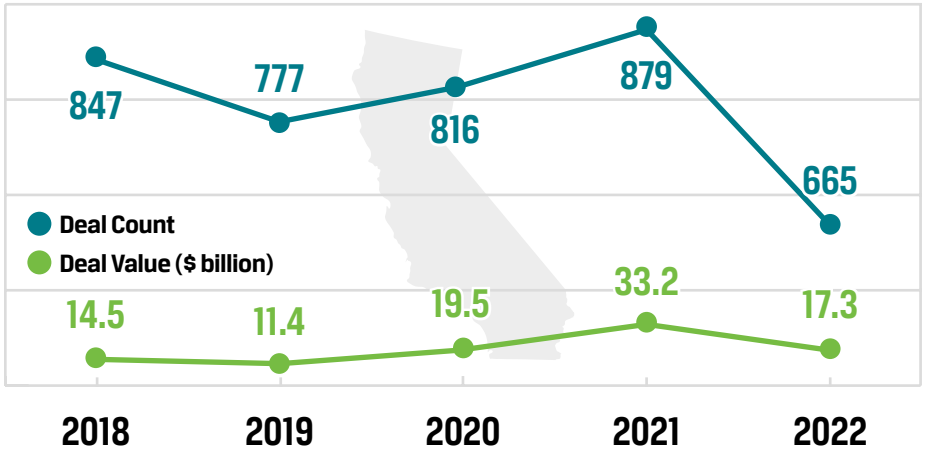
54 Source: CapIQ. Accessed May 2023
55 Healthcare equipment and services comprises healthcare distributors, equipment, facilities, services, supplies, technology, and managed healthcare.
56 Source: CapIQ. Accessed May 2023

## Top 15 Cities By Life Sciences Deal Value, 2022[57]

| Rank | Region | Dollars Invested ($ billion) | # Deals |
|---|---|---|---|
| 1 | Cambridge, MA | 4.5 | 85 |
| 2 | New York, NY | 3.4 | 175 |
| 3 | San Francisco, CA | 3.1 | 151 |
| 4 | San Diego, CA | 1.9 | 75 |
| 5 | South San Francisco, CA | 1.8 | 29 |
| 6 | Boston, MA | 1.7 | 77 |
| 7 | Watertown, MA | 1.2 | 10 |
| 8 | Waltham, MA | 1.2 | 16 |
| 9 | Menlo Park, CA | 1.1 | 17 |
| 10 | Austin, TX | 0.9 | 55 |
| 11 | Palo Alto, CA | 0.9 | 26 |
| 12 | La Jolla, CA | 0.8 | 6 |
| 13 | Hayward, CA | 0.8 | 7 |
| 14 | Chicago, IL | 0.7 | 32 |
| 15 | Emeryville, CA | 0.7 | 12 |

# Venture Capital In California

## California VC Investment In Life Sciences, 2018–2022[58]





57 Source: CapIQ. Accessed May 2023
58 Source: CapIQ. Accessed May 2023

## California Life Sciences VC Capital Invested And Deal Count By Sector[59]

| Sector | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $ Capital ($ million) | Deal Count | $ Capital ($ million) | Deal Count | $ Capital ($ million) | Deal Count | $ Capital ($ million) | Deal Count | $ Capital ($ million) | Deal Count |
| **Biotechnology** | 7,748.3 | 674 | 4,707.7 | 213 | 9,244.1 | 251.0 | 11,192.7 | 264.0 | 9,595.0 | 215.0 |
| **Healthcare Equipment And Services[60]** | 4,922.1 | 1,714 | 3,875.6 | 441 | 6,888.8 | 470.0 | 16,372.6 | 524.0 | 6,836.3 | 387.0 |
| **Life Sciences Tools And Services** | 508.1 | 102 | 1,520.7 | 36 | 2,059.5 | 34.0 | 4,198.9 | 21.0 | 547.6 | 18.0 |
| **Pharmaceuticals** | 1,371.3 | 288 | 1,294.7 | 87 | 1,322.4 | 61.0 | 1,459.3 | 70.0 | 348.0 | 35.0 |
| **Grand Total** | **14,549.8** | **2,778** | **11,398.7** | **777.0** | **19,514.8** | **816.0** | **33,223.5** | **879.0** | **17,326.9** | **655.0** |

59 Source: CapIQ. Accessed May 2023
60 Healthcare equipment and services comprises healthcare distributors, equipment, facilities, services, supplies, technology, and managed healthcare.

# Diversity, Equity, And Inclusion

**CLS gathered perspectives from a wide variety of leaders within the life sciences sector regarding its overall progress on its journey toward a more diverse, equitable, and inclusive ecosystem. CLS sponsored a series of interviews with industry and nonprofit executives, start-up founders, department heads, board members, and diversity leads to gauge current perceptions of the challenges, opportunities, and risks to the advancement of DEI.**

This topical section presents the common themes that emerged from the interviews. In addition, data from NSF and Bureau of Labor Statistics that summarize California graduation and workforce statistics by race, ethnicity, and gender are presented.

## Thematic Interviews With Stakeholders

The themes that emerged from the stakeholder interviews touched upon multiple aspects of DEI and the life sciences industry.[61] Key themes included:

### Current State

- When asked to characterize where the industry sits today in its DEI journey, interviewees consistently mentioned the **increase in awareness and the national dialogue around DEI as positive changes that have influenced the life sciences sector.** They said the increase in training and education geared toward promoting awareness of individual and systemic bias, expansion of employee resource groups (ERGs), and greater attention to DEI partnerships and programs were notable wins.
- **Respondents from multiple employers have seen expanded and actively promoted ERGs, including groups related to Black/African American networks, the LGBTQ+ community, women, and the Hispanic/Latinx community.** They said ERGs have facilitated collaboration among individuals from diverse backgrounds, provided a platform to express their views, and facilitated advancement into positions of leadership and influence.
- However, interviewees also commonly noted that there are **significant challenges to increasing DEI that current programming alone is not meeting**, specifically in the areas of: the creation of inclusive organizational cultures that foster a sense of belonging; talent attraction; representation in scientific, technical, and leadership roles; and sustainability of DEI efforts.

### Challenges Remain

- **The group said there is a substantial amount of mistrust of the healthcare system within the Black, Indigenous, and People of Color (BIPOC) community**, a challenge that must be overcome to attract students from underrepresented and historically marginalized backgrounds to consider careers in the life sciences sector.
- Several expressed concern that complacency with current DEI efforts is a challenge to sustainable improvement. They said **current DEI programming does not go far enough in creating an inclusive environment where individuals may bring their "authentic selves" to work.** An interviewee emphasized that genuine progress in DEI can only be achieved by addressing deeply ingrained societal issues that affect a wide range of individuals. To contribute to this process, companies must adopt a long-term approach that involves reaching out to elementary and high schools, identifying students from underrepresented and historically marginalized communities who have a passion for science, and nurturing their potential. By investing in these students, CLS can help them achieve great results in the future and create a more diverse and inclusive community.

61 The interviews included a limited set of interviewees across life sciences with extensive involvement in both the industry and its various initiatives in DEI. 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.

- **Several respondents cited the need to educate leaders regarding why DEI is important and why it must be embedded within an organization's strategy and culture.** They said DEI needs to be tied to business outcomes or else it is at risk of becoming deprioritized.
- They stated that there remains a **lack of access to growth opportunities, from early access to quality education to executive training programs.** The group noted that people from underrepresented backgrounds are less exposed to the experiences and programs that are critical to leadership development.

## Measuring Success

- **Many cited representation in leadership and upper management as a definition for success in DEI.** They consider achieving equal representation of minorities in comparison to the broader population as a crucial and easily measurable metric.

## Mentorship

- **They consistently emphasized the significance of mentorship in achieving DEI goals.** They discussed their current roles as mentors and how having a mentor in the past was instrumental in their development. In diverse communities, mentorship plays an even more crucial role as the networks may be limited and having a mentor can provide access to valuable resources and opportunities for growth.

## Venture Community

- **Interviewees noted that underrepresented and historically marginalized groups still lack access to venture capital.** One said venture capital firms often rely on personal connections and segmented networks when making investment decisions, and this tends to exclude underrepresented groups, including the BIPOC community.

## Talent Acquisition

- **Companies are now prioritizing the development of a diverse talent pipeline** by creating internships that target a broad range of candidates and creating partnerships with high schools and other organizations. One example of this was investing in enhancements to local labs by providing supplies and technical expertise. The interviewees emphasized the significance of addressing the systemic issues that prevent a significant portion of the population from accessing the right educational opportunities at an early age. Tackling these issues would yield sustainable, long-term progress in recruitment efforts.
- **The group considered company culture as the most crucial factor in retaining talent.** To address this issue, companies are developing intentional training on inclusion such as implicit bias training and other DEI-related concepts. They are also creating advisory boards that facilitate discussions with employees and implementing mentorship programs to demonstrate a clear path for career advancement.
- **They said the industry should consider taking a broader view regarding where talent lies in career advancement and promotion decisions.** One encouraged a greater focus on potential rather than on specific education or experience, noting that members of underrepresented and historically marginalized groups may not otherwise have similar leadership opportunities as employees with more "traditional" backgrounds.

## Opportunities For Improving DEI

When asked about the resources or initiatives that the life sciences industry needs to make for meaningful improvement in DEI, respondents noted the following:

- **There is a need for recognition that much more work needs to be done in order to see meaningful change.** Current levels of programming are important and should be maintained, but the sector must do more to create an inclusive environment.
- **Fresh ideas should be sought from people of underrepresented backgrounds.** The sector has an opportunity to identify people of underrepresented or historically marginalized backgrounds and create an intentional effort to understand their needs for inclusion.
- **The sector must increase access to capital, such as granting lab space and improving access to venture capital.**
- **There is a need to hold leaders accountable and measure performance based upon measurable achievements in DEI.** There is an opportunity to become more targeted in hiring and advancement decisions to choose leadership that more closely reflects the perspectives and experiences of the general population. One interviewee described a process their company implements for holding leaders accountable to DEI goals. At the start of the fiscal year, senior leadership is required to create an action plan outlining their DEI goals, which are then posted on the company's website for all employees to see. At the end of the fiscal year, leaders are evaluated based on their progress toward meeting these goals as part of their performance evaluation.
- **The opportunity for closer coordination among industry leaders is seen by several respondents as essential to DEI progress.** One noted that meaningful improvement in DEI is not achievable through actions at a single company but instead requires commitment and coordination across the industry.

- **The need to invest in outreach and education at all levels, including elementary, middle, and high schools, as well as universities is seen as crucial.** The industry should do more to attract students from underrepresented and historically marginalized backgrounds into STEM (science, technology, engineering, and math) fields and expand the search for talent beyond traditional networks.
- **Integrating DEI into hiring practices as a core company value is similarly seen as of great importance.** One respondent noted this could be done by including people of diverse backgrounds in interview panels, for example.
- **Mechanisms to audit and verify internal DEI practices are needed.** These can include conducting internal surveys, adverse impact assessments, and/or appointing a chief diversity officer (CDO) with the power and resources to hold executives accountable. A CDO, when fully supported by dedicated resources, can help ensure accountability to DEI efforts.

## What Is At Stake?

When addressing questions about the importance of DEI and what is at risk if DEI efforts within the industry fall short, respondents noted:

- **The life sciences sector risks losing out on diversity of thought in treating disease.** They expressed concern about the lack of representation of marginalized racial and ethnic groups in clinical trials, noting that a failure to improve will mean a failure to develop products that treat diseases that afflict these populations.
- **The industry risks failing to tap into a talented labor pool.** Summarizing this view, one respondent stated that *"Talent and potential are normally distributed throughout the population. Opportunity currently is not."*
- **The life sciences sector in the US risks losing its leadership in innovation if it fails to fully embrace the benefits of DEI.** The reliance on ideas generated disproportionately from the majority will leave out many innovative ideas from minority groups.
- **The country risks a loss of trust in the healthcare system**, a failure to eliminate health disparities within the patient population, and a *"race to the bottom"* in terms of serving patients' needs.
- **Financial risks related to failures on DEI were often deliberated upon.** Companies that fail to prioritize diversity may suffer irreparable damage to their reputation. Furthermore, a lack of diversity can indicate a lack of innovative thinking, which is crucial in a sector such as the life sciences.

### Calls To Action

- **Companies should integrate DEI into their organizational strategy and culture** and hold leaders accountable for achieving individual and functional DEI goals.
- **Empower ERGs by providing executive sponsorship, funding, and empowerment** to engage in fruitful collaborations that will lead to actionable next steps.
- **Invest in outreach and education at all levels**, from elementary schools to universities, to ensure that students from underrepresented and historically marginalized backgrounds have equitable access to high quality STEM education and training.
- **Increase access to venture capital** to address the lack of representation of underrepresented and historically marginalized groups in the life sciences sector.
- **Provide mentorship and sponsorship** to high potential talent from underrepresented groups.
- **Provide underrepresented talent access** to the training and development opportunities necessary for retention, promotion, and long-term success.

# Education

**Graduates in California with degrees in life sciences-related fields self-identify across a variety of race, ethnicity, gender, and citizenship categories. From 2017 to 2021, the total number of graduates in life sciences-related fields increased by 18.9 percent in California. In particular, the percentage increases for Hispanic or Latino and Black or African American graduates in California were 59 percent and 33 percent, respectively. These numbers are well above the percentage increase in Hispanic or Latino and Black or African American graduates in the US. In 2021:**

- **California boasted a more diverse racial and ethnic representation among life sciences graduates than the US average**, as evidenced by the higher proportion of graduates who self-identify as Hispanic and Latino or non-white, non-Hispanic (70.3 percent in California versus 46.4 percent in the US). This is driven mostly by the Latino and Asian students, each of which account for 26 percent of all graduates in California and 14.5 percent and 11.8 percent in the United States, respectively. Female graduates in California increased by 27.1 percent, six percentage points above the percentage increase in female graduates in the US.

**From 2017 to 2021, the total number of graduates in life sciences-related fields increased by 18.9 percent in California.**

## Race And Ethnicity Of Life Sciences Graduates, Bachelors, And Above In California And The United States[62]

| Race and Ethnicity | California | | | | | United States | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2017 | % Of Total | 2021 | % Of Total | Pct Growth | 2017 | % Of Total | 2021 | % Of Total | Pct Growth |
| **Total** | **21,060** | **100.0%** | **25,041** | **100.0%** | **18.9%** | **186,280** | **100.0%** | **209,351** | **100.0%** | **12.4%** |
| Hispanic or Latino (all races) | 4,097 | 19.5% | 6,520 | 26.0% | 59.1% | 21,209 | 11.4% | 30,302 | 14.5% | 42.9% |
| American Indian or Alaska Native, non-Hispanic | 56 | 0.3% | 49 | 0.2% | -12.5% | 763 | 0.4% | 833 | 0.4% | 9.2% |
| Asian, non-Hispanic | 6,034 | 28.7% | 6,519 | 26.0% | 8.0% | 21,643 | 11.6% | 24,646 | 11.8% | 13.9% |
| Black or African American, non-Hispanic | 441 | 2.1% | 588 | 2.3% | 33.3% | 12,000 | 6.4% | 14,890 | 7.1% | 24.1% |
| Native Hawaiian or Other Pacific Islander, non-Hispanic | 80 | 0.4% | 87 | 0.3% | 8.8% | 345 | 0.2% | 336 | 0.2% | -2.6% |
| White, non-Hispanic | 7,194 | 34.2% | 7,434 | 29.7% | 3.3% | 107,401 | 57.7% | 112,227 | 53.6% | 4.5% |
| Two or more races, non-Hispanic | 1,180 | 5.6% | 1,463 | 5.8% | 24.0% | 6,670 | 3.6% | 8,754 | 4.2% | 31.2% |
| Other or unknown race or ethnicity, non-Hispanic | 819 | 3.9% | 754 | 3.0% | -7.9% | 5,758 | 3.1% | 5,625 | 2.7% | -2.3% |
| Temporary visa holder[63] | 1,159 | 5.5% | 1,627 | 6.5% | 40.4% | 10,491 | 5.6% | 11,738 | 5.6% | 11.9% |

## Gender Of Life Sciences Graduates, Bachelor's, And Above In California And The United States[64]

| Gender | California | | | | | United States | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2017 | % Of Total | 2021 | % Of Total | Pct Growth | 2017 | % Of Total | 2021 | % Of Total | Pct Growth |
| **Total** | **21,060** | **100.0%** | **25,041** | **100.0%** | **18.9%** | **186,280** | **100%** | **209,351** | **100%** | **12.4%** |
| Female | 12,745 | 60.5% | 16,201 | 64.7% | 27.1% | 111,154 | 59.7% | 134,585 | 64.3% | 21.1% |
| Male | 8,315 | 39.5% | 8,840 | 35.3% | 6.3% | 75,126 | 40.3% | 74,766 | 35.7% | -0.5% |

62 Source: NSF, National Center for Science and Engineering Statistics, IPEDS Completions Survey from Department of Education. Accessed May 2023. Figures represent number of degrees awarded by year.
63 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."
64 Source: NSF, National Center for Science and Engineering Statistics, IPEDS Completions Survey from Department of Education. Accessed May 2023

# California **Workforce**[65]

## California Health And Life Sciences Workforce[66]

### When comparing the health and life sciences workforce to the total workforce across all industries in California, the health and life sciences workforce is more racially diverse. From 2017 to 2021:

- The proportion of total California health and life sciences employees that identify as **non-white and non-Hispanic increased by two percentage points to make up about 37 percent of the workforce.**
- Compared to the total workforce across all industries in California, **the health and life sciences workforce is more racially diverse and had a higher share of representation by employees who identify as Asian.**

However, the data suggest there remains room for greater diversity in the health and life sciences workforce. Notably:

- Although the proportion of **female employees in the health and life sciences workforce increased by 0.8 percent relative to males**, the proportion of female employees remains 7.2 percentage points lower than the total workforce in California.
- **The proportion of Hispanic/Latino and non-white, non-Hispanic employees in the health and life sciences workforce increased by 3 percent from 53.7 percent to 56.7 percent**; however, the representation of Hispanic/Latino and non-white, non-Hispanic employees was still lower than the total workforce across all industries in the state.

While there has been a steady growth in the representation of female and Hispanic/Latino employees over the last five years, both groups are less represented in California's life sciences workforce compared with the state average and the proportion of graduates with bachelor's degrees or higher in California.

### Total Workforce And Health And Life Sciences Workforce By Race In California, 2017 And 2021

| Race | Total | | Healthcare And Life Sciences | |
|---|---|---|---|---|
| | 2017 | 2021 | 2017 | 2021 |
| American Indian or Alaska Native Alone | 1.5% | 1.5% | 0.9% | 0.9% |
| Asian Alone | 16.8% | 17.5% | 27.0% | 28.4% |
| Black or African American Alone | 6.9% | 6.9% | 3.8% | 4.0% |
| Native Hawaiian or Other Pacific Islander Alone | 0.6% | 0.6% | 0.4% | 0.5% |
| Two or More Race Groups | 3.2% | 3.4% | 2.9% | 3.2% |
| White Alone | 71% | 70% | 65% | 63% |

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

## Total Workforce And Health And Life Sciences Workforce By Sex In California, 2017 And 2021

| Sex | Total | | Healthcare And Life Sciences | |
|---|---|---|---|---|
| | 2017 | 2021 | 2017 | 2021 |
| Female | 47.0% | ↑ 47.2% | 39.2% | ↑ 40.0% |
| Male | 53.0% | ↓ 52.8% | 60.8% | ↓ 60.0% |

## Total Workforce And Health And Life Sciences Workforce By Ethnicity In California, 2017 And 2021

| Sex | Total | | Healthcare And Life Sciences | |
|---|---|---|---|---|
| | 2017 | 2021 | 2017 | 2021 |
| Not Hispanic or Latino | 65% | ↓ 64.3% | 78.8% | ↓ 77.6% |
| Hispanic or Latino | 35% | ↑ 35.7% | 21.2% | ↑ 22.4% |

## Total Workforce And Health And Life Sciences Workforce By Race In California, 2017 And 2021

| Race | Total | | Healthcare And Life Sciences | |
|---|---|---|---|---|
| | Hispanic or Latino | Not Hispanic or Latino | Hispanic or Latino | Not Hispanic or Latino |
| American Indian or Alaska Native Alone | 0.7% | 0.2% | 0.7% | 0.2% |
| Asian Alone | 0.5% | 26.4% | 0.5% | 27.8% |
| Black or African American Alone | 0.4% | 3.4% | 0.5% | 3.5% |
| Native Hawaiian or Other Pacific Islander Alone | 0.1% | 0.3% | 0.1% | 0.4% |
| Two or More Race Groups | 0.8% | 2.1% | 0.9% | 2.3% |
| White Alone | 18.7% | 46.3% | 19.7% | 43.3% |

## Total Workforce By Race And Ethnicity In California, 2017 And 2021

| Race | Total | | Healthcare And Life Sciences | |
|---|---|---|---|---|
| | Hispanic or Latino | Not Hispanic or Latino | Hispanic or Latino | Not Hispanic or Latino |
| American Indian or Alaska Native Alone | 1.2% | 0.3% | 1.2% | 0.3% |
| Asian Alone | 0.6% | 16.2% | 0.6% | 16.9% |
| Black or African American Alone | 0.8% | 6.0% | 0.9% | 6.0% |
| Native Hawaiian or Other Pacific Islander Alone | 0.2% | 0.4% | 0.2% | 0.4% |
| Two or More Race Groups | 1.2% | 2.0% | 1.3% | 2.1% |
| White Alone | 30.9% | 40.0% | 31.5% | 38.5% |

# Workforce **Trends**

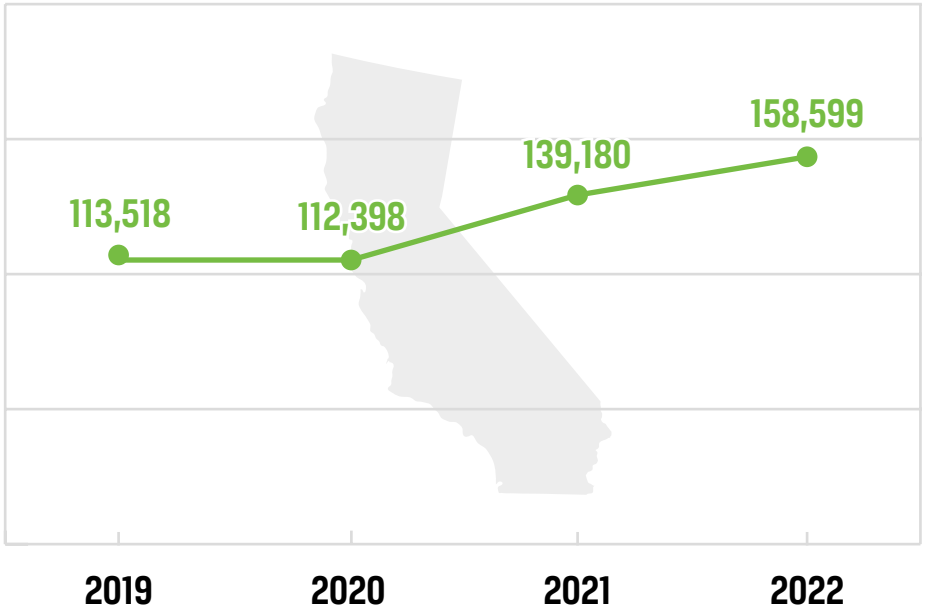
**This data represents a state-specific supplement to the national CSBI/ TEConomy Life Sciences Workforce Trends report and presents summary information on industry job postings for California. The data represent the latest four years of unique (non-duplicative) job postings across the life sciences industry and its five major subsectors—agricultural feedstock and industrial biosciences; bioscience-related distribution; drugs and pharmaceuticals; medical devices and equipment; research, testing, and medical laboratories. From January 2019 through December 2022, California life sciences companies posted a total of 471,492 unique job opportunities.**

**Leading CLS Members in Job Postings 2019-2022**

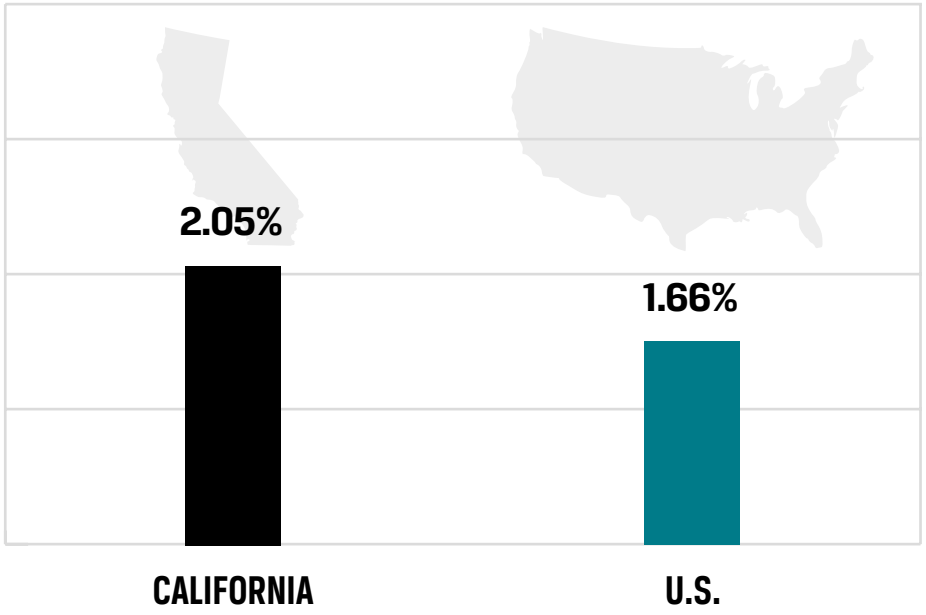
- **Amgen**
- **Gilead Sciences**
- **Genentech**
- **Johnson & Johnson**
- **Abbott Laboratories**
- **Edwards Lifesciences**
- **AbbVie**
- **Cepheid**
- **BD** (Becton, Dickinson and Company)

## Job Postings

### Trend In Total Unique Job Postings, 2019-2022



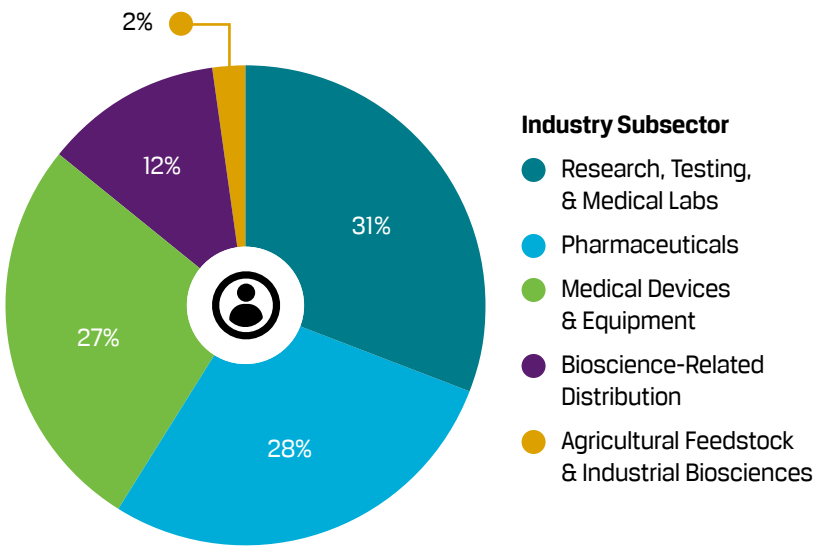

### Life Sciences' Share Of Total Unique Job Postings, 2019-2022




Note: the individual years in trend analysis will not sum to cumulative totals due to unique postings that span across individual years.

## Share of Industry

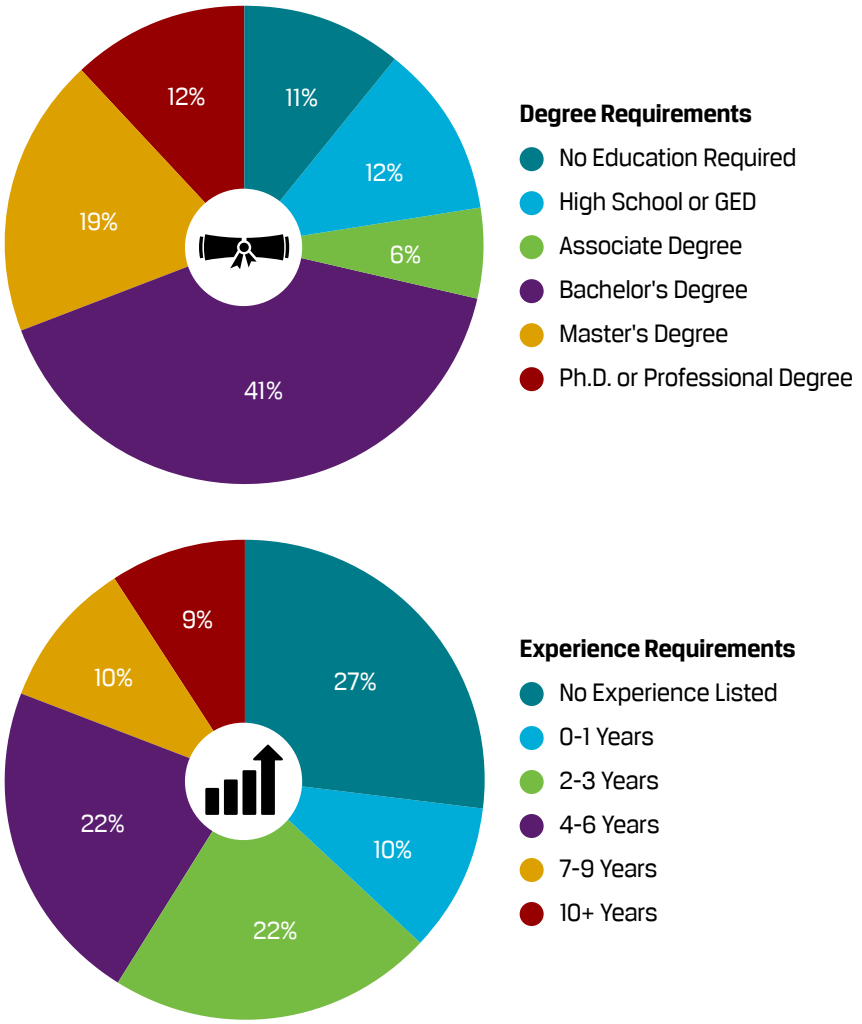
**Job Postings In CA By Major Life Sciences Subsector, 2019-2022**




To access the complete 2023 CSBI-TEconomy National Workforce Trends Report, visit **www.csbioinstitutes.org**

## Education & Experiences

**Requirements In CA Life Sciences Industry Job Postings**



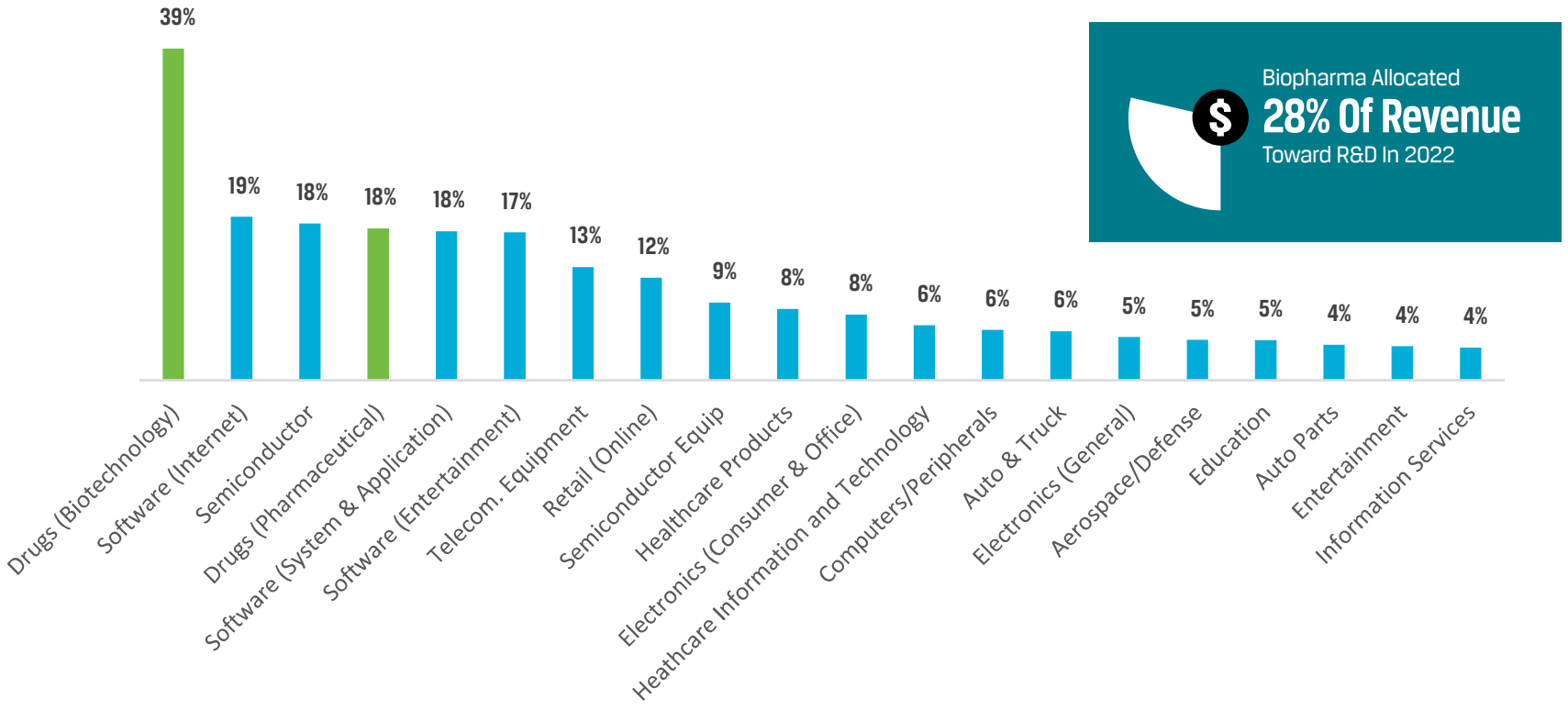
# Impact Of The **Inflation Reduction Act** (IRA) On Life Sciences Innovation

Data Provided By
**Biotechnology Innovation Organization**

## Biotech is An R&D Intense Industry

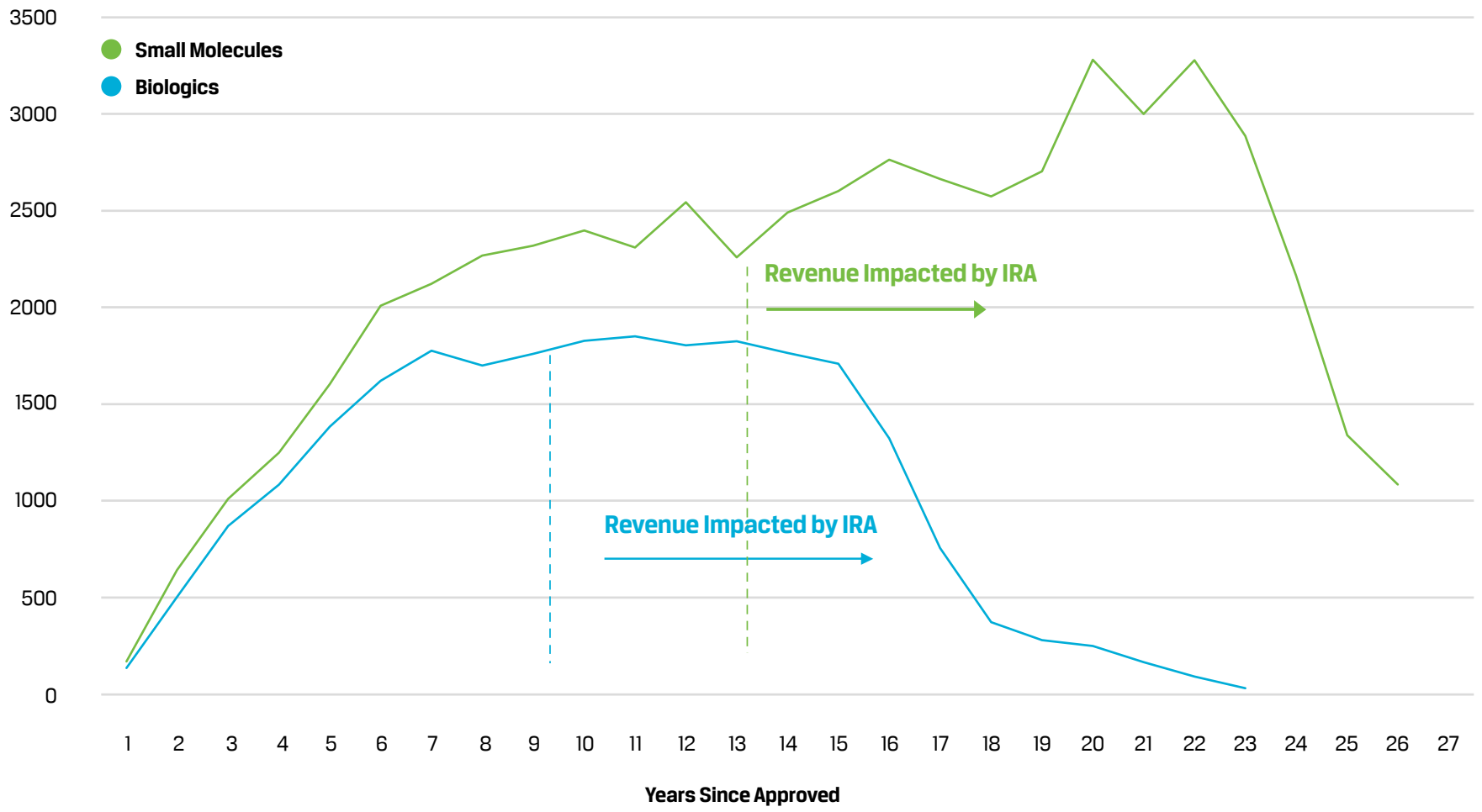
**The IRA empowers the Centers for Medicare and Medicaid Services (CMS) to set prices on 100 drugs over the next 10 years and impose costly penalties on manufacturers. As a result, drug manufacturers could decide they can't afford to invest years of work and billions of dollars into R&D.**

**R&D As A % Of Sales -Jan 2023 | TOP 20 SECTORS**



# Future Revenues Are Directly Connected To R&D Expenditures

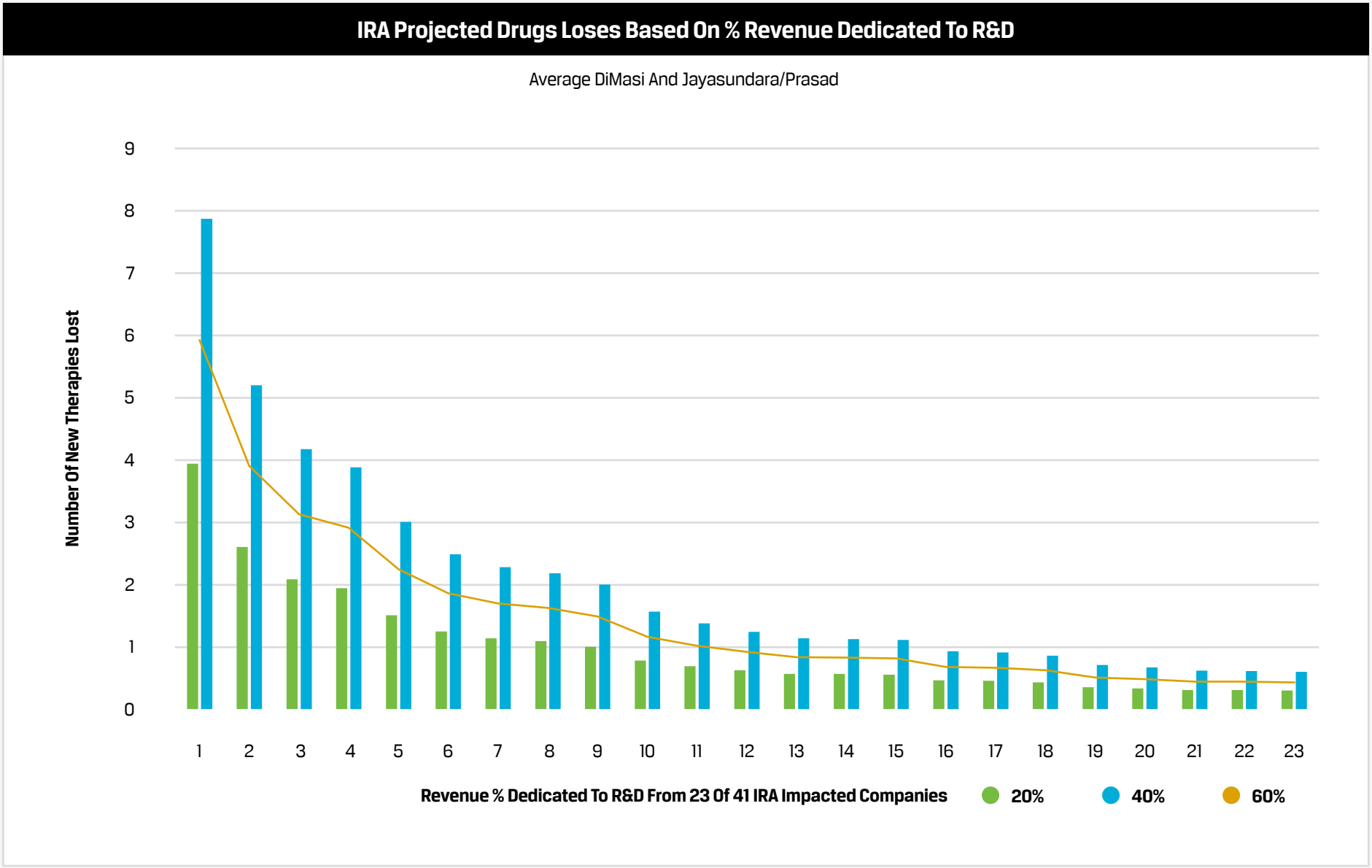
**Average US Sales Of Top 30 Products By Year Since FDA Approval (Excluding Peak Sales Outliers)**




Arrows indicate where IRA will put revenues at risk for negotiations after years 9 & 13

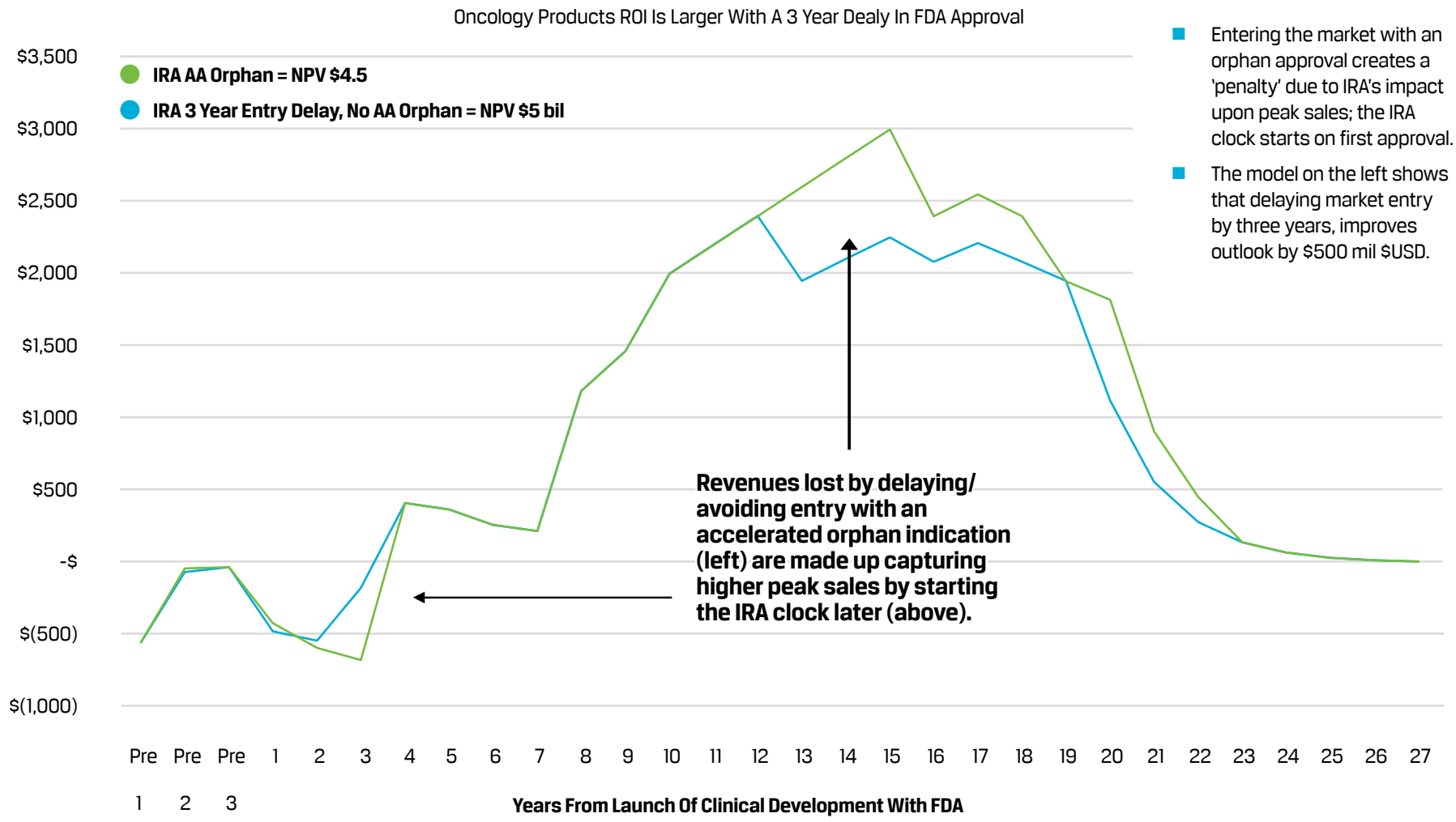
## Fewer Cures

**The 41 firms in our cohort have 92 approved therapies impacted by IRA; a loss of 37 of their developed therapies represents 40% of their drug approvals in this cohort.**



# IRA Penalizes Accelerated Orphan Oncology Indications

## IRA Impact Of Avoiding Accelerated Orphan Release




- Entering the market with an orphan approval creates a 'penalty' due to IRA's impact upon peak sales; the IRA clock starts on first approval.
- The model on the left shows that delaying market entry by three years, improves outlook by $500 mil $USD.

$Us Mil, 10% Cost Of Capital, 2023 Constant Dollars

# IRA Direct & Supported Annual Job Losses

Source: TEConomy analysis; IMPLAN U.S. 2017 Model, VT adjusted for projected reductions in peak sales, 2023 constant dollars.

| Jobs Impact: 2026 - 2035 $76.3 Billion Avg Annual Revenue Reductions (Peak Sales Projection) | | | | | | | |
|---|---|---|---|---|---|---|---|
| State | Direct Biopharma Jobs Impact | Total Biopharma Supported Jobs Impact | Biopharma Supported Output Impact ($M) | State (Cont) | "Direct Biopharma Jobs Impact (Cont)" | Total Biopharma Supported Jobs Impact (Cont) | Biopharma Supported Output Impact ($M) |
| **Totals, U.S. & Puerto Rico** | **-135,948** | **-676,928** | **($192,656)** | | | | |
| California | -23,405 | -127,337 | ($38,617) | South Carolina | -861 | -4137 | ($1,143) |
| New Jersey | -10,176 | -51,161 | ($13,984) | Maine | -761 | -3877 | ($865) |
| Massachusetts | -10,180 | -47,658 | ($11,882) | West Virginia | -785 | -3807 | ($1,263) |
| Pennsylvania | -7,849 | -42,550 | ($11,280) | Iowa | -937 | -3656 | ($988) |
| North Carolina | -7,537 | -42,076 | ($12,480) | Kentucky | -886 | -3219 | ($736) |
| Illinois | -6,832 | -41,355 | ($12,234) | Oregon | -701 | -2900 | ($646) |
| New York | -9,245 | -38,686 | ($11,247) | Delaware | -832 | -2879 | ($640) |
| Texas | -6,375 | -32,892 | ($9,017) | Nebraska | -523 | -2453 | ($696) |
| Indiana | -4,133 | -23,455 | ($9,322) | Alabama | -588 | -2411 | ($677) |
| Florida | -4,317 | -21,939 | ($4,865) | Rhode Island | -323 | -2221 | ($612) |
| Maryland | -5,120 | -21,752 | ($5,667) | New Mexico | -599 | -2093 | ($438) |
| Ohio | -3,502 | -15,220 | ($3,698) | New Hampshire | -403 | -1882 | ($454) |
| Michigan | -2,678 | -14,495 | ($3,819) | Oklahoma | -464 | -1825 | ($429) |
| Puerto Rico | -3,000 | -13,073 | ($9,661) | Nevada | -359 | -1656 | ($401) |
| Utah | -2,066 | -12,272 | ($2,902) | Louisiana | -461 | -1562 | ($353) |
| Missouri | -2,056 | -11,071 | ($2,706) | Mississippi | -302 | -1342 | ($380) |
| Washington | -2,581 | -9,556 | ($2,261) | Vermont | -194 | -786 | ($189) |
| Georgia | -1,946 | -9,551 | ($2,237) | Idaho | -157 | -648 | ($152) |
| Wisconsin | -1,832 | -8,635 | ($2,017) | Arkansas | -138 | -641 | ($170) |
| Tennessee | -2,035 | -7,782 | ($1,751) | Montana | -142 | -472 | ($96) |
| Colorado | -1,445 | -7,665 | ($1,880) | Hawaii | -151 | -433 | ($81) |
| Arizona | -1,409 | -6,961 | ($1,532) | DC | -107 | -249 | ($73) |
| Virginia | -1,626 | -6,807 | ($1,659) | Wyoming | -51 | -183 | ($66) |
| Minnesota | -1,274 | -6,723 | ($1,640) | South Dakota | -54 | -165 | ($30) |
| Connecticut | -1,502 | -5,939 | ($1,511) | North Dakota | -47 | -136 | ($35) |
| Kansas | -973 | -4,624 | ($1,159) | Alaska | -27 | -60 | ($12) |

## The Sum Of The Parts

**Had the IRA been in place beginning in 2014, we estimate the reductions in revenue on the impacted drugs to be up to 40%.** Because of this, between 24 and 49 therapies currently available today would most likely not have come to market and therefore not available for patients and their providers.

Both biologics and small molecule drugs are impacted, with an **average reduction in revenue per therapy of $4.9 billion and $4 billion respectively.**

Looking forward, we estimate that because of the IRA pricing provisions, the substantial reduction in revenue will significantly narrow investment opportunities. Conservatively, **as many as 139 drugs over the next 10 years are at risk of not being developed at all.**

IRA provides a negotiation exemption for orphan drugs that treat only one rare disease. This disincentivizes investments in orphan drugs and areas of high unmet patient need as the broader indications will provide a **superior return on investment, as much as $500 million over three years.**

Based on two impact scenarios, **we estimate a loss of between 66,800 -135,900 direct and 342,000 - 676,000 indirect jobs in the U.S. biopharma ecosystem.**

# 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, which were 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, 6 of them were classified as partially attributable to life sciences, with less than 100.0 percent of Quarterly Census of Employment and Wages (QCEW) employment and wage attributable to 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

| 2022 NAICS Code | NAICS Description | Category |
|---|---|---|
| 311221 | Wet Corn Milling and Starch Manufacturing | 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 |

| 2022 NAICS Code | NAICS Description | Category |
|---|---|---|
| 334510 | Electromedical and Electrotherapeutic Apparatus Manufacturing | Medical Devices & Equipment |
| 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 and Services | 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) QCEW. QCEW data shows employment and wages as reported by employers and covers more than 95.0 percent of US jobs at the national, state, metropolitan statistical area, and county levels. Data is aggregated starting at the six-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 percent of employee data and 14 percent of wage data are 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[67] 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 five major California MSAs including Los Angeles – Long Beach – Anaheim MSA; San Diego – Carlsbad MSA; San Francisco – Oakland – Hayward MSA; San Jose – Sunnyvale – Santa Clara MSA; and Orange County. The analyses of the aforementioned four geographic areas rely on the IMPLAN 546 industry sector model.

### The Analysis Involved The Following Steps:

1. **Obtained wage and employment data** for six-digit life sciences NAICS code from the BLS QCEW
2. **Adjusted QCEW's wage** to include benefits and contributions using methodology suggested by IMPLAN
3. **Configured the model inputs** and ran them through IMPLAN.

67 IMPLAN® model, 2021 Data, using inputs provided by the user and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Drive, Suite 120, Huntersville, NC 28078, www.IMPLAN.com

# CALIFORNIA LIFE SCIENCES

California Life Sciences (CLS) is the state's most 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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