

Profile of Biomedical Research and Biotechnology Commercialization

San Francisco–Oakland–San Jose Consolidated Metropolitan Statistical Area

Overview and History of Biotechnology in San Francisco

The San Francisco Bay area is in many ways the cradle of the world's biotechnology industry. The 1973 discovery of a practical technique for recombinant DNA production by Stanford's Stanley Cohen and the University of California San Francisco's Herbert Boyer was the breakthrough that opened up the possibility of using genetic engineering to diagnose and combat disease. In 1980 Genentech, the company that Cohen and Boyer founded to commercialize their discovery, launched its initial public offering, triggering huge public and investor interest in the biotechnology industry.

Although the bulk of Genentech was merged with pharmaceutical giant Hoffman-LaRoche in 1990, the company remains the anchor of the Bay Area biotech cluster, employing more than 3,500 at its headquarters and chief manufacturing facility in South San Francisco. In addition, the company's former employees have started more than 30 local spin-offs accounting for an additional 3,700 employees in the Bay Area.

The Bay Area benefits from an impressive combination of intellectual and financial capital. Biotech firms have spun off from each of the region's three major research institutions (Stanford, Berkeley, and the University of California at San Francisco). Silicon Valley continues to have the largest concentration of venture capital investors in the world, as well as the greatest number of highly active biotech investors.

The San Francisco–Oakland–San Jose Consolidated Metropolitan Statistical Area had a year 2000 population of 7 million, making it the fifth-largest metropolitan area in the United States. During the 1990s population in the Bay Area grew by nearly 13 percent.

Biomedical Research Activity in San Francisco

The San Francisco–Oakland–San Jose Consolidated Metropolitan Statistical Area consists of three major cities and includes the area popularly known as Silicon Valley. The region has a considerable amount of biomedical research activity, with more than 3,000 life scientists working in this Californian area. There are three biological institutions granting life science PhDs; these institutions are ranked among the top 20 nationally in life sciences research. Total NIH financial support flowing to the San Francisco area is more than \$703.5 million annually.

Table 1. San Francisco: Indicators of Biomedical Research

Biomedical Research Indicators	Year	San Francisco-Oakland-San Jose, CA CMSA
Life Scientists Employed	1998	3,090
Institutions Granting Life Science PhD Degrees	1999	3
Life Science PhDs Granted	1999	215
Universities Ranked among the Top 20 Nationally in Life Sciences Research	1982	3
Total NIH Financial Support	2000	\$703,529,044
NIH Funding for Medical Schools	1985	\$175,333
	1990	\$279,852
	1995	\$309,574
	2000	\$473,463
Biotechnology Patents	1975–79	414
	1980–89	1,173
	1990–99	3,991

Three research institutions in the San Francisco area are among the country's top 100 institutions in terms of funding received from the National Institutes of Health. The University of California at San Francisco, the University of California at Berkeley, and Stanford University received almost \$600 million in NIH research support in 2000. The University of California at San Francisco is the fourth-ranking recipient of NIH support nationally.

Table 2. San Francisco: Principal NIH-Funded Research Institutions, 2000

Rank	Institution	Research Grants	Grant Amount (in millions)	Total NIH Support (in millions)
4	University of California, San Francisco	704	\$266.8	\$295.2
12	Stanford University	506	\$193.1	\$211.9
46	University of California, Berkeley	231	\$80.1	\$89.0

Source: National Institutes of Health

Genentech and Incyte Pharmaceuticals are the two private corporations that held the most biotechnology patents in the 1990s in the San Francisco region. The University of California accounted for 321 patents in the 1990s, while Stanford University held 124 patents in the same period. Private firms and public institutions accounted for a majority of the increase in biotechnology patenting in the region during the decade.

Table 3. San Francisco: Top Biotechnology-related-Patent Holders, by Decade, 1975–1999

Rank	Company Name	1970s	1980s	1990s
1	Genentech, Inc.		36	335
2	Incyte Pharmaceuticals, Inc.			322
3	University of California	7	53	321
4	Alza Corporation	53	145	238
5	Individually Owned Patent	11	71	208
6	Syntex (U.S.A.), Inc.	67	204	168
7	Chiron Corporation		13	167
8	Stanford University	1	35	124
9	Cetus Corporation	1	76	64
10	SRI International	1	30	50
11	Hoffmann-La Roche, Inc.	1	1	46
12	Genencor International, Inc.			45
13	Cor Therapeutics, Inc.			39
14	Affymax Technologies N.V.			38
15	Sugen, Inc.			37
16	Schering Corp.		1	36
17	Xoma Corporation		1	36
18	Tularik, Inc.			33
19	Glycomed, Inc.			31
20	Celtrix Pharmaceuticals, Inc.			29
21	Systemix, Inc.			29

Source: U.S. Patent & Trademark Office, 2001

Biotechnology Commercialization in San Francisco

The San Francisco region is the most entrepreneurial region among the nine studied. The area has attracted more than \$3 billion in venture capital investment in biopharmaceutical firms since 1995. Investments have been made in 261 new firms, and 21 venture capital companies are present in the region. The area has had the most initial public offerings by biotech companies since 1998 and has attracted more than \$1 billion in pharmaceutical-biotech research alliances since 1996. The San Francisco area has 90 publicly traded biotech companies with an aggregate market capitalization of nearly \$82 billion. The industry includes 46 firms with more than 100 employees, and 114 firms are members of the national Biotechnology Industry Association.

Table 4. San Francisco: Indicators of Biotechnology Commercialization

Indicator	San Francisco-Oakland-San Jose, CA CMSA	
Venture Capital Investment, 1995–2001	Number	261
	Amount	\$3,028,917,500
	Share	31%
Venture Capital Firms among the 50 Most Active in Biopharmaceutical Investment	1995–2001	21
Number of Initial Public Offerings by Biotech Companies	1998–2001	31
Value (in millions) of Research Alliances between Pharmaceutical Companies and Local Biotechnology Companies	Prior to 1990	\$230
	1990–1995	\$1,357
	1996–2001	\$1,205
Number of Publicly Traded Biotechnology Companies	2001	90
Market Capitalization (in millions) of Local Biotechnology Companies, 2001	2001	\$82,731
Local Biotechnology Firms Established	through 1980	16
	1981–1990	64
	1991–2001	71
	Not Available	1
	All Firms	152
Local Biotechnology Firms with More than 100 Employees	2001	46
NAICS 3254: Pharmaceuticals	Establishments	77
	Employment	11,302
NAICS 5413: Life Sciences R&D	Establishments	353
	Employment	9,674
Number of Members of the Biotechnology Industry Organization (BIO)	2001	114

The area's largest biotechnology firms are Chiron Corporation and Genentech.

Table 5. San Francisco: Principal Biotechnology Firms

Company	City	Employment	Segment
Chiron Corporation	Emeryville	6,400	Therapeutics; Clinical Diagnostics; Vaccines; Veterinary
Genentech Inc.	South San Francisco	3,800	Therapeutics; Fermentation/Production; Vaccines; Toxicology
Applied Biosystems Group	Foster City	3,504	Equipment; Bioseparations; Reagents; Specialty Chemicals; Clinical Diagnostics; Food Production/Processing
ALZA Corporation	Mountain View	1,610	Therapeutics; Vaccines; Veterinary; Drug Delivery
Gilead Sciences Inc.	Foster City	1,353	Therapeutics; Drug Delivery Systems; Reagents; Clinical Diagnostics; Specialty Chemicals
Roche Bioscience	Palo Alto	1,200	Therapeutics; Clinical Diagnostics; Veterinary
Incyte Genomics Inc.	Palo Alto	900	Bioinformatics; Therapeutics; Reagents; Toxicology
Berlex Biosciences Inc.	Richmond	425	Therapeutics; Cell Culture; Clinical Diagnostics; Fermentation/Production
Axys Pharmaceuticals Inc.	South San Francisco	400	Therapeutics; Plant Agriculture
COR Therapeutics Inc.	South San Francisco	317	Therapeutics

Source: Institute for Biotechnology Information, 2001

Table 6. San Francisco: Venture Capital Investment in Biopharmaceutical Firms, 1995–2001

Year	Venture Capital
1995	\$138,488,000
1996	\$ 216,926,500
1997	\$ 393,530,000
1998	\$ 311,055,000
1999	\$ 668,977,000
2000	\$1,063,516,000
2001*	\$ 236,425,000

Source: PriceWaterhouseCoopers, 2001 (* Six Months)