

Profile of Biomedical Research and Biotechnology Commercialization

San Diego Metropolitan Statistical Area

Overview and History of Biotechnology in San Diego

San Diego has a significant concentration of biomedical research institutions and biotechnology firms. The leading research institutions include the Salk Institute, Scripps Research Institute, and the University of California San Diego, all founded between 1955 and 1965. The region's biotechnology industry began in the late 1970s with the formation of Hybritech, a company that pioneered commercial use of monoclonal antibodies. The company was founded by two relatively unknown researchers at UCSD, Ivor Royston and Howard Birndorf. Hybritech itself was purchased by pharmaceutical giant Eli Lilly, but key personnel from the firm went on to start their own biotechnology businesses. Hybritech alumni reportedly have produced more than 40 biotech start-ups in the San Diego metropolitan area in the past 15 years. The development of the industry has been supported by the UCSD's Connect program, founded in 1985, which encourages networking among biotech researchers and businesses. Area biotech pioneers have become serial entrepreneurs, and the fortunes they built in the 1980s have helped form venture capital funds to fuel successive rounds of start-ups. During the past two decades, the region has built up a formidable network of supporting resources, such as venture capitalists, headhunters, and patent attorneys, all intimately familiar with the special needs of the biotech industry.

The San Diego Metropolitan Statistical area had a year 2000 population of 2.8 million, making it number 17 among the largest metropolitan areas in the United States. During the 1990s population in the San Diego area grew by nearly 13 percent.

Biomedical Research Activity in San Diego

The San Diego metropolitan area has a considerable amount of biomedical research activity, with more than 1,400 life scientists working in the region. There are three biological institutions granting life science PhDs; one of these institutions is ranked among the top 20 nationally in life sciences research. Total NIH financial support flowing to the San Diego area is more than \$680 million annually.

Table 1. San Diego: Indicators of Biomedical Research

Biomedical Research Indicators	Year	San Diego, CA MSA
Life Scientists Employed	1998	1,430
Institutions Granting Life Science PhD Degrees	1999	3
Life Science PhDs Granted	1999	82
Universities Ranked among the Top 20 Nationally in Life Sciences Research	1982	1
Total NIH Financial Support	2000	\$680,954,889
NIH Funding for Medical Schools	1985	\$113,463
	1990	\$181,844
	1995	\$237,912
	2000	\$379,150
Biotechnology Patents	1975–79	23
	1980–89	210
	1990–99	1,632

Two research institutions in the San Diego area are among the 100 institutions that receive the most funding from the National Institutes of Health. The University of California at San Diego and the Scripps Research Institute received more than \$300 million in NIH research support in 2000.

Table 2. San Diego: Principal NIH–Funded Research Institutions, 2000

Rank	Institution	Research Grants	Grant Amount (in millions)	Total NIH Support (in millions)
15	University of California, San Diego	454	\$175.7	\$190.5
26	Scripps Research Institute	371	\$135.8	\$138.8

Source: National Institutes of Health

The top two patent holders in San Diego are the Scripps Research Institute and the University of California: these two public institutions account for more than 270 patents during the 1990s. A mix of private firms and public institutions accounted for a majority of the increase in biotechnology patenting in the region during the decade.

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

Rank	Company Name	1970s	1980s	1990s
1	Scripps Research Institute			152
2	University of California		19	120
3	Individually Owned Patents	4	23	99
4	Mycogen Corporation		8	96
5	Salk Institute for Biological Studies		49	89
6	Gen-Probe Incorporated			86
7	Isis Pharmaceuticals, Inc.			84
8	La Jolla Cancer Research Foundation		2	65
9	Stratagene			35
10	Corvas International, Inc.			30
11	Scripps Clinic and Research Foundation		32	30
12	Agouron Pharmaceuticals, Inc.			28
13	Alliance Pharmaceutical Corp.			28
14	Sibia Neurosciences, Inc.			27
15	Syntro Corporation			23
16	Ligand Pharmaceuticals Incorporated			20
17	Molecular Biosystems, Inc.		4	20
18	Idec Pharmaceutical Corporation			19
19	Cytel Corporation			18
20	Advanced Tissue Sciences, Inc.			17

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

Biotechnology Commercialization in San Diego

The San Diego region is very young and entrepreneurial. The area has attracted more than \$1.5 billion in venture capital investment in biopharmaceutical firms since 1995. Investments have been made in 169 new firms, and four venture capital companies are present in the region. The region has had ten initial public offerings by biotech companies since 1998 and has attracted more than \$1.6 billion in pharmaceutical-biotech research alliances since 1996. The San Diego area has 33 publicly traded biotech companies with an aggregate market capitalization of nearly \$25 billion. The industry includes 31 firms with more than 100 employees, and 61 firms are members of the national Biotechnology Industry Association.

Table 4. San Diego: Indicators of Biotechnology Commercialization

Indicator		San Diego, CA MSA
Venture Capital Investment, 1995–2001	Number	169
	Amount	\$1,505,896,000
	Share	15%
Venture Capital Firms among the 50 Most Active in Biopharmaceutical Investment	1995–2001	4
Number of Initial Public Offerings by Biotech Companies	1998–2001	10
Value (in millions) of Research Alliances between Pharmaceutical Companies and Local Biotechnology Companies	Prior to 1990	\$46
	1990–1995	\$1,022
	1996–2001	\$1,615
Number of Publicly Traded Biotechnology Companies	2001	33
Market Capitalization (in millions) of Local Biotechnology Companies, 2001	2001	\$24,764
Local Biotechnology Firms Established	through 1980	7
	1981–1990	46
	1991–2001	38
	Not Available	3
	All Firms	94
Local Biotechnology Firms with More than 100 Employees	2001	31
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	61

San Diego's largest biotechnology firms are Dura Pharmaceuticals and the R.W. Johnson Pharmaceutical Research Institute. The area's largest private employers include Sharp Health Care (8,000 workers) and Qualcomm (7,000 workers).

Table 5. San Diego: Principal Biotechnology Firms

Company	City	Employment	Segment
Dura Pharmaceuticals Inc.	San Diego	1,022	Therapeutics; Immunological Products
R.W. Johnson Pharmaceutical Research Institute	San Diego	1,000	Therapeutics; Clinical Diagnostics; Vaccines; Veterinary
Agouron Pharmaceuticals Inc.	La Jolla	991	Therapeutics
Gen-Probe Inc.	San Diego	628	Clinical Diagnostics; Reagents; Therapeutics
Ligand Pharmaceuticals Inc.	San Diego	418	Therapeutics; Cell Culture
Hybritech Inc.	San Diego	400	Therapeutics; Clinical Diagnostics
Invitrogen Corporation	Carlsbad	376	Reagents; Cell Culture; Specialty Chemicals; Fermentation/Production; Immunological Products
IDEC Pharmaceuticals Corporation	San Diego	375	Therapeutics; Cell Culture; Clinical Diagnostics; Immunological Products
Isis Pharmaceuticals Inc.	Carlsbad	350	Therapeutics
Quidel Corporation	San Diego	333	Clinical Diagnostics; Immunological Products; Medical Devices; Drug Delivery System

Source: Institute for Biotechnology Information, 2001

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

Year	Venture Capital
1995	\$62,031,000
1996	\$165,960,000
1997	\$129,185,000
1998	\$143,170,000
1999	\$221,208,000
2000	\$432,822,000
2001*	\$351,520,000

Source: PriceWaterhouseCoopers, 2001 (* Six Months)