Good neighbours

A tight-knit community and a cooperative spirit has helped San Diego to succeed. Eric Niiler checks out California's rising star.

Connected: San Diego's research network has allowed it to flourish as a high-tech hub.

Large-scale business success tends to conjour up images of a sprawling metropolis — huge areas of industrial activity linked by lengthy highways to financial hubs and disparate research institutions.

But for one rising star in the US business firmament the opposite is true. In fact, many cite San Diego's densely packed research community as a major reason for its success as a high-tech and biotech hub. Biotechnology research, for example, is located along a densely packed two-mile stretch of North Torrey Pines Road that features institutions such as the University of California, San Diego (UCSD), the Scripps Research Institute and the Salk Institute for Biomedical Studies.

"We can throw a rock and hit UCSD," says Polly Murphy, vice-president for technology management at the Salk Institute. "I can hit a golf ball and hit Scripps. Everything is within walking distance. That means more heads get together and we do a lot of collaboration."

This open attitude has helped the region to brush off the effects of economic recession in the early 1990s to become the third in terms of the number of biotech companies in the United States behind the San Francisco Bay Area and Boston (see map, overleaf). But this success has come at a price — San Diego is running out of land for development and is facing escalating house prices. As a result, some technology firms are beginning to look elsewhere to build their new facilities. But with a high influx of federal funds, the region looks unlikely to relinquish its status just yet.

High-technology and biotechnology clusters don't grow overnight. Each follows its own long-term formula for success, usually backed by the presence of outstanding universities, a healthy flow of government research money, and venture capitalists prepared to fund start-up firms.

The cluster in San Diego is no exception, although its rapid rise has attracted the attention of scientists, entrepreneurs and policy-makers worldwide, who are keen to emulate its success in their own cities.

Strength in diversity

Today, one in eight San Diego workers is employed in the technology cluster, a broad category that includes the biotechnology, life-science and medical-device sectors, telecommunications and electronics firms, computer companies and military-related tech firms. In 2003, San Diego biotech companies reported a collective $1.8 billion in revenue and had nearly 200 products in development, according to BIOCOM, the local biotech industry organization.

San Diego began its transformation from a tourist and military town into one of the world's most innovative high-tech regions after a crippling recession in the early 1990s, which hit as a result of cuts in US military spending as the cold war dwindled. This led to the loss of some 60,000 jobs, but the region has managed to avoid the massive job losses in other areas during the more recent tech decline. Many other tech-dependent regions — such as the San Francisco Bay Area — continue to suffer economic headaches following the collapse of the dotcom bubble in 2001–02. Despite contractions in some fields — notably telecoms — overall employment in San Diego's tech sector has risen steadily from 99,377 in 1995 to 162,251 this year, according to Alexander X, a publisher based in San Diego that tracks such employment in California (see chart, opposite). It achieved this partly by balancing biotech with high-tech — the wireless, software and telecoms sectors have seen reduced profits over the past two years, but biotech has grown.

Another factor is that San Diego-based companies and universities have received $1.4 billion in new defence research and development contracts since 2001 for counter-terrorism R&D. High-tech communications software and biodefence research are now priorities for the US government. Fortunately for San Diego, which suffered significant job losses in the defence sector in

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the early 1990s, it already had the infrastructure in place to meet the new challenges. "We've been saved because of our diversity," says Kelly Cunningham, an economist and research director at the San Diego Regional Chamber of Commerce.

Biotech boost

Nowhere is San Diego's resurgence more obvious than in biotechnology. The city designated the 50-square-kilometre Torrey Mesa region as a zone for research and industry in the early 1960s, and since the first biotech firms were set up in the late 1980s, dozens of academic scientists have taken their ideas to nearby technology companies or started up their own.

Since 1990, for example, UCSD has produced 69 biotech and high-tech firms, which currently earn the school $17 million per year in licensing fees. The Salk Institute has launched 17 companies since the late 1980s, and researchers at Scripps — one of the largest non-profit research institutes in the United States — have developed 40 companies over a similar period of time.

Despite its rapid growth, many inhabitants maintain that San Diego still feels like a small town, living in the shadow of Los Angeles two hours' drive to the north. It is off the beaten track, which means that researchers and business people feel that they must share ideas and sometimes even office space.

BIOCOM has been important for promoting such informal networking. This has been particularly true for young tech entrepreneurs looking for experienced mentors who have already gone through the boom-and-bust cycles of the technology industry, says Bob Slapin, executive director of the San Diego Software Industry Council.

"The biggest difference between San Diego and other regions is a support structure and experienced individuals who are willing to assist companies," Slapin says. BIOCOM, for example, has set up joint purchasing contracts with a variety of suppliers so that a group of small biotech firms can save money by making bulk orders of specialized equipment or services such as compressed gas, lab equipment, insurance and cleaning services.

Networking and informal get-togethers have also led to a 'cross-pollinization' of new technologies. For example, a blend of genomics and computational modelling has led to the evolution of several hybrid firms. Cengent Therapeutics is using three-dimensional technology originally designed to spot military targets to identify possible drug-delivery locations. "These are crossover technologies that lead from software to biology," says Fred Cutler, former head of UCSD CONNECT, an arm of the university that helps to develop and foster start-up technology firms.

"Industry executives and other experts are warning that San Diego's technology cluster is facing some immediate challenges."

Such opportunities have also proved attractive to the pharmaceutical industry. Several big drug firms have expanded their research divisions into San Diego because of the cluster of biotech talent hat exists there. Pfizer opened a new 70,000-square-metre research centre in May 2002 to study AIDS, diabetes and cancer. Novartis, Johnson & Johnson, Merck and Elan have all established West Coast research hubs in San Diego in recent years, providing more jobs in the area.

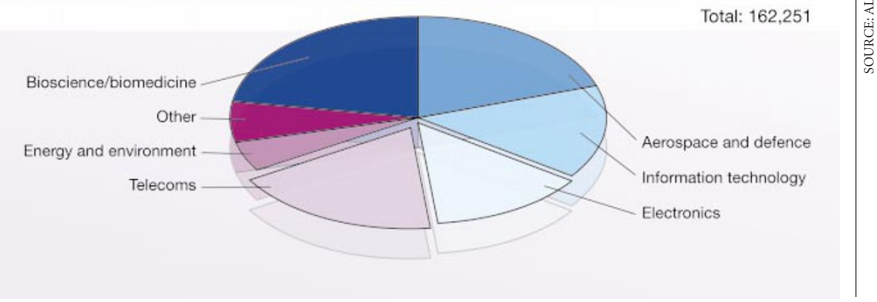
Cash rich

But if networking and cross-fertilization are driving San Diego's success, then oiling the wheels is the high level of funding available to the region. In 2002, San Diego's entire technology sector received $1 billion in private venture-capital funding. And in a report by the Brookings Institution, the city — along with Raleigh-Durham and Seattle, two other successful biotech clusters — was identified as receiving an average of $500 million annually from the National Institutes of Health (NIH) during 1990–2000 and at least $700 million in private venture-capital funds from 1994–2001.

San Diego's success at attracting such high levels of funding can largely be attributed to its proactive approach. UCSD CONNECT, for example, was set up in 1995 to help start-up companies obtain financial back-up. It has subsequently initiated a series of scientist-to-business forums that to date have helped technology companies raise more than $5.8 billion. The various institutions in the region agree that their active solicitation of ideas from their own faculty members has also helped to bring money into the area.

"We try to make them understand that their duty is to do more than just make a

Who works where: the number of employees across San Diego's technology sector in 2003.



SOURCE: ALEXANDER X

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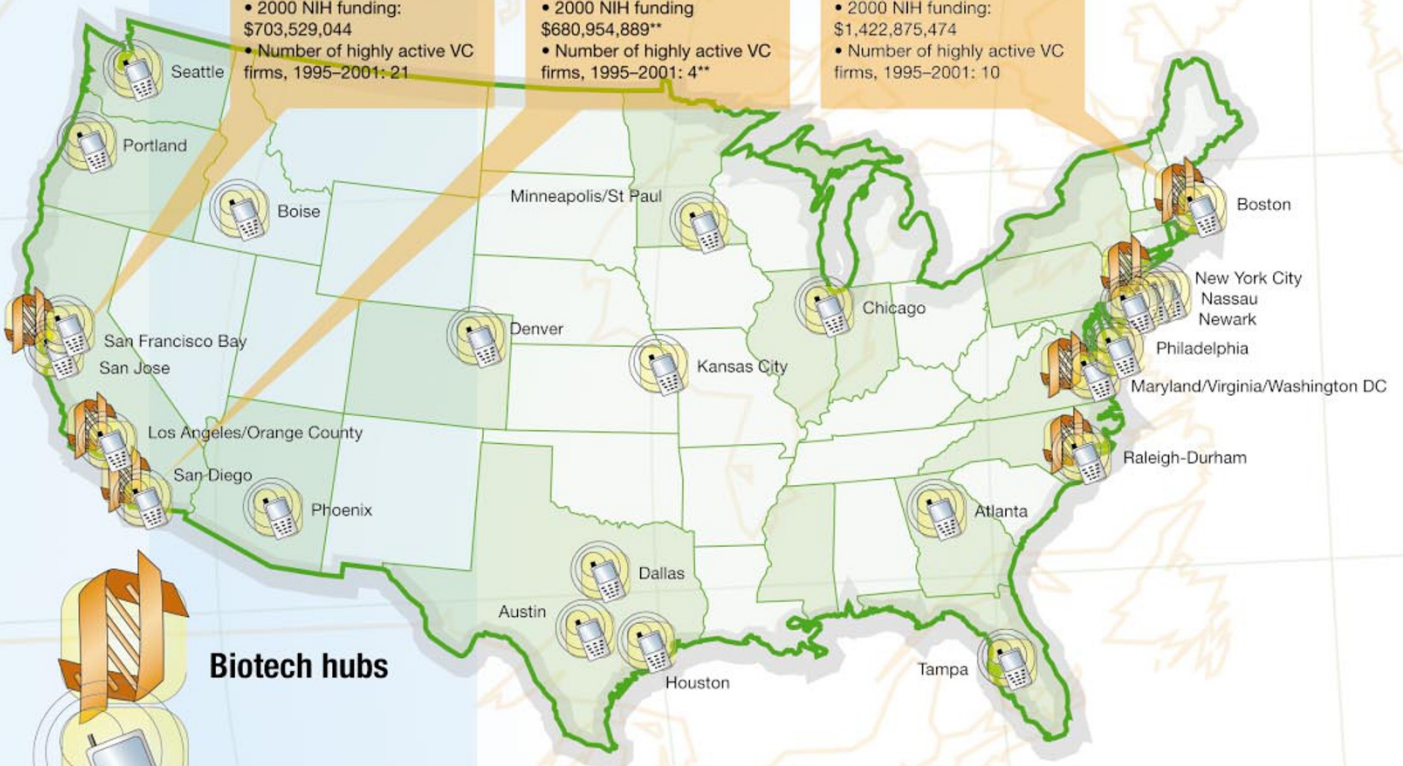
Biotech and high-tech hubs

San Francisco
- 3 major research universities
- Average price of family house: $470,230
- Average biotech wage: $65,800
- 2000 NIH funding: $703,529,044
- Number of highly active VC firms, 1995–2001: 21

San Diego
- 2 major research universities
- Average price of family house: $325,500*
- Average biotech wage: $62,362*
- 2000 NIH funding $680,954,889**
- Number of highly active VC firms, 1995–2001: 4**

Boston
- 7 major research universities
- Average price of family house: $367,300
- Average biotech wage: $58,030
- 2000 NIH funding: $1,422,875,474
- Number of highly active VC firms, 1995–2001: 10



Biotech hubs

High-tech hubs

	Value of venture-capital investments, 1995–2000 US$ million†	Number of biotech companies, 2002*	Number of venture-capital investments, 1995–2000†	Value of pharmaceutical–biotech alliances, 1996–2001 US$ million†	Number of initial public offerings, 1995–2000†
San Francisco Bay Area	3,029	215	261	1,205	31
Boston Area	1,916	250	219	3,924	3
San Diego	1,506	110	169	1,615	10
New York/New Jersey	639	135	63	1,729	5
Raleigh-Durham	380	85	54	192	1
Los Angeles/Orange County	181	105	26	69	1
Maryland, Virginia, Washington DC	85	110	20	358	2

Source: *Ernst & Young; †Brookings Institution

Institutions and associations in San Diego

• Institutes

Burnham Institute
California Institute for Telecommunications and Information Technology
Jacobs School of Engineering, UCSD
La Jolla Institute for Allergy and Immunology
School of Medicine, UCSD
The Neurosciences Institute
Salk Institute for Biological Studies
San Diego State University
San Diego State University Graduate School of Business
San Diego Supercomputer Center at UCSD
Scripps Clinic
Scripps Foundation for Medicine and Science
Scripps Institution of Oceanography
Sidney Kimmel Cancer Center
The Scripps Research Institute
University California, San Diego
University of San Diego

• Associations

BIOCOM
California Healthcare Institute
San Diego Regional Chamber of Commerce
San Diego Regional Economic Development Corporation
San Diego Telecom Council
UCSD CONNECT

Research: Emily Burke
Source: * San Diego Regional Economic Development Corporation
** Brookings Institution

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	Number of employees, 2003 (thousands)						
	Wireless telecom	Telecom	Internet service provision	Computer and electronics manufacturing	Communications equipment manufacturing	Semiconductor manufacturing	Total employment
San Jose, California	—	—	9.3	124	—	56.3	189.6
Los Angeles/Orange County	3.4	45.2	11.1	99.6	3.4	15.1	177.8
Dallas, Texas	—	39.8	17.6	50.2	11.5	25.7	144.8
Maryland, Northern Virginia, Washington DC	3.6	59	22.3	18.9	—	—	103.8
Chicago, Illinois	—	36.8	15.5	37.7	—	—	90.0
Boston Area	—	15.4	—	48.9	5.2	11.3	80.8
San Diego	7.4	15	14.5	25.5	5.2	—	67.6
Portland, Oregon	—	—	—	34.5	—	25.3	59.8
Philadelphia, Pennsylvania	—	20.2	12.9	25.8	—	—	58.9
Atlanta, Georgia	13.4	44.6	—	—	—	—	58.0
Phoenix, Arizona	—	17.2	—	38.5	—	—	55.7
Minneapolis/St Paul, Minnesota	—	—	9.2	38.9	—	—	48.1
Austin, Texas	—	—	—	30.9	—	16.7	47.6
Seattle, Washington	10.3	18.8	—	15.7	—	—	44.8
San Francisco Bay Area	—	14.2	7.5	22.9	—	—	44.6
Houston, Texas	—	15.4	—	18.7	—	—	34.1
Tampa, Florida	—	15.8	5.3	—	3.4	3.8	28.3
New York City	—	26.2	—	—	—	—	26.2
Kansas City	—	25.8	—	—	—	—	25.8
Denver, Colorado	—	25.8	—	—	—	—	25.8
Raleigh-Durham, North Carolina	—	—	—	25.2	—	—	25.2
Boise, Idaho	—	—	—	14.5	—	9.8	24.3
Nassau, New York	—	—	—	17.8	—	4.4	22.2
Newark, New Jersey	—	13.5	—	—	—	—	13.5

Source: US Bureau of Labor Statistics, August 2003

High-tech world view

Country	R&D expenditure, US$ billion*	Number of patents filed, 1998
United States	282.3	14,401
Japan	103.8	10,230
China (excluding Hong Kong)	58.8	—
Germany	53.9	5,736
France	35.1	2,044
United Kingdom	29.4	1,851
Korea	22.3	355
India	19.4	—
Canada	17.4	511
Italy	15.5	713
Brazil	13.7	—
Russian Federation	11.6	—
Chinese Taipai	10.9	—
Sweden	9.9	951
Netherlands	8.4	782
Spain	8.2	105
Australia	7.7	271
Israel	6.4	—
Switzerland	5.6	848
Belgium	4.9	380
Finland	4.7	386
Austria	4.4	260
Mexico	3.5	12
Denmark	3.2	220

Country	R&D expenditure, US$ billion*	Number of patents filed, 1998
Norway	2.7	117
Turkey	2.7	4
Poland	2.6	10
South Africa	2.6	—
Czech Republic	2.0	10
Singapore	2.0	—
Argentina	1.9	—
Portugal	1.5	6
Ireland	1.4	43
Hungary	1.3	24
Greece	1.1	11
Hong Kong	1.0	—
Chile	0.9	—
New Zealand	0.8	37
Slovenia	0.6	—
Romania	0.5	—
Slovak Republic	0.4	5
Iceland	0.3	11
Bulgaria	0.3	—
Lithuania	0.2	—
Estonia	0.1	—
Latvia	0.1	—
Cyprus	0.04	—

Source: OECD; *2001 or latest available year

discovery and publish a paper," says Alan Paau, assistant vice-chancellor at UCSD and director of the school's technology-transfer programme.

Although San Diego produces a large number of science graduates, helping to fuel its culture of innovation, relatively few of them have the business and administration experience needed to manage and expand technology firms. To help meet this need, UCSD will open a graduate business school in 2004, and has already begun a dual major PhD/MBA programme with San Diego State University. This programme allows molecular-biology students to earn a business degree at the same time as working for their main degree.

Junfu Zhang, a research fellow at the Public Policy Institute of California, says that entrepreneurs who can understand both business and science — such as those graduating from a dual programme — are more likely to succeed than those following a more traditional degree path. Zhang has studied California's high-tech industry and found that 40% of venture-backed entrepreneurs came from a university setting. "You can never overestimate the role played by universities in developing entrepreneurship," he says.

Saturation point

Nevertheless, industry executives and other experts are warning that San Diego's technology cluster is facing some immediate challenges. At 50% above the national average, house prices are very high compared with wages, commuting times are increasing and the area is running out of land that can be developed. City of San Diego councillor Scott Peters admits that the region could soon become a victim of its own success. "It's getting a little crowded," he says.

This crowding was painfully clear during October, when wildfires spread from house to house, destroying 2,400 homes and killing 16 people in San Diego County. Fortunately for the region's tech development, no research centre was destroyed and most analysts believe that there will not be a long-term economic effect.

Despite the damage caused by the fires in rural San Diego, the most pressing issue is the long-term provision of housing. Currently, only one in five San Diego families can afford the average house price of about $380,000 ($490,000 for new homes). Many young families moving to the area are forced to seek out cheaper housing in areas north and east of the city, such as Riverside county, about 60 minutes away by car. The housing

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situation is so bad that the city council declared a 'housing emergency' in 2003, and is looking for innovative ways to encourage developers to build more housing that is affordable to low- and middle-income earners.

"It's a market issue," says Peters, "and probably bigger than we can do locally. We do have to find a way to make investment in housing more attractive to private capital." One possibility, Peters says, is to require suburban developers to include in their plots a certain number of housing units that are affordable to low- and middle-income residents, although builders are distinctly uneasy about this proposal.

Another problem is the lack of water in the region. San Diego imports 80% of its water from the Colorado River 200 kilometres to the east. But the federal government has ordered California to reduce its use of the river by 20% over the next decade. San Diego officials are looking at alternatives such as desalination and recycling. Already, firms such as Ligand Pharmaceuticals, a biotech firm based in San Diego, are using reclaimed water in their manufacturing, but the price of water is likely to add to the cost of doing business in San Diego. As a state, California is taking an increased amount of water from agricultural regions to sell to the cities. So far, it is not clear how the cost structure will pan out, although analysts agree that the price of water is going to go up.

The amount of land left to build on is shrinking, and the vaunted Torrey Mesa area is developed almost to capacity. The recent wildfires were a disquieting reminder that the wholesale real estate development in the region makes it especially vulnerable to natural disasters.

As a result, San Diego firms are starting to look for cheaper locations. IDEC Pharmaceuticals recently opened a manufacturing centre 32 kilometres north of San Diego in the city of Carlsbad (but now that it has merged with Biogen, it will move its headquarters to Massachusetts), and CancerVax is relocating its manufacturing to a Los Angeles suburb.

California officials, meanwhile, are mired in a state budget deficit of at least $10 billion, which could double or even triple by the middle of 2004. The state's newly elected governor, Arnold Schwarzenegger, hopes to sell bonds to plug the growing hole in the budget, but the legality of such a move is under question in the courts.

Despite the uncertainties, technology leaders in San Diego say that they are optimistic about the future. Local economic forecasters expect the region's population to grow from 2.8 million in 2000 to 3.6 million in 2020. Industry chiefs note that San Diego has grown steadily in the past 15 years by focusing on education, cross-discipline training and a cooperative business atmosphere. Although they admit that the technology cluster won't continue to grow forever, they believe that they can adapt to economic changes, natural disasters and population growth.

"We've lived with earthquakes and other disasters and people still come to California," says Joseph Panetta, executive director of BIOCOM. "We have to continue to maintain a business climate in San Diego that will allow us to continue to attract people." ■

Eric Niiler is a correspondent for KPBS radio in San Diego.

Profit and pitfalls: building a biotech hub

Biotechnology is now one of the prime points of focus for US regions that want to develop their local economies. In 2002 it was listed as one of the top two priorities by 83% of state and local economic-development agencies, according to a survey by the Brookings Institution. Forty-one states currently have biotech development programmes.

"Ten years ago, everyone wanted to be the next Silicon Valley; three or four years ago everyone wanted to be the centre of electronic commerce; now everyone in the economic-development community has zeroed in on biotechnology," says Joseph Cortright, an economist at Impresa, a research-analysis firm in Portland, Oregon. "That says a lot more about the herd instinct of the economic-development fraternity that it does about the economic potential and realities of biotechnology."

The problem is that biotech takes decades to develop, Cortright says, and it needs a healthy supply of venture capital to take it from research to commercialization. "If you have half-a-billion dollars, it's possible to start a research institution, but it's much more difficult, and less likely, that you will spawn a biotechnology industry as a result," he explains.

So does a region go about creating its own biotech hub? Sceptics say that it requires not just a few big-name companies or research institutions, but a critical mass of talent and money. Bringing all of these elements together is no easy task.

Florida and South Dakota are two states that are doing their best to attract the necessary components. In late October, Florida officials approved a $510-million package to set up a campus for the Scripps Research Institute in Palm Beach County. Based in San Diego, Scripps has an excellent record of producing spin-off companies that Florida is keen to capitalize on.

South Dakota, meanwhile, has successfully attracted biotech company Hematech, currently based in Westport, Connecticut. The company, which generates human antibodies in cattle, took advantage of the state's offer to cover half of the $15-million costs of building a research facility in Sioux Falls.

Such moves may be helped by the rising cost of doing business in established clusters such as San Diego or the San Francisco Bay Area. "Within corporate boardrooms, there's a trend towards smaller, more manageable, less costly locations," says John Boyd, president of corporate-relocation firm the Boyd Company, based in Princeton, New Jersey.

Boyd notes that companies also follow money. "Venture-capital firms are now being more selective about who they will fund," he says. "They would be more likely to fund a start-up in South Dakota than in San Diego because of the cost structure."

This evolution is making working conditions more flexible for prospective employees, notes John McCamant, editor of the *Medical Technology Stock Letter*, a weekly guide focusing on bioscience. "The biotech industry is big enough now and has a lot of people who can now work where they want," he says.

As an investment adviser, McCamant says that he often looks to the out-of-the-way places to find undervalued companies to invest in. He believes that biotechnology clusters could spring up just about anywhere with the help of 'tech angels', which provide unexpected assistance to start-up firms. "Most get started with angels, friends and family, and there are millionaires all over the place," he says. **E.N.**

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