# Incubating Biotech

## Yale Prospers, New Haven Waits

*A report prepared by the*
*Connecticut Center for a New Economy*
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For twenty years, biotechnology has been heralded as New Haven's postindustrial savior. When the firearms corporations and other heavy manufacturers abandoned the city in the late 1970s, taking with them 20,000 jobs, the eyes of local leaders turned to high tech to form the foundation of New Haven's New Economy. This was the rationale behind Science Park, a high-tech incubator founded in 1981 in New Haven's impoverished Newhallville neighborhood.

Since the first start-up moved into Science Park in 1982, biotechnology-an industry that researches the life sciences for marketable discoveries and inventions—has brought promises of revitalization, stability and growth. Government officials, Yale administrators and industry leaders claimed New Haven would benefit in two ways: an expanded tax base, and numerous new jobs.

Two decades have come and gone—and headlines still flash optimism about biotech's future potential for the New Economy. But biotechnology's promises have not been realized.

This report takes a sober look at biotechnology's accomplishments. An evaluation of biotech's two decade record shows:

- A string of successful biotech companies have abandoned the city to expand in other locations.
- Few jobs have appeared. Excluding CuraGen (which recently announced its departure), there are only about 400 biotech jobs in New Haven. Most of these jobs require higher degrees and remain out of reach for poorly educated city residents.
- Negligible property taxes have come to the city. Biotech-owned property and leased real estate provide only 1.6% of the city tax base. Also, several biotech companies have a record of delinquency in filing taxes.
- Yale is prospering from its relationships and contracts with regional biotech start-ups. As a policy, Yale expects and receives millions in sponsored research, licensing fees, company equity and royalty payments from its biotech start-ups.

This report recommends:

- New Haven policymakers should consider ways to encourage biotech companies to stay in New Haven once they grow.
- Yale University should make substantial payments to improve New Haven's public schools, so that both biotech companies and Yale itself can draw upon a more prepared workforce.

## The Biotech Life Cycle

A biotech company generally grows in three stages: 1: Scientific discovery and patent, 2: Research and development, and 3: Production and marketing. Academic research centers offer a prime location for the first stage. A university's patents, however, cannot become profitable without stages two and three. So far, although New Haven has served as a stepping stone for Yale to turn patents into profits, the broader promise of biotech remains unfulfilled.

### Stage 1: Scientific Discovery and Patent – Inside Yale's Academic Labs

When Richard Levin became Yale president in 1994, he placed heavy emphasis on "tech-transfer," or the commercial development of academic patents. As the *Yale Medicine* magazine explained: "Guiding the transfer of Yale technology to private, for-profit companies within the region seemed the most promising way to assure that the gold and diamonds mined in Yale laboratories would be turned into jewelry close to campus."[1]

In New Haven, most biotech companies grow out of research conducted at Yale University. When lab experiments discover a marketable new idea, the Office of Cooperative Research (OCR), Yale's tech-transfer office, files for a patent. Eighty percent of Yale's patents come from biomedical sciences.[2]

OCR then may pursue tech-transfer by licensing the patent to a large pharmaceutical corporation, a smaller biotech company, or a "Yale start-up"—a company founded by Yale faculty, by OCR, and/or by using Yale capital investments. OCR's mission statement explains its goals: "we seek to increase the commercial value of University inventions in a way that leads outside organizations—investors, corporate partners, executives, industrial scientists, and governmental and nonprofit agencies—to invest their talent, time, money and other resources in the inventions."[3]

Yale professors and students often find opportunities in these Yale start-ups. Yale professor Sherman Weissman, whose inventions spurred the creation of several start-ups, said, "There are tremendous advantages having companies here for our own resources. We do things of common interest and mutual benefit. We get analyses of our data we couldn't otherwise afford."[4] According to *Yale Today*, local biotech companies also bring employment opportunities to Dr. Weissman's former students and post-doctoral fellows. [5]

Yale administrators also point to biotech as the way to help New Haven's struggling economy. As Yale president Richard Levin claimed: "There are few things that Yale can do that will make a larger contribution to advancing the economy of this city and region than with this expanded commitment to technology transfer."[6]

### Stage 2: Research and Development – Incubating in New Haven

It can take years of research and development (R&D) to turn a patent into a marketable product. A biotech company's early years are spent trying to woo venture investors and maintain R&D in an inexpensive "incubation" environment.

A location near the non-profit research base is beneficial to an incubating company. New Haven start-ups frequently turn to Yale for skilled labor and consulting work, and spend millions of their R&D capital on the continued development of licensed technology in Yale labs through "sponsored research agreements." This is one of the most significant ways Yale receives returns from its biotech licenses.

New Haven, on the other hand, sees few returns at this stage.

### The Science Park Story

Through Science Park, a publicly subsidized joint venture between New Haven, Yale and the state of Connecticut, New Haven has provided low-cost incubation space to a number of Yale start-up companies.

Founded in vacant manufacturing facilities in 1981, Science Park was the first major effort to foster high tech job creation in New Haven. At its inception, policy-makers touted the incubator as a job-creation vehicle for the Newhallville neighborhood. Newhallville at the time had just been demarcated a state-law defined Enterprise Zone (EZ)[7]—a distressed urban area slated for economic development through special state grants and tax programs. In addition to funneling EZ money to its tenants, Science Park also handily beat-out other neighborhood organizations for additional urban development-targeted funds.

The result was an ideal incubation environment for high-tech and biotech. As one early tenant put it, "Science Park has gone out of its way to help new firms take away some of the risk," with low cost rent and utilities, a flexible month-to-month lease, room to grow and access to temporary labor from Yale graduate students.[8] The tenants themselves qualified for various tax breaks, expansion incentives, grants and low-interest loans.

However, Science Park was a let-down for the community. It provided very few jobs—never even meeting the modest original goal of 1,800[9]—and those jobs required advanced skills, making them inaccessible to the impoverished neighborhood. "If Science Park makes money, who gets the jobs? Who gets the money?" asked Milton Smith, a Dixwell community leader, whose application for a Community Development Block Grant was turned down multiple times as money was diverted to Science Park. "The beneficiaries are the white, middle-class businesses." [10]

Still, as Yale increased tech transfer from its life sciences, biotech's appeal to state legislators grew, as did the industry's receipt of generous new tax subsidies and exemptions.[11] Science Park was continuing to run a deficit, and was at risk of bankruptcy. In 1998, the state prepared a $15 million bailout to "revitalize" not the neighborhood, but the struggling Science Park.

Recently, a new developer from Cambridge was contracted to take over renovations, leading a recent pamphlet from the Connecticut Development Authority to call Science Park "A model for a successful public/private/university partnership." The pamphlet echoes the promises from two decades ago: "The rewards will be measured in terms of scientific advances, new technologies, job growth, tax revenues and revitalized neighborhoods."[12] On its twentieth anniversary, Science Park still makes promises for the future.

### The Enterprise Zone and Biotechnology

The benefits for companies locted in an Enterprise Zone include:

- 5-year, 80% abatement of taxes on property new to the grand list
- 10-year, 25% tax credit on corporate income attributable to expansion or renovation
- 10-year, 50% credit on corporate income attributable to expansion if 30% of new jobs employ Zone residents
- 100% corporate tax credit for first 3 years, and 50% for the next seven years, if 40% of employees are Zone residents
- Up to $300,000 in loans through the Connecticut Development Authority
- Direct job creation grants of up to $75,000

• Urban Jobs Program benefits throughout EZ municipality
• Incentives for building renovation, construction, expansion and re-occupation projects.

Unique steps were taken recently in the Connecticut Legislature to adapt the Enterprise Zone mandate for New Haven biotechnology. Passed in 1997, Public Act 96-264 grants EZ benefits to any biotech, pharmaceutical or photonics firm with fewer than 300 employees, as long as it locates anywhere in a municipality with both an EZ and a "major research university," a condition only New Haven-based companies fulfill. This means that biotech companies in New Haven can receive benefits designated for poor neighborhoods—without locating in poor neighborhoods.

## Stage 3: Production and Marketing – Sublicense or Expansion

After years of small scale development, a successful biotech company will bring its technology to market. For this final stage, companies in New Haven have generally sublicensed their marketable technology to outside corporations, or expanded their operations to encompass advanced R&D and production.

Companies that sublicense technology to another corporation can remain small and move on to other R&D projects. Vion Pharmaceuticals, Inc. is an example: the Science Park-based biotech company sublicensed a number of products for development and manufacturing by companies outside of Connecticut. Vion's own employment levels have hovered below 60 since its founding in the early 1990s.

Companies that expand seek out capital to develop and market their technology. Often an advanced company will "go public," or sell shares of stock to the public. At this point, the biotech company is less reliant on a cheap incubation environment. From an economic development standpoint, this stage presents the greatest opportunity for creating jobs and tax revenue.

Unfortunately, companies that reach this stage also tend to leave New Haven.

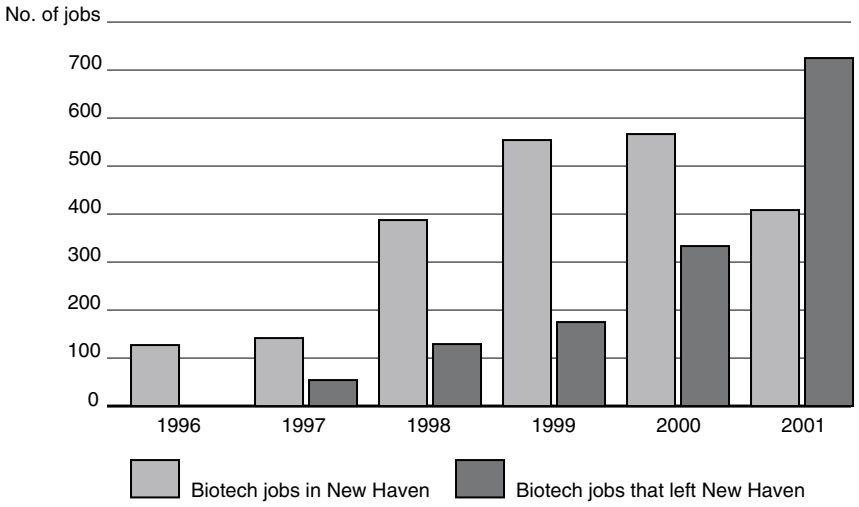
## New Haven's Losses

Rather than expanding in New Haven, three highly successful and promising biotech companies have decided to grow outside of New Haven or out of state. In addition, New Haven's largest biotech firm, CuraGen, announced in May 2001 its decision to follow suit, and will be departing soon for the suburbs.

Of those four companies:

- All are Yale-based. Three out of four have former Yale faculty as executive officers.
- Three out of four were incubated in Science Park.
- At $1.9 and $3.9 million, CuraGen and Alexion had the highest personal property net tax assessments of all New Haven biotech companies in 2000, the revenue for which will now be lost.
- Three out of four are now publicly traded and employ over 100 people. Two out of four employ over 200 people.
- CuraGen, Alexion, Cellular Genomics and Gene Logic together employ over 700 people. After subtracting CuraGen's jobs from New Haven, *this is more jobs than all the remaining New Haven biotech employment combined.*[13]

**When CuraGen goes, where are the biotech jobs?**




Sources: Compiled using employment levels for biotech companies profiled in B*usiness New Haven Book of Lists,* 1996-2001; Gene Logic data from Gene Logic 10k SEC filings 1997-2000 and the *Baltimore Sun,* 4/11/96; Genaissance's 1999 employment figure, not listed in *Business New Haven*, comes from Genaissance's 1999 10-K Annual Report. The 2001 figure speculates on employment levels after CuraGen moves to Branford.

### The Departed Companies

**Gene Logic, Inc.** A bioinformatics company, Gene Logic was founded in 1995 based on the technology of Yale professor Sherman Weissman. In the spring of 1996, Gene Logic announced it was moving its operations to Columbia, Maryland, which had offered $500,000 in venture financing in return for a guarantee that it would stay in Maryland for at least five years.[14]

"The most salient things that attracted us to Maryland were the large biotechnology infrastructure in Maryland and the availability of key people we will need for our work," said the president and CEO of Gene Logic, Michael Brennan.[15] Reporting on the move, the Baltimore Sun wrote, "The company, which joins 176

other biotechnology companies based in Maryland, also believed it would be easier to recruit top scientists to Columbia, because of its strong schools, housing and other quality of life features." [16]

Gene Logic had its Initial Public Offering in 1997. When it left New Haven, it employed 11. It now employs over 220 people.

**Alexion Pharmaceuticals, Inc.** Founded in 1992 by Yale professors, Alexion began its operations in Science Park, and, as one of its larger companies, was considered one of the Park's "flagships." Alexion successfully went public in 1996.

In 1999, Alexion prepared for expansion. According to the *Yale Daily News*, "Both Genaissance and Connecticut Innovation officials said they expected these expansions to help the surrounding neighborhood of Newhallville."[17]

Early in 2000, Alexion announced its decision to transfer all operations to Cheshire, CT.

In the two months before Alexion announced its move, the company had raised $120 million in financing. Salvatore Brancati, New Haven's economic development officer, said, in reference to Alexion's exxecutive, "There isn't much we can do now... He has money now. It's not an issue of we're broke we need money."[18]

In response to Alexion's decision, Debra Pasquale, the president of the state-funded bioscience promotional organization, Connecticut United for Research Excellence, said: "Science Park was meant to be an incubator facility and it may be that it's time for Alexion to move on."[19]

The *New York Times* reported that Dr. Leonard Bell, a former Yale professor and current CEO of Alexion, "had little praise for New Haven."[20]

**Cellular Genomics, Inc.** Cellular Genomics, Inc. (CGI) was launched in 1999 in Science Park. The company was based on Yale technology licenses, and founded by Yale's Office of Cooperative Research and Yale professor Ira Mellman. One OCR associate director, R. Bennet Muskin, became CGI's Vice President for Business Development. CGI hired Yale students and faculty, and began working closely with professor Mellman's laboratory at Yale.[21]

CGI started up in Science Park, in lab space newly refurbished using money from Connecticut Innovations, Inc. (CII), the state-funded high-tech venture-financing agency. According to Muskin, "Without CII's contribution, it would have been difficult to get going."[22]

In 2000, CGI moved to a new building in Branford, CT which would give CGI "an opportunity to expand within the building," said Muskin. Richard Grossi, the chairman of the Science Park Development Corporation Board, said that events like Cellular Genomics' outgrowing Science Park was "a natural progression we have to get used to."[23]

**CURAGEN CORPORATION** Since its founding in Branford, CT in the early 1990s, CuraGen has grown into one of the largest biotechnology companies in the world. Founded by Yale professor Jonathan Rothberg CuraGen uses Yale technology in its genomics research on heart disease and cancer. Rothberg, who grew up in New Haven, became the company's CEO, president and chairman of the board.

In 1996 CuraGen went public. The next year, it expanded part of its operations to 555 Long Wharf Drive in New Haven, keeping branches in Branford and in Gainesville, FL. Before long, CuraGen was referred to as the "crown jewel" of New Haven's fledgling biotechnology industry.[24]

In March of 2000 Rothberg spoke of the New Haven company's growing success: "We are at the right place at the right time, and we are seeing a lot of interest by the state, Yale and investors that was just not there when I first started CuraGen."[25] In December 2000, Rothberg told the New Haven Register, "I started the company in my basement right here in New Haven—so, yes, I'm bullish on this city." Rothberg continued, "I want this to work—and I want it to work here."[26]

*"The university has realized that good ideas come from the young start-ups, but we are reaching a transition point where Yale must appeal to more experienced business-savvy companies rather than rely on small players…. I love New Haven and Science Park, and bioscience is here to stay. But we are reaching the point where Yale needs to go beyond a dependence on small start-ups."*

*—Gualberto Ruaño*
*CEO of Genaissance Pharmaceuticals* [30]

Late in 2000, CuraGen announced it was seeking a "campus-like" facility to expand and consolidate its operations.[27] Five months later, CuraGen made up its mind to purchase 88 acres for its "campus"—in Branford, CT.

In an editorial titled "Convenient site wins CuraGen," the *New Haven Register* wrote: "CuraGen's new complex will be less than two miles from the Guilford home of Jonathan M. Rothberg, the company's founder, chairman and chief executive officer. Half of its workers already live east of the city along the shoreline. Staying in New Haven would have meant fighting traffic during the some 12 years of construction as Interstate 95 is rebuilt and a new harbor bridge constructed."28

Bruce Alexander, Yale's vice president and director of the Office of New Haven and State Affairs, called CuraGen's move "natural evolution." "Their future growth is unpredictable and could be very large," said Alexander.[29]

## New Haven's Gains?

A Yale Tercentennial pamphlet called "Yale and New Haven: Economic Growth through Biotechnology" recently claimed, "These companies bring both the promise of new treatments and cures for human diseases and the reality of new jobs and taxes for the local economy."[31] Local politicians have reiterated a prediction of more jobs and taxes through biotechnology. However, trapped in the role of an incubator city, New Haven has had a difficult time fulfilling these two promises.

### Local Jobs

Twenty years of biotech subsidy and promotion have failed to create many jobs in New Haven. New Haven's biotech "boom" so far comprises fewer than 800 jobs.[32] After CuraGen, New Haven's largest biotech employer, departs for the suburbs, New Haven will be left with just over 400 jobs. According to the *Boston Globe*, the jobs provided in the entire New Haven region are "equivalent to just a small office park in Massachusetts."[33]

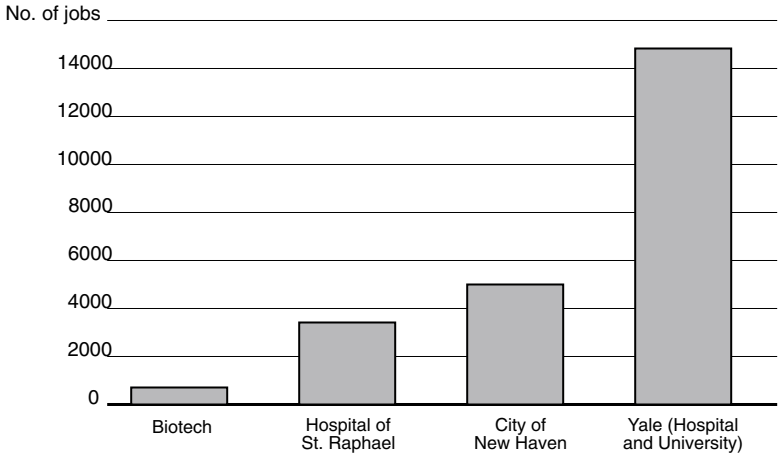
Comparing local biotech to New Haven's largest employer, Yale, puts this level of job creation into perspective. Yale and its teaching hospital employ more people than the rest of the top ten New Haven employers combined, and far more than biotechnology.

**Biotech draws primarily from a highly educated workforce**

In New Haven, biotech's privileged access to state subsidies targeted for inner-city poverty alleviation creates an added twist to the jobs promise — that biotech will help revitalize impoverished inner city neighborhoods. But the few jobs that biotech has brought to the city remain out of reach for most New Haven residents.

The first stage of biotech development, starting in Yale labs, draws directly from clusters of Yale faculty, post-docs, graduate and technical employees. The incubation stage, in New Haven, also depends on exclusive groups of highly specialized research scientists and computer programmers, or "R&D" workers. Only when companies grow beyond incubation do they begin to seek support services from a large number of technical, production, clerical and maintenance workers.

**Biotech vs. the three top employers in New Haven**




Source: New Haven Office of Economic Development, "New Haven's Ten Largest Employers," in the City of New Haven Five-Year Strategic Plan, 2000.

"You start at the PhD level, then move to the bachelor's level, then to the junior college level and you do on-the-job training," said Gualberto Ruaño, the CEO of Genaissance, one of New Haven's largest biotech firms. "That's the typical evolutionary pattern of biotech companies."[34]

Currently, close to half of Genaissance employees have advanced

degrees. Almost one third of Genaissance employees hold PhDs or MDs.[35]

Eighty-eight percent of Connecticut's biotechnology workforce holds at least a bachelor's degree.[36]

New Haven's working poor currently do not receive a competitive education. Even "low-level" biotech jobs require strong academic skills, which city schools struggle to provide.

New Haven's Gateway Community College instituted a one-year biotechnology certificate program in 1998 in an attempt to train local residents for technical assistant jobs in biotech. Newhallville community activist William Battle was among those who tried to attract students into the program. "We went through a massive effort with Gateway trying to get kids in a certificate program," said Battle. "I got a fax from the guy who was running it. He said 'Mr. Battle, we have a problem. The kids that are applying for the course can't pass English and Math 100.' I was astounded."[37]

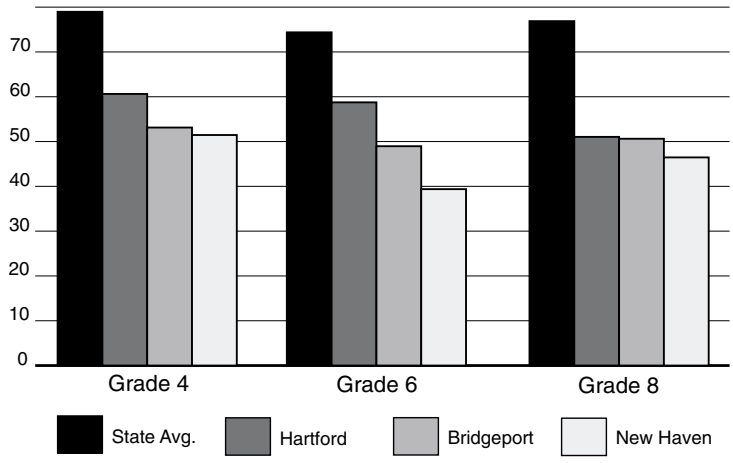
Due to the lack of qualified applicants, the Gateway Community College biotech certificate program was discontinued, and then was recently re-opened this year. Regardless, New Haven has some of the worst math and reading mastery test scores in the state. New Haven consistently scores far below neighboring suburbs. In 1999-2000, New Haven's math test scores ranked even below Hartford and Bridgeport in every grade tested (grades 4, 6, and 8).

Lacking local talent to fill biotech jobs, government organizations are compelled to look out-of-state to attract workers to New Haven. According to the *New Haven Register*, one of the Regional Growth Partnership's principal goals is to grow the center city's employment base "particularly by marketing the area to the national high technology community. *Its aim is to help area companies recruit out-of-state workers*."[38]

*David Birch, president of an economics research firm in Cambridge and author of two books on New Haven, told the* Wall Street Journal *that he doubted many biotech companies would stay in New Haven after expanding beyond a few dozen employees. "First, you've got no significant airport nearby, and then you've got no substantial work force," Birch explained. "The educational system the last time I looked was awful."*

*"There's lots of places that are really swinging today," said Birch, "Austin, Dallas, Palo Alto. You've got to ask the question, 'Why would they stay?' I'm not sure I know the answer."*[39]

**Connecticut Mastery Test Index: Math Scores**




Source: CT State Department of Education, Strategic School Profiles, 1999-2000.

### Indirect Employment

The recent annual reports of Connecticut United for Research Excellence (CURE), the state-funded "bioscience" industry promotional organization, emphasize indirect "ripple effects" in measuring the accomplishments of its industry. In addition to providing "high-paying jobs and career opportunities that attract intelligent, entrepreneurial people," CURE writes, "Connecticut's growing BioScience workforce also generates significant employment opportunities in the general economy by creating an increased demand for the goods and services we all need."[40]

**Recruiting for the Suburbs**

Yale proudly takes credit for attracting a Yale-based start-up called Achillion to New Haven in 2000.

The *Boston Globe* explained how Alfred Brown, a Yale OCR director, persuaded William Rice, one of Achillion's founders, to choose New Haven over Princeton, NJ: "To persuade the founder of a biotechnology start-up to locate his company in this city, home of Yale University, Brown drove him around some tony nearby suburbs where the entrepreneur's family might live. He told him that more than 90 percent of local students go to good public schools and that property values are high and taxes reasonable."[41]

William Rice is now CEO of Achillion Pharmaceuticals, which is located in New Haven, near the Yale Medical school at 300 George Street. Rice himself lives in Madison, a town with excellent schools and high property values.[42]

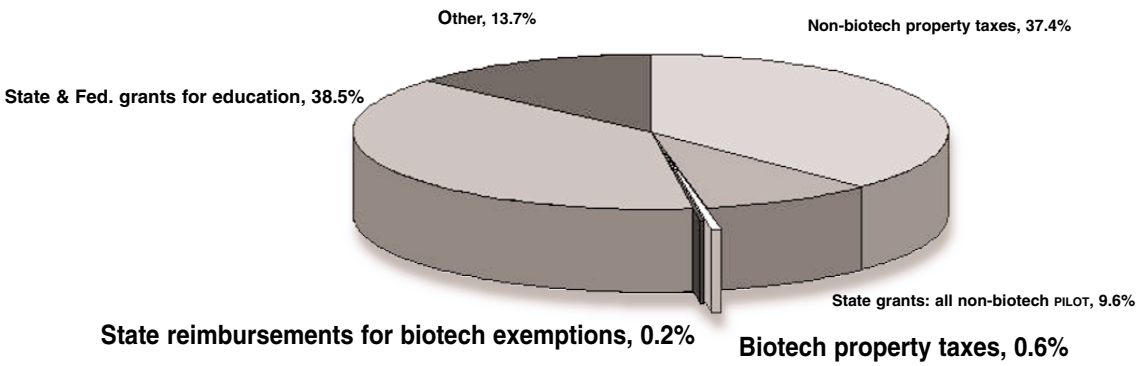
Indirect job opportunities may take place in New Haven when a notable amount of new direct employment takes place, and when biotech employees spend time and settle in the inner city. At the moment, about 87% of the executive officers of New Haven's three publicly traded biotech companies live in Connecticut suburbs, in such towns as Madison, Cheshire and Greenwich.

Most importantly, indirect employment in goods and services is only satisfactory as an economic development concept if quality employment opportunities can be guaranteed, such as those enjoyed by high-paid R&D workers, or by the unionized clerical, technical, and maintenance workers who support the first stage of biotech discovery in Yale laboratories.

## Property Taxes

The $1 billion in capital investment regional biotech raised in 2000 was celebrated as a hallmark of New Haven's biotech "boom." However, an analysis of the New Haven 2000 Grand List shows that biotechnology makes a negligible contribution to the New Haven tax base.

**Biotech's Contribution to City Budget Revenue, FY 2000-01**



New Haven receives taxes from biotechnology on two categories of property: personal property (machinery, equipment and supplies) and real estate. Biotech companies in New Haven both lease and own personal property, and only lease real estate.

### Personal Property

Taxes owed to the city on personal property owned by biotech companies equaled $296,292 in 2000, amounting to 0.23% of the city's total tax revenue. These are the only taxes that come to New Haven directly from biotechnology companies, rather than from lessors. (Tax information on personal property leased by biotech companies was unobtainable through a freedom of information request.)

The biotech-owned property was 6% of the gross assessed worth of the city's personal property in 2000. However, five-year tax exemptions for new biotech machinery and equipment keep a large proportion of biotech personal property continuously off the tax rolls, possibly due to the rapid turnover of obsolete laboratory equipment. In 2000, 71.7% of biotech-owned personal property was tax-exempt. That year, biotech companies received 32.5% of the city's total personal property exemptions, and only paid 2.0% of the personal property revenue. (A portion of the property accounted for in this calculation belongs to companies that left New Haven late in 2000).

*"I think we're overselling this big-time…. We've already seen that the original story of Science Park, which was supposed to employ its neighbors, was hollow. I give biotech two cheers — it may be wonderful for PhDs, but I don't see it as a replacement for Winchester."*
*—Yale professor Douglas Rae, who has taught a class called "New Haven and the Problem of Change in an American City."*[43]

### Real Estate

Biotech firms in New Haven do not own any laboratories, but lease properties at three locations: Science Park, 300 George Street, and 555 Long Wharf Drive. All three locations, in addition to housing one or more biotech firms, are partially vacant, host non-biotech businesses, or both. Still, as the tax records do not break these properties down per usage, the only figure available is for total taxes on all of the buildings. Taxes paid by lessors on all three sets of real estate amounted to just under $1.8 million in 2000, which is 1.3% of the city's tax revenue. The real property received $178,536 in tax exemptions.

### Biotech's Role in the City Budget

Biotech-owned personal property and leased real estate is responsible for 1.6% of New Haven's tax revenue. These taxes form an even smaller fraction of the city budget, which also includes state and federal revenue. Biotech provides just 0.8% of the city budget.[44] While any addition to the tax base is helpful, biotech is far from becoming a major contributor.

### Biotech Tax Delinquency

It is of some concern that a considerable number of New Haven biotech firms have been inconsistent and delinquent in filing local taxes.

Over the past five years, the following companies received personal property no-file penalties from the New Haven Tax Assessor:

- BIOS (later Genaissance), for a $75,407 assessment in 1996
- CuraGen, for a $3,500 assessment in 1997 (when CuraGen first moved some operations into New Haven)
- Alexion, for a $1.2 million assessment in 1997

- Applied Biotech Concepts, for a $4,055 assessment in 1998
- Ikonisys (a brand-new, Yale-based biotech start-up in Science Park), for a $872,505 assessment in 2000.

A number of other biotech start-ups operating in New Haven before and during the 2000 assessment year have not filed personal property taxes as of July 19, 2001. These include:

- TurboGenomics (2000)
- L2 Diagnostics (1999-2000)
- Intellectual Property Technology Exchange (1999-2000)
- PhytoCeutica (1998-2000)
- OncoRx and MelaRx (later Vion) (1995).[45]

Upon being informed of these delinquencies, the New Haven Tax Assessor's office has begun an investigation.[46] Again, all of these companies are Yale-based. Intellectual Property Technology Exchange was even spun directly out of technology invented by Yale's OCR in 1999, and TurboGenomics is run by an OCR staff member. Since Yale's OCR maintains an updated list of all Yale-based companies, sharing this list annually with the assessor would help build reliable communication between the city and Yale's spin-offs.

**CuraGen's Special Tax Break**

In 2000, the Connecticut General Assembly approved Public Act 00-192, which included an amendment creating a personal property tax credit for "any company" that purchased or leased equipment for manufacturing or biotechnology, if the property was "assessed at two million one hundred eighty-seven thousand three hundred sixty one dollars and five million seven thousand twelve dollars for the assessment years 1997 and 1998, respectively," and the company paid $76,645.14 and $174,995.14 in property taxes for those respective years. "Any company" meeting these precise criteria could receive a credit of 20% of the taxes paid in 1997 and 1998 for five years from 1999 to 2003.

In other words, a particular company that had paid a total of $251,640.28 in taxes on roughly $7.2 million worth of personal property (owned or leased) would effectively receive a 100% reimbursement over five years.[47]

According to city documents, CuraGen Corporation qualifies for the full benefit of this law. CuraGen was granted a $251,640.28 tax credit across five years.[48]

In 1997 and 1998, CuraGen leased property assessed at the exact values described in Public Act 00-192 from Transamerica Business Credit Corporation, a capital lending firm.[49] The 2000 New Haven Grand List shows that the specified property had been made subject to a no-file penalty for both years because it had not been disclosed to the Tax Assessor.

CuraGen is a successful corporation that already receives thousands in property tax exemptions every year. Last year alone, close to 70% of CuraGen's personal property was tax-exempt. This special law absolves CuraGen of another quarter million of its tax burden.

## Yale's Returns

New Haven must wait for the final stage of product development to see significant benefits from biotechnology. If the companies sublicense or leave, New Haven does not even benefit at this stage. Yale, on the other hand, prospers early and often:

- Yale collects an up-front fee for each licensing agreement, before R&D begins.
- Yale receives "founder's equity," or part ownership of start-ups.
- Yale collects milestone payments every time the R&D process reaches a new goal.
- Yale collects "sponsored research" payments from biotech companies to Yale labs, which perform related research.
- Yale faculty collect "consulting fees" for their work assisting the companies, and sit on directing and advisory boards.
- Yale faculty founders become major shareholders.

Yale officials frequently refer to $1 billion in investments that New Haven region biotech companies received in 2000. Still, the bulk of money invested by venture capitalists does not flow to municipal tax revenue or to job creation. A lot of this investment flows directly to Yale.

Let's look at just one of Yale's spin-offs, Vion, to gauge how much money is involved. Vion employs about 60 people at its Science Park facilities, and last year was required to pay about $18,000 in taxes to New Haven.

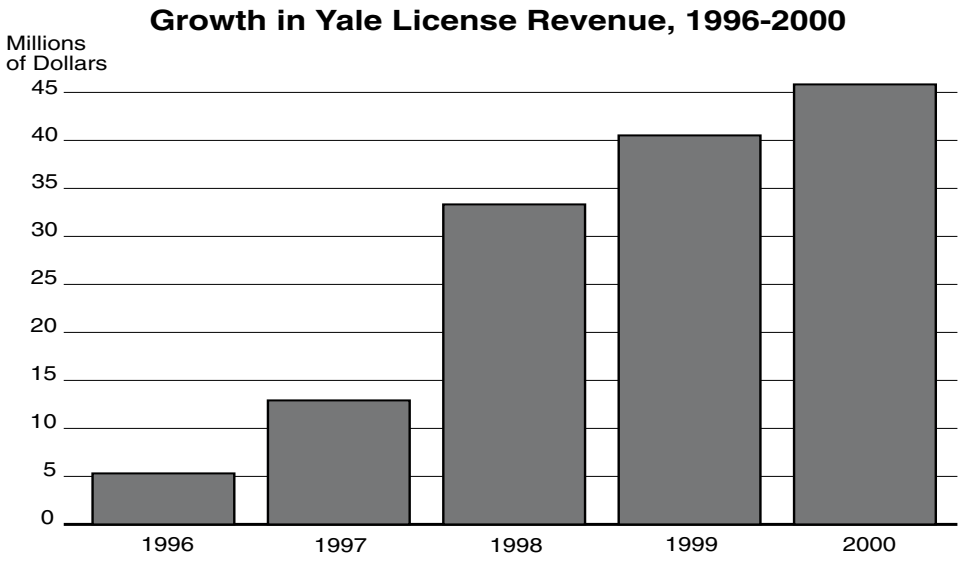
- Yale has collected at least $150,000 from Vion in licensing fees.
- Yale owns over 300,000 shares of Vion stock, worth roughly $2.2 million.[50]
- Yale collects milestone payments for Vion's development of 10 Yale patents. According to OCR, milestone payments for just one license with a typical biotech firm can add up to over $5 million.
- Yale has collected over $15 million from Vion for sponsored research in the Yale labs of faculty active in Vion, on technology licensed by Vion.
- A number of Yale faculty receive consulting fees from Vion. One faculty member, also a Vion director, receives $48,000 per year.
- Yale professor Alan Sartorelli, also a Vion director, is one of Vion's largest beneficial shareholders, with over 418,455 shares, 1.6% of the company's common stock.[51]

All of the income discussed thus far flows to Yale prior to the marketing of any product. When a product is successfully marketed, royalty payments can provide substantial, ongoing additional revenue. Yale has been particularly successful at generating this revenue (see Yale license revenues graph). Yale stands on the cusp of even greater rewards: as the university with the largest number of products in the commercialization "pipeline,"[52] Yale's royalties are poised to boom more than ever.

## A Typical Yale License

Yale currently has over 270 active license agreements. For one patent licensing agreement with a Yale start-up (which typically is based on 3-5 licenses), Yale can receive:

*Initiation fee:* $100,000
*Royalty:* 5% on all future sales including sub-license revenue
*Development milestones:* $850,000 through 3 phases
*Registration milestone:* $5 million
*Founders Equity:* 45% of common shares, 7.6% of total shares[53]




Source: Yale Office of Cooperative Research, 1999-2000 Annual Report

## New Haven: Beyond Incubation

In order for New Haven to share in the prosperity promised by biotech, the city must be more than an incubator. The challenge facing policymakers is clear: how to convince biotech companies to stay in town once they become mature, productive and profitable. The city will be denied significant tax revenue or job creation until this challenge is faced head-on.

This challenge can begin to be addressed from a policy perspective: holding companies accountable for the promises of job creation or growth, linking state subsidies to the fulfillment of these promises, and demanding repayment of all subsidies if the company leaves the area. Such policies would certainly help. The only full solution, however, must address root problems. Why is it that mature companies choose not to anchor in New Haven?

One problem, New Haven's lack of flexible, ready lab space, has begun to be addressed. The city attracted two biotech developers to New Haven last year, who plan renovations to 300 George Street and Science Park for new labs. However, these renovations or the option of building on other New Haven brownfields did not interest CuraGen, which chose to build its new "campus" from the ground up in suburban open space. While continued efforts to remedy lab space shortages are necessary, New Haven will need other assets to offer companies ready for expansion.

The problem most in need of serious attention is New Haven's struggling educational system. As the *New Haven Register* wrote last December: "The severe shortage of skilled technical workers is of statewide and national concern, but community leaders say solving the problem is crucial for New Haven if it wants to court high-tech companies and keep them in town."[54] Biotech companies won't stay in New Haven until the city can provide a well-educated, well-prepared work force. This would demand that significant new resources be channeled to New Haven's public schools.

Last year, Yale announced plans to spend $1 billion building new, tax-exempt biomedical and scientific research labs. Yale must believe this investment will pay off.

An investment by Yale in New Haven's public schools would also pay off, in the long term. There are many things Yale could do:

- Commit a share of its licensing and royalty income to the schools
- Voluntarily pay the city for taxes that the city loses due to Yale's tax exemption
- Pay the city a fee for every child living in Yale's tax-exempt housing and attending a public school, as Princeton does.
- Purchase land, fund construction, or pay for staff at a public school, as Stanford and the University of Pennsylvania do.

Biotech companies will continue to base their operations elsewhere if New Haven's serious education problem is not overcome. Companies will grow in New Haven only if there is an adequately skilled workforce. And New Haven residents will have access to the highly paid R&D jobs only if their children have the opportunity to excel in reading, science and math.

As an immense, tax-exempt organization prospering considerably from biotech, Yale has the ability, opportunity and obligation to invest not only in biotech start-ups, but in New Haven's school system.

## Notes

1 Marc Worman, "New Haven's Biotech Boom" Y*ale Medicine* Fall 2000/Winter 2001.

2 Yale Office of Cooperative Research 1996-1998 Annual Report.

3 Emphasis added. Yale Office of Cooperative Research 1999-2000 Annual Report.

4 "A New Haven for Biotechnology," *Yale Today* 24 (3), March 2001.

5 "A New Haven for Biotechnology," *Yale Today* 24 (3), March 2001.

6 "A New Haven for Biotechnology," *Yale Today* 24 (3), March 2001.

7 Although similar in its geographically targeted poverty alleviation strategies, the Enterprise Zone is a state-run program, distinct from the federally funded Empowerment Zone program.

8 Carole and Paul Bass, "New Haven's Hi-Tech Park," *Connecticut* May 1986.

9 Ron Kysiak, original coordinator of Science Park, claimed the park would provide 1,800 jobs, with one third—600—slated for neighborhood residents. Francine Kiefer, "Aid for a run-down New Haven area comes in a package," T*he Christian Science Monitor,* 4/6/81.

10 Carole and Paul Bass: "New Haven's Hi-Tech Park," C*onnecticu*t May 1986

11 In 1996, Public Act 96-252 granted further tax breaks specifically for biotech, including broad sales tax exemptions, comprehensive 5-year property tax breaks on new R&D equipment, and a clause for companies to carry unused R&D corporate income tax exemptions forward for fifteen years. Soon after, a temporary R&D corporate tax credit implemented in 1981 was made permanent. More recently, a law was passed allowing companies to receive cash reimbursements for unused R&D tax credits, and extend their net operating loss carry-forward from 5 to 20 years.

12 Emphasis added. "Science Park: Creating a World-Class Biotech Center," a pamphlet by Connecticut Development Authority and Connecticut Innovations, Inc., 2000

13 Job statistics come from the May *2001 Business New Haven Book of Lists,* Gene Logic Inc. 10-K Annual Reports.

14 Mark Guidera, "Research firm to move to Md.; State funding helps attract fledgling Conn. company," *The Baltimore Sun*, 4/11/96.

15 Mark Guidera, "Research firm to move to Md.; State funding helps attract fledgling Conn. company," *The Baltimore Sun,* 4/11/96.

16 Mark Guidera, "Research firm to move to Md.; State funding helps attract fledgling Conn. company," *The Baltimore Sun,* 4/11/96.

17 Emma Snyder, "Bolstered by new investments, Science Park ready to take off," *Yale Daily News*, 9/27/99. Connecticut Innovations, Inc. is a state-funded, high-tech venture capital agency which has spent millions on biotech lab refurbishment in Science Park.

18 Walter Kita, "Alexion may bid farewell," *New Haven Register,* 4/3/00.

19 Walter Kita, "Alexion may bid farewell," *New Haven Register,* 4/3/00.

20 Molly Ball, "In New Haven, Growing Plans for Biotech," *New York Times* 2/18/01.

21 OCR 1999-2000 Annual Report.

22 DECD Industry Clusters Report, February 2001; Wayne E. Travers, Jr, "Science Park firm joins exodus, *New Haven Register*, 12/13/00.

23 Wayne E. Travers, Jr, "Science Park firm joins exodus, *New Haven Register,* 12/13/00.

24 Walter Kita, "New Haven is becoming a Tech Haven," *New Haven Register,* 12/3/00.

25 Ronald Rosenberg, "A boost from biotech," *Boston Globe* 3/12/00.

26 Walter Kita, "New Haven is becoming a Tech Haven," *New Haven Register,* 12/3/00.

27 Walter Kita, "CuraGen seeking 'campus-like' home in New Haven area," *New Haven Register* 12/14/00.

28 "Convenient site wins CuraGen," *New Haven Register* 5/4/01.

29 Luther Turmelle, "CuraGen buying 88 acres for new Branford campus," *New Haven Register*, 5/2/01.

30 Ronald Rosenberg, "A boost from biotech," *Boston Globe* 3/12/00.

31 "Yale and New Haven: Economic Growth Through Biotechnology," handout from Yale Tercentennial seminar, 4/20/01.

32 Based on biotechnology employment listings in the *2001 Business New Haven Book of Lists*.

33 The Cambridge-to-Worcester corridor hosts over 120 biotechnology companies, employing 13,000 people. Ronald Rosenberg, "A boost from biotech," *Boston Globe* 3/12/00.

34 Karen Abrecht, "Connecticut gives $100M boost to Science Park," *Yale Daily News*, 9/14/98.

35 Genaissance Pharmaceuticals Inc. 2000 10-K Annual Report.

36 Connecticut United for Research Excellence, Fifth Annual Economic Report, April 2000.

37 Natalie Missakian, "Lab jobs go begging for want of skilled labor," *New Haven Register*, 12/6/00.

38 Emphasis added. Adelle Waldman, "Group focuses on city center," *New Haven Register,* 6/20/01. Connecticut United for Research Excellence (CURE) is an example of another state-funded organization that has spent money in attempts to attract out-of-state biotech workers. See CJ Abate, "Welcome mat out for biotech firms," *New Haven Register* 6/14/01.

39 Geeta O'Donnell Anand, "With Yale leading the way, New Haven woos biotech," *Wall Street Journal* 9/20/00.

40 Connecticut United for Research Excellence Fifth Annual Economic Report, April 2000.

41 Ronald Rosenberg, "A boost from biotech," *Boston Globe* 3/12/00.

42 Ronald Rosenberg, "A boost from biotech," *Boston Globe* 3/12/00.

43 Bruce Fellman, "New Haven: Biotech City?" *Yale Alumni Magazine* May 2001.

44 Grand List 2000; Fiscal Year 2001 Budget, adjusted 11/20/2000. Without state reimbursements, biotech comprises 0.6% of the city budget. Figures do not include leased personal property.

45 Most of these companies are or were Science Park tenants. In 1996, OncoRx and MelaRx merged into Vion Pharmaceuticals, which is still a Science Park tenant.

46 Due to a three-year window for collection on unregistered property, unpaid taxes for OncoRx and MelaRx will be permanently lost.

47 PA 00-192, Section 86 (for House Bill 5922, Section 86).

48 Email correspondence from 5/21/01-5/23/01 between New Haven Office of the Tax Collector and the New Haven Office of the City Controller, regarding "the Curagen credit," discussing the method of application of the $251,640.28 tax credit from House Bill 5922, Sec. 86 to CuraGen's account; City of New Haven Accounts Receivable Inquiry transaction record dated 4/12/01, showing the reversed application of a tax credit of exactly $251,640.28 to CuraGen's account.

49 Fax between New Haven Assessor's Office and Connecticut Office of Policy and Management dated 10/3/00, regarding recreated 1997 and 1998 assessments for "Transamerica Business Credit (the lessor for Curagen)" and discussing House Bill 5922; email dated 10/16/00 from New Haven Assessor's Office to Office of Policy and Management referring to House Bill 5922, Curagen's lessor report and CuraGen's retroactive exemption; letter from New Haven Assessor's Office to Elizabeth Whayland, CuraGen's director of financial management, dated 9/19/00, regarding "TransAmerica Business Credit Corp(House Bill 5922)"; letter from CuraGen's director of financial management to New Haven Tax Assessor, referring to "the personal property tax filing/payment issue that concerns CuraGen Corporation and Transamerica Business Credit Corporation," also with note from Assessor on 9/18/00 referring to an amendment with the Office of Policy and Management to the retroactive exemption to include Transamerica.

50 Value on the Nasdaq stock index as of July 16, 2001.

51 Vion 10k annual reports; licensing agreements between Yale, OncoRx and MelaRx obtained from the Securities Exchange Commission. Dr. Sartorelli's stock information is as reported in the Vion 2001 Definitive Proxy Statement. $17,874 in taxes was due for Vion's personal property for the 2000 assessment year.

52 OCR Annual Report 1998-99.

53 "Biotech Licensing 2000: Equity in the Pharmaceutical Food Chain," presentation by Alfred Brown, Director, Yale Office of Cooperative Research (http://www.yale.edu/ocr/ocr_new/recent_news_spring00.html#presentations)

54 Natalie Missakian, "Lab jobs go begging for want of skilled labor," *New Haven Register,* 12/6/00.

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