

A Pharm State

New York State is gearing up to capture the biotech jobs of the future. Our pharmaceutical industry already gives us an edge in the field. So we have an interest in keeping this sector strong.

New Yorkers know that employment in our manufacturing sector, which is so vital to the upstate economy, has been declining in recent years.

But there is a silver lining in the cloud. Because the pharmaceutical sector – a perfect fit for this state’s high-tech capabilities, and our highly educated workforce – is bucking the trend. It has been growing steadily. And it shows potential for even greater growth in the future.

To capitalize on that potential, New York must follow through on its recent efforts to stimulate

New York has a huge stake in the research-based pharmaceutical industry.

university and industry R&D in the whole biotech sector. And it must also avoid joining in the punitive campaigns some forces are directing these days at the pharmaceutical industry. The research-based drug

companies, and their products, are an asset, and not a liability, for our health-care system and our economy.

The pharmaceutical industry plays to the future we like to think of for New York – a future of high-paying, high-value-added, intellectually demanding jobs in clean, high-tech industries that make a solid contribution to human well-being. Employment in the industry in New York has grown 22 percent over the last 25 years, while the state’s overall manufacturing employment has *declined* by 41 percent (as illustrated by the graph on the back page of this report).¹ Average monthly direct employment in the pharmaceutical industry in New York in 2001 was 26,300 jobs.

INSIDE

- ◆ With an above-average concentration of biotech and pharmaceutical firms, New York has an edge in this field.
- ◆ The pharmaceutical sector already accounts for almost 100,000 jobs in the state.
- ◆ It produces about \$9.6 billion in exports to other states and countries that bring income back to New York, and about \$1 billion in state and local tax revenues.
- ◆ The sector has the potential for significant growth in the future, as spending on health care rises and as prescription drugs play an increasingly important role in health care.
- ◆ So it is clear that New York has no interest in contributing to politicized attacks on the industry’s prices and practices.
- ◆ And getting our share of the industry’s growth will require that the state make sustained investments in biotech R&D at our universities and other institutions.

December 2002

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New York's presence in pharmaceutical manufacturing is larger than the state's share of overall U.S. manufacturing.

Total shipments from New York pharmaceutical manufacturers in 2000 were about \$11.25 billion, according to the Census Bureau – up 89 percent from 1997.² Industry estimates suggest that more than 85 percent of these sales are out-of-state – which means the pharmaceutical industry is in effect bringing back to New York some \$9.6 billion in wealth it has generated from its exports to other states and other countries.

New York's 26,300 pharmaceutical jobs pay, on average, 16 percent more than manufacturing jobs overall in the state – and of course manufacturing jobs in general pay better than most other sectors.³ The pharmaceutical manufacturing sector has more than 130 establishments all over the state, including industry giants (nine establishments had over 500 employees) as well as dozens of small- and medium-sized businesses; they invested \$497 million in new plant in 2000, the most recent year for which numbers are available.² Empire State Development calculates that another 590 firms in related biotech fields employ another 13,000 to 14,000 workers across the state.⁴

New York ranks third among the states in overall pharmaceutical employment, after New Jersey (averaging 50,300 jobs in 2001) and California (40,100). And New York's presence in pharmaceutical manufacturing is larger than the state's share of overall U.S. manufacturing; the state accounts for 8.2 percent of all pharmaceutical jobs in the nation, compared to only a 4.5 percent share of overall U.S. manufacturing jobs.

The Buffalo Branch of the Federal Reserve Bank published a study earlier this year concluding that medical manufacturing (including both the pharmaceutical sector, and related industries like medical instruments) is “a bright spot in the upstate New York economy,” and is strong downstate, as well.

Regional strengths

The Federal Reserve calculated that pharmaceutical employment in upstate New York has what economists call a “location quotient” of 1.4 – meaning, upstate has 1.4 times as many jobs in pharmaceuticals as would be expected if it matched the national average. Syracuse has a pharmaceutical LQ of 1.8, Rochester was at 1.6 and Buffalo at 1.6. The Capital District is home to Albany Molecular Research, Inc.; Bristol-Myers Squibb is a major presence in Syracuse; Westwood-Squibb and Mentholatum are among those with operations in Western New York; and the Hudson Valley is home to major operations owned by Wyeth-Ayerst and Novartis, among others. Among major research centers active in the field are Roswell Park Cancer Institute in Buffalo, the University of Rochester's Medical Center, the State University's Upstate Medical Center at Syracuse, and the University at Albany.

Downstate is not far behind, with an LQ of 1.3. This is partly a reflection of New York's strength as a headquarters state; five of the fifty largest pharmaceutical companies in the world have either their world headquarters, or their U.S. headquarters, in New York. These five firms account for almost 20 percent of global pharmaceutical sales.⁵

But downstate has strengths in the industry beyond its headquarters status.

Pfizer, the second largest U.S. drug maker and fourth largest worldwide, not only is headquartered in Manhattan, but has a major manufacturing facility in Brooklyn and has developed a new training center in Westchester County. Long Island has numerous pharmaceutical companies, including Del Laboratories, NBTY and Pall Corporation. The State University at Stony Brook and Rockefeller University in Manhattan are among major downstate academic centers of related research.

The broader economic and fiscal impact

Any goods-producing industry brings economic benefits to the city, region or state in which it is based that go well beyond the jobs it directly provides — because of the jobs and income derived from the purchases it makes, the taxes it pays, and the spending done by, and the taxes paid by, its employees. This is especially true of the pharmaceutical industry, which requires large amounts of capital investment, makes sales in other states and nations that result in money coming back to New York, and requires an unusually well-educated, highly compensated workforce.

In New York State overall, for example, each manufacturing job is calculated by economists to sustain 2.03 other jobs in other sectors, from retail to services to government. For pharmaceuticals, this ratio is even higher — 2.71 additional jobs for every job the industry provides directly.⁶

This means that in addition to its direct employment in New York of 26,300, the pharmaceutical industry accounts for another 71,000 jobs in the state — all told, nearly 100,000 jobs attributable to this one industry.

The 97,300 jobs dependent upon the pharmaceutical industry, in turn, account for more than \$1 billion in state and local tax revenues. Each private-sector job in New York State is associated with about \$12,750 in state and local tax revenues, so the pharmaceutical industry and its employees directly account for over \$335 million in state and local government revenues. To that can be added another \$750 million in state and local revenues associated with the 71,000 indirect jobs attributable to the pharmaceutical industry in the state.⁷

Great expectations for the future

The pharmaceutical industry's impact in New York today is, however, only the leading edge of its potential future benefits for the state. This global industry is growing rapidly, and New York has every reason to want to capture an increasing — not a decreasing — share of that growth.

Pharmaceutical sales in the United States cracked the \$100 billion mark in 1999 — up from just under \$40 billion in only a decade. As of the year 2000 they accounted for 9 percent of total U.S. spending on health care, which in turn accounts for about 13 percent of U.S. gross domestic product.

Pharmaceuticals' share of total health-care spending has been growing (it was a little over 8 percent in 1999), and it is to be hoped that this trend will continue — given the fact that newer and better pharmaceuticals often obviate or reduce the

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need for more expensive, more intrusive forms of health care, such as hospitalization. That is, as newer and more effective prescription drugs reduce the need for doctor care and hospital stays, it is to be expected that the share of the total health-care dollar devoted to pharmaceuticals will increase, while the share devoted to physicians and hospitals will decrease. And as the “baby boom” cohort ages and needs more medical care, the share of the economy devoted to health care overall is also expected to increase—to as much as 16 percent by 2010. So the pharmaceutical industry has strong prospects for growth in the U.S.

The industry also sees strong and growing demand in international markets. Less than half of global pharmaceutical sales, which totaled \$317 billion in 2000, are in North America. Europe accounts for nearly 25 percent, and Japan for over 16 percent. Significant growth can also be expected in the underdeveloped world. Pharmaceutical sales rose 9 percent in Latin America in 2000, for example, and 10 percent in Africa and Asia (including Australia but not Japan).⁸

As the global market grows, the United States is building a growing advantage in the research and development that leads to new drugs, new therapies—and new jobs. During the 1990s the U.S. surpassed Europe as the leading site for pharmaceutical R&D, and in the last 10 years R&D investments in the U.S. have grown fivefold, about twice as fast as in Europe. As of 1999, European pharmaceutical companies themselves had reduced the portion of their R&D budgets that they spent in Europe to 59 percent (down from 73 percent in 1990); meanwhile they were increasing their R&D spending in the U.S.⁹

New York voters have high hopes for this sector. A Zogby poll recently done for Sawchuk Brown Associates, an Albany public relations firm, found that upstate residents rated biotechnology and medical research as the industry sectors they most wanted to see the state and their local communities target for economic development and retention.¹⁰

In addition to its own substantial share of the pharmaceutical industry, New York has another interesting advantage in this area, and it’s something New Yorkers aren’t necessarily accustomed to thinking of *as* an advantage—to wit, proximity to New Jersey. For historical reasons, New Jersey is, as the pharmaceutical industry’s trade group in the state puts it, “the global epicenter” of the industry.¹¹ On the “location quotient” scale cited by the Federal Reserve study (the proportion of an industry’s overall jobs that are in a state, compared to what would have been expected if the proportion matched that state’s share of the U.S. population), New Jersey rated an LQ for pharmaceuticals of 4.3—more than double that of any other state, except for Connecticut (which is at 3.3).

New York already benefits from a number of pharmaceutical operations that are tied to headquarters or larger operations in neighboring New Jersey. And there is a good chance that this “spillover” effect will grow—especially because New Jersey has recently increased corporate taxes and taken other steps that have tarnished its desirability as a business location. Economic developers in New York are already stepping up their targeting of New Jersey pharmaceutical companies, in hopes that they will want to locate some of their operations and/or expansions in the friendly territory of New York State.

Better – and more cost-effective – health care

The pharmaceutical industry is more than simply an engine of past and potential economic growth, of course. Its products have immeasurably improved the quality and longevity of life, and there is more to come. According to the Pharmaceutical Research and Manufacturers of America, “more than 1,000 new medicines are currently in development, either in human clinical trials or at the (federal Food and Drug Administration) awaiting approval. They will improve the treatment of AIDS, congestive heart failure, Alzheimer’s disease, stroke, many forms of cancer (including breast cancer), diabetes, asthma, Crohn’s disease, Parkinson’s disease, osteoarthritis, rheumatoid arthritis, rotavirus infection, migraine headaches, glaucoma, urinary incontinence, and depression, among many other diseases.”¹²

The therapeutic impact of pharmaceuticals delivers economic benefits well beyond the jobs and income the industry itself generates. The reason is simple: people who enjoy improved health are more productive than are people who are disabled or limited by illness. Pharmaceuticals cure diseases that can kill or disable. And they help millions of people stay at work despite chronic conditions that might otherwise make working impossible – ranging from arthritis to depression to migraines to diabetes.

How do we strengthen this economic engine?

If we want to strengthen the pharmaceutical industry in New York, increasing our share of the jobs and income and other good things it brings, what policies should we pursue?

One good place to start is with the traditional physicians’ maxim: “First, do no harm.”

Like every other sector of New York’s private-sector economy, the pharmaceutical industry would benefit from a lower cost of doing business – reductions in taxes, regulation, energy costs, workers’ comp and the other costs of providing jobs. Even more than most industries, the pharmaceutical sector needs protection from predatory lawsuits, too.

But the pharmaceutical industry also needs flanking against a form of trouble that lately has been focused specifically at it – a drumbeat in some circles of the political world and the media that would target the industry for punitive measures directed at its prices, its profits, and ultimately its vitality.

The suspicion directed at the industry is an outgrowth of the clash between two forces. First, many drugs do indeed seem to be incredibly expensive – until you think about it. And second, our system of health-care financing hasn’t worked out a rational way of paying for pharmaceuticals, particularly for the elderly.

That second point may be dealt with soon, at least to some extent. When the Medicare health-care system for the elderly was adopted in 1965, pharmaceuticals were a relatively small part of health-care costs and weren’t covered by most health insurance plans, and so they were excluded from Medicare. As

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pharmaceuticals became a larger share of health-care costs and as evidence grew that their deployment would help cut the incidence of hospitalization and other more costly forms of care, most health-insurance plans in the private sector adjusted and added coverage for pharmaceuticals. But partisan gridlock in Washington prevented the adoption of a prescription-drug plan for the elderly (although some states, notably New York with its EPIC program, have adopted their own plans to help). Although the Washington stalemate may soon be over, the effects of the negative publicity and misinformation surrounding access to pharmaceuticals for the elderly may linger over the industry for some time.

As to the reality of high prices, well, there's more to that issue than meets the eye at first glance.

A single tablet of, say, Fosamax®, a product of Merck & Co., Inc., can cost \$15. To look at it, you'd have say: How can that be? It's a plain-looking little thing; by appearance it might be a football-shaped breath mint. \$15? But think about it. A weekly dose of one \$15 pill can prevent osteoporosis – which threatens 25 million Americans, mostly older women. Osteoporosis leads to 1.5 million fractures per year, mostly in the hip, wrist, or, most seriously, the spine. The cost of treatment is estimated at \$10 billion to \$15 billion a year, or up to \$10,000 per incident, according to the National Institutes of Health. To prevent that, \$15 for one little pill is clearly a bargain.

Most people who have an ordinary headache can take care of it with a couple of aspirin, costing a few pennies. But the best new medicines for *migraine* headaches, like Astra-Zeneca's Zomig®, can cost \$13 a dose. Expensive? Yes, until you consider that the annual cost of migraines in terms of work loss and decreased work productivity have been put as high as \$22 billion.

Prices reflect the enormous cost of research

But still, why do they have to cost so much? The simple truth is that the newest and best prescription drugs cost a lot because it is incredibly expensive to perform the 10 to 15 years of research and testing that are required to discover, develop and bring these vital products to market. According to the Tufts Center for the Study of Drug Development, as of the year 2000 the cost of developing a single new prescription drug had hit **\$802 million** – up from \$231 million in 1987, and from \$54 million in 1976. Why is this?

First, as is the case with any pioneering research, initiatives in the field fail more often than they succeed. According to Tufts,¹³ of 5,000 compounds initially screened in hopes they will prove to have some therapeutic value, only 250 will prove promising enough to enter preclinical testing. Of those 250, only five will enter clinical testing. This ratio – 5,000 possibilities leading to five potential new medicines – is getting higher over time, as research focuses more and more on diseases and conditions that are chronic and that have proven difficult to crack.

Second, the process of getting a drug approved by the federal Food and Drug Administration after the company has conducted the initial R&D research is also expensive and time-consuming – since safety is paramount. After clinical trials involving 1,000 to 5,000 patient volunteers, and an FDA process that takes an

average of 16-18 months, only one of those five potential new drugs will end up going to market. That single new drug must bear the cost of all the R&D that led to it—including the cost of working on the 4,999 compounds that did not succeed.

Third, and after all that effort, most of those new drugs will not bring in enough revenue for the pharmaceutical company that developed them to pay back the cost of R&D; one study put the ratio of money-making drugs at 3 in 10.¹⁴ Again, this compounds the pressure on a relatively few successful drugs to pay the cost of the whole development chain.

And finally, once the pharmaceutical company that developed the new drug gets it to market, it has very little time to sell it under patent protection, before facing competition from generic manufacturers who bore none of the development costs. U.S. patents on pharmaceuticals in theory last 20 years. However, drug companies often file for patent protection early in the development cycle, well before their products actually come to market, because of the amount of information about their products that is made public (and, hence, available to competitors) during the trial period. So the average effective patent life for a newly developed prescription drug is only 11 to 12 years.¹⁵

Expensive as this R&D is, at the same time the employment and spending generated by the research is healthful economic activity. It is therefore in New York State's interest to capture an ever larger share of this R&D spending—rather than adopt policies that undermine the companies that undertake it.

Expensive drugs = less costly health care

And ultimately, if it costs \$802 million to develop a new drug, it's worth it. That's because newer, more advanced drugs are more effective—not only in terms of patient outcomes, but also in terms of reducing other health-care costs. One study found that each dollar spent on pharmaceuticals was associated with a \$3.65 reduction in hospital expenditures, alone.¹⁶

A new study at Columbia University carefully assessed this issue by weighing the costs of newer drugs (measured in terms of their "age," that is, the years since FDA approval) against their effectiveness in offsetting or preventing other health-care costs. It reported this past summer that "a reduction in the age of drugs utilized reduces non-drug expenditure 7.2 times as much as it increases drug expenditure. For example, reducing the mean age of drugs used to treat a condition from 15 years to 5.5 years is estimated to increase the prescription drug spending by \$18 but reduce other medical spending by \$129, yielding a \$111 net reduction in total health spending. Most of the savings are due to reductions in hospital expenditure (\$80) and in physician office-visit expenditures (\$24)."¹⁷

With so much news media attention directed at drug prices, the public tends to exaggerate their impact on health-care costs. A survey commissioned by Excellus, a Rochester-based health insurer, found that on average its customers believed that 24.6 percent of their premium dollars went to pay for prescription drugs—when in fact, according to Excellus, the figure is 18 percent.¹⁸ A recent study of rising health-care costs found that spending on health care jumped 10 percent in 2001, primarily because of a 12 percent increase in hospital costs, not

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because of drug expenditures.¹⁹ The Blue Cross and Blue Shield Association released a study in October concluding that “79 percent of health-care costs are driven by hospital and physician costs.”²⁰

Cheaper in other countries?

Much of the recent news-media and political criticism of the pharmaceutical industry has seized on the idea that prescription drugs cost less in other countries than in the U.S. The newspapers recount stories of bus trips taking senior citizens to drugstores in Canada, of doctors handing out prescriptions in Mexico, and of people using the Internet to order drugs from overseas. Political figures call for the U.S. (or for individual states) to consider price controls, bulk purchasing, or approved formulary lists to try to force the industry to cut its domestic prices.

It turns out on examination, however, that *overall* prescription drug prices in the U.S. are probably no higher than average among industrialized countries. Aggressive purchasing tactics by some countries do, indeed, get them lower prices on certain, highly visible drugs. But by the same token, those tactics sometimes mean that the newest and most effective drugs are completely unavailable in those countries, or are available later than in the U.S. Moreover, if those tactics had been employed by the U.S., too, these new and more effective drugs might never have existed in the first place; only the opportunity to earn a fair return on new drugs in the U.S. market provides the incentive to invest the hundreds of millions of dollars required to develop those new drugs.

Perhaps the most comprehensive international comparison of prescription drug costs was undertaken by Patricia Danzon of the Wharton School of Business. Analyzing the whole menu of prescription drugs being purchased in nine developed countries, including the U.S. — and not just a few highly visible drugs — she found that overall costs were higher than the U.S. in four countries, and lower in four countries. In other words, U.S. prices were in the middle of the pack.²¹

Countries that achieve lower prices for specific pharmaceuticals than are standard in the U.S. have commonly done so by setting up one form or another of a mass purchasing system (for example, permitting drugs to be purchased only from an approved formulary list, and requiring that manufacturers who want to get their drugs on that list meet certain price targets and/or rebate some of their sales revenues to the government). A U.S. research pharmaceutical manufacturer may then find that it can sell a particular product in that country only if it prices the drug at a cost reflecting the incremental cost of production of the medicine itself — that is, without recouping a full share of the R&D costs that went into the original development of the drug.

If the pricing of some drugs must be “approved” in other countries, it follows that some are “unapproved” (or, not yet approved) and, hence, unavailable. In Canada, for example, of 148 new drugs cleared for safety between 1991 and 1998, 138 had not been “listed” for health-plan coverage in one or more provinces as of 1999.²² One analysis found that patients in Greece, Belgium and France (where governmental intervention in pharmaceutical markets is extensive) have to wait five to six times longer for new medicines than patients in the United States.²³

The effect of these strong-arm tactics by other countries is to force U.S. consumers to bear a disproportionate share, or even the entire cost, of the R&D that went into developing the drugs in the first place. But to date, U.S. consumer “advocates” have tended to blame the pharmaceutical companies, who are the victims of these tactics, rather than the foreign governments who want U.S. consumers to pay for developing their new drugs. In reality this is a fair trade issue, not a fair price issue. If the U.S. government were to adopt the same purchasing-list approach, as consumer “advocates” sometimes recommend, these new drugs might well never have been developed in the first place. Then the comparison would be moot – but patients would be worse off.

And in another sense the U.S. is having the last laugh. The global pharmaceutical industry is slowly but surely migrating away from those places where the rewards of innovation are limited, to the U.S., where they are not.

Pharmaceutical R&D spending in Europe was 27 percent higher than in the U.S. in 1990; by 2000, R&D spending in the U.S. was 14 percent higher than in Europe. The European industry’s trade group complains that “Insufficient prices in Europe erode the pharmaceutical industry’s profitability on its home market and make it increasingly difficult to finance R&D.” It goes on: “Europe, as a site for innovation and investment, is in decline compared to the situation in America.”²⁴ This represents an important opportunity for New York’s own economic development – assuming we do not jump on a bandwagon of punitive actions aimed at the industry.

Why not just use generics all the time?

Critics of the research pharmaceutical industry often argue that the solution to high drug prices is to make more use of the “generic” equivalents of the brand-name drugs.

Examined only casually, this can resonate with the public. Consumers perhaps relate to generics as kind of the “store brand” of the medicinal world. A name-brand 15-oz. can of peas for \$1.19 is sitting on the grocery-store shelf right next to the store brand selling for 69 cents. If the peas taste the same, why not save the 50 cents? And if it works for canned peas, why not for prescription drugs?

But canning was invented in 1809. If the brand-name pea company goes out of business tomorrow the store-brand manufacturer will just keep rolling along, and you’ll still be able to buy canned peas. Not so with the brand-name pharmaceutical. It may have been brought to market only 10 years ago, or so – after its manufacturer had invested hundreds of millions of dollars in developing it. If the research pharmaceutical manufacturer cannot recoup that investment, there will be no new drugs for generic manufacturers to copy.

There are periodic calls for legislation that will stimulate the generic drug industry in the U.S., but the short answer is: *been there; done that*. Major federal legislation was adopted in 1984, and has resulted in the development of a healthy and growing industry that copies and sells drugs after their patents have expired. Before 1984, it often took three to five years for a generic copy to reach the market, after the expiration of the research manufacturer’s patent. But federal legislation

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known as the Hatch-Waxman law now allows generic manufacturers to begin working on their copies before a patent has actually expired. The practical consequence is that today, almost all significant pharmaceuticals face generic competition after their patents expire, and on a unit basis the generics' share of the U.S. prescription drug market has grown from less than one-fifth in 1984 to almost half today.²⁵ Generics play an important role, by making their copies available at lower prices once patents have expired – but the whole system is dependent upon the research-based pharmaceuticals being able to earn a return on their R&D investment before the patents expire and the generics enter the market.

On balance, then, the attacks aimed at the pharmaceutical industry are ill-founded. New York State has nothing to gain by adopting punitive policies with respect to the industry. It is a vital part of a healthy nation, and it offers huge economic potential to this state. The real question for New York is: how do we make the most of it?

Growing our state's advantage

Beyond “doing no harm,” the most important way to strengthen New York's stake in this industry is to accelerate and institutionalize the state's recent commitment to R&D in the biotech sector.

New York's research universities and institutions have enormous strengths in health-related fields; the state ranks third (after California and Massachusetts) in capturing research grants from the National Institutes of Health. Although competitors such as Ohio and Michigan may have moved more quickly, New York's state government has begun to make substantial investments in Centers of Excellence and other biotech initiatives at its research universities and institutions.

It is important that the state sustain and expand those commitments, even in the face of difficult budget times, because it is clear that investments in marketable research have a real economic payoff. As the Center for Governmental Research has pointed out, “a strong relationship exists between the location of research activity and the commercial investment that turns research into new jobs.”

For example, 82 percent of licenses that universities granted to private companies to develop products on the basis of their research went to firms located in the same state, according to a 1999 member survey of the Association of University Technology Managers.²⁶ Harvard economist Adam Jaffe reported in 1989 that states with higher levels of university research had more patents – and this pattern was particularly strong with drug patents.²⁷

The pharmaceutical industry is a huge asset to New York now. But sustained investment in our research universities and institutions will be required to ensure that we capture its full potential in the years ahead.

Endnotes

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2. U.S. Bureau of the Census, *2002 Economic Census*, Annual Survey of Manufactures.
3. U.S. Bureau of Labor Statistics, payroll survey data.
4. Empire State Development, "New York State's Technology-Driven Industries: Biotechnology and Pharmaceuticals," Albany, 1991. Investment from U.S. Census Bureau, *Survey of Manufactures*, 2000.
5. Kent Gardner, *Will NYS Miss the Biotech Train?* Center for Governmental Research, Rochester, 2001.
6. Empire State Development uses what is known as the IMPLAN regional input-output model for these multipliers; see www.implan.com. Many of the 14,000 jobs in New York in biotech fields related to the pharmaceutical industry would be included in this count, since pharmaceutical manufacturers are major customers of these firms. The Center for Governmental Research calculates that after accounting for these links within the bio-pharm sector, the pharmaceutical and biotech industries account for 128,000 jobs and \$6 billion in 2000 payrolls. (Gardner, *op. cit.*, p. 10.)
7. Estimated total state and local revenues in 2001 divided by average private-sector employment in the state equals \$12,755.31. This represents income, sales and property taxes paid by these employees as well as corporate, sales and property taxes paid by their employers. The revenue impact of the industry's spin-off jobs is lower (we calculate \$10,575, the average of all revenues divided by all jobs) because these spin-off jobs include public-sector jobs, which produce but also consume tax revenues. Given the industry's higher-than-average wages and higher-than-average capital investment, both of which drive tax revenues up, it is likely that the state and local tax revenues attributable to the industry are somewhat higher than this \$1 billion figure.
8. IMS Health, a UK firm specializing in health data analysis. See www.ims-global.com.
9. Pharmaceutical Research and Manufacturers of America (PhRMA), *2002 Industry Profile*, Washington, D.C., 2002, p. 16.
10. Some 700 respondents were asked "which of the following types of industries do you think the state and communities should concentrate on attracting?" Biotechnology/medical research was ranked first by 26 percent, and "health care/medical" first by 14 percent of the respondents. See www.sawchukbrown.com.
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25. PhRMA, *op. cit.*, p. 32.
26. PhRMA, *Industry Primer 2001*, Washington, D.C., 2001, p. 10.31. Gardner, *op. cit.*, p. 6.
27. A.B. Jaffe, "Real Effectiveness of Academic Research," *The American Economic Review*, 9 (5) 1989, pp. 957-970.

Money invested in our research institutions will pay off for our economy. One study found that 82 percent of licenses universities granted to private companies to develop products on the basis of their research went to firms located in the same state.

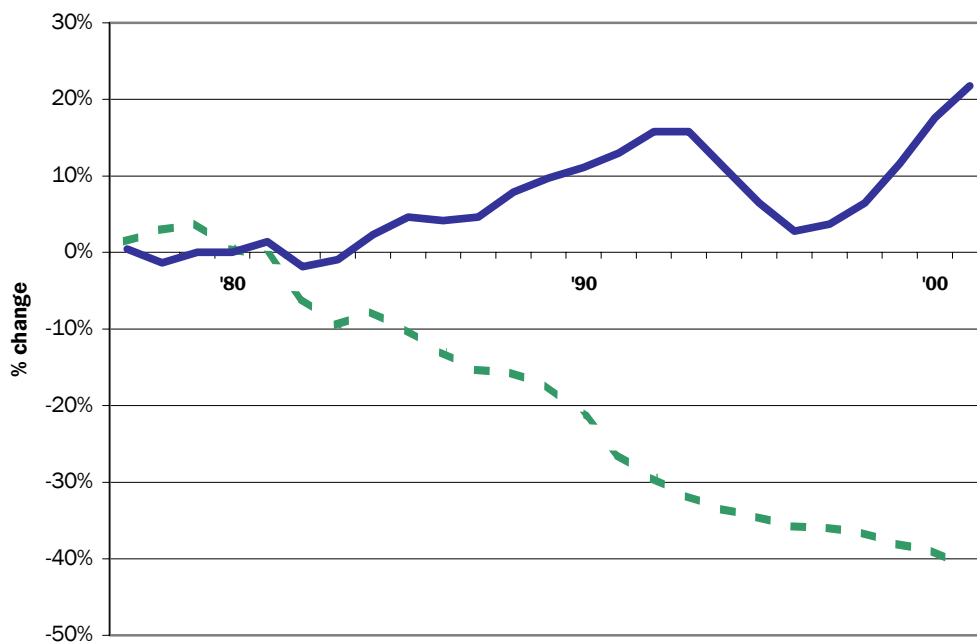


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152 Washington Avenue
Albany, NY 12210-2289

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A Pharm State: Growth in Pharmaceutical Jobs Compared to Manufacturing Overall



New York State, 1976-2001

