# THE ECONOMIC DEVELOPMENT POTENTIAL OF STEM CELL RESEARCH IN TEXAS

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## Executive Summary

Stem cell research is a critical component of the life sciences and the study of diseases. In particular, it is believed that *embryonic* stem cell research will lead to treatments or cures for diabetes, Parkinson's, various cancers, leukemia and other chronic diseases as well as spinal cord injury.

Unlike Texas, many other states are making strong commitments to stem cell research, not only to improve public health but also to capitalize on its economic development potential. Institutions in California, New Jersey, Massachusetts and Wisconsin have been the leaders in this field, in part because of state laws that ensure the legality of embryonic stem cell research.

Even without explicit state support for embryonic stem cell research, Texas nonetheless possesses a sizeable biotechnology sector comprised of about 850 private companies as well as world-class universities and research facilities. Still, compared to California, Massachusetts and New York, Texas is currently a minor player in the biotechnology industry. With eight percent of the nation's population, and 7.8 percent of its gross domestic product (GDP), Texas currently accounts for only 2.3 percent of the nation's biotech employment and under three percent of total output.

Ironically, Texas Governor Rick Perry has identified "biotechnology and life sciences" as one of six industry clusters targeted by the state of Texas for future growth, even though no monies from the $200 million Emerging Technology fund have been earmarked for stem cell research. But if Texas is to be a leader in stem cell research, including embryonic stem cell research, it will have to invest more of its own resources,

just as many other states are doing. In his 2007 State-of-the State address, Governor Perry announced a $3 billion state effort to eradicate cancer over the next decade. Stem cell research should be an integral part of this important initiative.

The future of biotechnology can follow one of two paths:

- **Scenario I:** If Texas retains its current market share of 2.9 percent, the state's biotech industry will grow to $30.4 billion by 2014. An industry of this size will contribute $42.5 billion to state economic activity and support 112,000 direct, indirect and induced jobs. State and local tax receipts would increase by $632 million annually.
- **Scenario II:** If Texas' share of the nation's biotechnology spending rises from 2.9 percent to 6 percent by 2014, the state will possess a $62.5 billion industry contributing $87.4 billion to state economic activity, supporting 230,000 jobs, and generating $1.3 billion in new state and local tax revenues annually.

To realize Scenario II, Texas must create a legislative and regulatory environment that encourages researchers and industry to remain in the state. That means passing a law or referendum which ensures that state policy toward stem cell research, including embryonic stem cell research, is no more restrictive than that at the national level. A more restrictive environment would force talented researchers to leave Texas and would make it extremely difficult to attract new researchers and biotech companies into the state.

If Texas is to be a leader in the biosciences, with all the anticipated health and economic benefits that will follow, the state must maintain a hospitable environment for

research and development. At a minimum, Texas needs to be known as a "safe haven" for regenerative medical research, including embryonic stem cell research. And if Texas is serious in its desire to become a major player in the global bioscience arena, it should invest some of its own resources into this cutting-edge research.

*Introduction*

Scientific research and economic development go hand-in-hand. Think of the revolution in solid state physics in the latter half of the 20th century, spawned by the invention of the transistor and the semiconductor which, in turn, led to the development of the information technology industry. This has literally transformed economic life in the United States and many other parts of the world.

Just as the 20th century was defined by developments in the physical sciences, the economic driver in the present century will likely be the life sciences. As treatments and cures are found for chronic diseases, the quality-of-life will improve along with longevity. A new agricultural revolution and profound changes in energy technology may also evolve from research in the life sciences. But the economic "promises" and potential health benefits from the life sciences will only be realized in an accommodating financial and regulatory environment.

Stem cell research is a critical component of the life sciences. Stem cells—both pluripotent (embryonic) and multipotent (adult or somatic) cells that are characterized by (a) being able to transform into other cell lines while (b) remaining immortal—are crucial in the study of diseases with or without a genetic predisposition. In particular, it is believed that *embryonic* stem cell research will lead to treatments or cures for diabetes, Parkinson's, various cancers, leukemia and other chronic diseases as well as spinal cord injury.

***From a research perspective, embryonic stem cells cannot be separated from adult stem cells because of the symbiotic relationship between the two.*** The implication of this link is that unless the current ban on federal funding for research using stem cell

lines derived from excess donated embryos is repealed—which also includes the removal of the Dickey Amendment from its perch of reapplication in the Health and Human Services Finance Subcommittee—the U.S. may soon find itself at a competitive disadvantage in life science research as countries such as Sweden, Israel, Japan, China, Singapore, the United Kingdom and others increase funding to explore stem cells and develop patents related to them. Until, and unless, the current ban is lifted, America is in danger of being relegated to minor player status in the development of therapies related to stem cell research.[1]

Stem cell research, along with the life sciences in general, involves much more than possible cures for serious diseases. It means jobs, income and economic development. According to the Biotechnology Industry Organization in Washington, DC, the bioscience industry today employs 1.2 million Americans in more than 40,000 firms across all 50 states. In Texas alone, biotechnology is estimated to generate almost 50,000 jobs, not including researchers at hospitals, medical schools and clinical research institutions.

Unlike Texas, many other states are making strong commitments to stem cell research in order to capitalize on its economic development potential. Most notably, the voters of the state of California approved proposition 71 in 2004 that authorized the expenditure of up to $3 billion to support stem cell research at the state's hospitals, medical schools, universities and other research institutions over a 10-year period. By contrast, one bill pending in Austin during the current legislative session would ban the

[1] Embryonic stem cells can become all cell types in the body while adult stem cells are generally limited to differentiating into the cell types of their tissue of origin. Researchers are hopeful that these cells can be directly differentiated to repair damaged organs in need of healthy cells.

use of state money for any type of biomedical research that is ineligible for federal funding as of January 1, 2007.

Though the newly-elected Democratic Congress may attempt to remove the current federal limitations on stem cell research, a Presidential veto of such action is likely. And, even if the bill gets past the veto, the Dickey Amendment is still in place. It is up to the state of Texas to decide whether it wants to continue to be a major player in the life sciences or relegate itself to a minor role with the attendant loss of economic development potential.

In what follows, we first discuss the potential of the life sciences as a force for economic development. We then describe stem cell initiatives being pursued by other countries and various American states, including Texas. Next we calculate the current and potential economic and fiscal impacts of the life sciences in Texas, including stem cell research, assuming a "safe harbor" legislative environment with no state restrictions more stringent than those imposed by the Federal government. We then estimate the economic losses that could occur in a hostile legislative climate that limits the types of research that can be conducted by university and private researchers. Finally, we derive our conclusions.

*The potential of biotechnology as a force for economic development*

The primary goal of medical research is to prevent and to cure disease, thereby enhancing the quality-of-life for mankind. Biomedical research also has sizable economic impacts that result from the development of products and procedures. Concerned that federal policy for funding embryonic stem cell research is hindering the development of important medical therapies, many states are funding or considering

funding such research on their own. Some states hope to benefit economically by encouraging the development of the stem cell equivalent of Silicon Valley within their borders. They hope to achieve this goal by attracting scientists, biotechnology companies, and venture capital dollars. Or, at least, they hope to prevent other states from luring away their human brain-power.

*An overview of global initiatives in stem cell research*

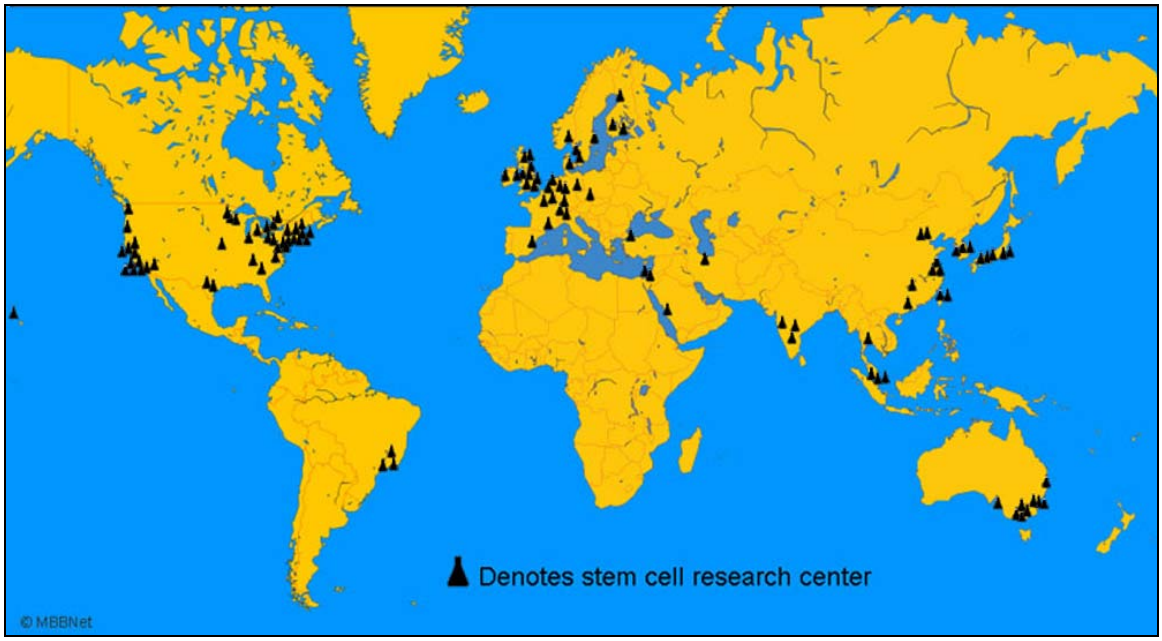
Biotechnology is a large and fast-growing industry. According to the research firm Datamonitor, the global biotechnology marketplace grew 10.4 percent in 2004 to an estimated $114.1 billion and is forecast to reach $180.5 billion by 2009.[2] Between 2000 and 2004, biotechnology recorded a compound annual growth rate of 11.5 percent. According to one estimate, total employment in the biosciences reached 1.2 million in 2004, with another 5.8 million jobs supported elsewhere in the economy by the activities of the biotechnology sector.[3]

Because of the industry's costly, research-intensive nature, activity tends to be concentrated in large urban areas that possess universities and research institutions, a well-educated workforce, and healthy entrepreneurship. These criteria have made the United States the primary location for the biotech marketplace, with 2004 sales of $60.5 billion representing more than half of all global activity. Between 2000 and 2004, the U.S. biotechnology market expanded at a compound annual rate of 14.5 percent. Datamonitor forecasts the U.S. market to reach $102 billion by 2009.

[2] Datamonitor defines the biotechnology marketplace as the development, manufacturing, and marketing of products based on advanced biotechnology research—including stem cell research.
[3] Biotechnology Industry Organization (BIO), *Growing the Nation's Bioscience Sector: State Bioscience Initiatives*, Washington, DC, 2006.

While the moral debate over embryonic stem cell research continues in the United States, countries in Europe and Asia are pouring billions of dollars into the field (see Figure 1). For example, the British government is committed to spending $1.3 billion over the next decade to support the construction of five manufacturing facilities that will produce millions of pure stem cells for research. The British entrepreneur Sir Richard Branson has recently launched a venture with a London investment firm to create a "bank" that will preserve stem cells from umbilical cord blood.[4] Sweden and India are developing tests that use embryonic stem cells to determine the toxicity of potential therapies. In Israel, scientists are changing the genetic makeup of embryonic stem cell lines by deactivating specific genes. By understanding how the genes function, researchers believe the cells can serve as a model for a human disease on which treatments may be tested.

**Figure 1**




Source: *Financial Times*, October 28, 2004.

[4] "Branson Banks on Stem Cells," *Business Week*, February 19, 2007. Note: stem cells from cord blood are adult stem cells.

In 2000, Singapore initiated a plan to turn the country into a global biomedical hub. To that end, the government has invested more than $300 million to build "Biopolis," a 500-acre biotechnology development park. Between 2000 and 2005, Singapore spent nearly $4 billion on the biomedical sciences and plans to increase that amount to $7.5 billion over the next five years. To date, more than 10,000 jobs have been created in Singapore's biomedical industry.[5]

President Hu Jintao of China has stressed the importance of both adult and embryonic stem cell research, and the Chinese government is reported to be doubling its investment in such research. Chinese physician-scientists are already testing experimental therapies on humans at more than 100 hospitals, including the use of stem cells isolated from umbilical cord blood to treat spinal cord injuries.[6] Australia recently rescinded a four-year ban on cloning human embryos for stem cell research, a move that could put Australia at the forefront of research into diseases such as diabetes and Parkinson's.

*Recent state initiatives in stem cell research*

California: California has been more aggressive that any other state in terms of attempting to establish leadership in embryonic stem cell research. In 2004, voters approved a $3 billion bond issue, the proceeds of which are intended to fund $300 million annually in basic embryonic stem cell research over a ten-year period. Though a few restrictions were placed on the types of research that could receive funding, the

[5] With a population only one-fifth that of Texas, the city-state of Singapore boasts a biotech sector that is almost as large as that of Texas.

[6] The February 12, 2007 issue of *Business Week* includes an article entitled "Stem-Cell Refugees" about Americans who are traveling to China for experimental therapies.

proposition mandated that priority be given to projects unlikely to receive federal funding.

Though legal challenges have delayed the issuance of bonds, private funding and creative state maneuvering have filled the gap. In March of 2006, UCLA announced the creation of a $20 million Institute for Stem Cell Biology and Medicine while private donors have pledged $31 million to the California Institute for Regenerative Medicine and $25 million to establish a stem cell institute at the University of Southern California. Over the past year, more than 30 notable stem cell scientists have been recruited to these institutions from out-of-state.

In their report, *An Economic Impact Analysis of the Proposition 71 California Stem Cell Research and Cures Initiative*, Baker and Deal estimate that the $3 billion bond issue will more than pay for itself through higher state revenues and health care cost savings of between $6.4 billion and $12.6 billion. In addition, they project that spending these new research dollars will create between 5,000 and 22,000 new jobs per year in California's biotechnology industry.[7]

New Jersey: New Jersey was the first state to commit funding for stem cell research by spending $8.5 million to create the Stem Cell Institute of New Jersey, operated jointly by the University of Medicine and Dentistry of New Jersey and Rutgers University. The state also funds $10 million annually in competitive grants for stem cell research. Just recently, legislation was enacted that authorizes the issuance of $270 million in state bonds for construction of research facilities. About $150 million is allocated for stem cell research facilities at the Rutgers campus in New Brunswick and

[7] Laurence Baker and Bruce Deal, *An Economic Impact Analysis of the Proposition 71 California Stem Cell Research and Cures Initiative*, Analysis Group, September 14, 2004.

$50 million for facilities at the medical school in Newark. An additional $10 million has been dedicated to building a center for cord blood collection.

In September 2005, Seneca and Irving prepared an economic impact assessment of the New Jersey initiatives for the governor's office.[8] The researchers concluded that the state's stem cell initiatives would generate $1.4 billion of new economic activity in the state, close to 20,000 additional jobs, and about $72 million in new state revenues over the time period 2006 to 2025.

New York: In 2005, the privately-funded New York Stem Cell Foundation was established to further embryonic stem cell research in the state. The foundation opened its first laboratory in March 2006 to serve as a "safe haven" where scientists from academic medical centers could conduct advanced embryonic stem cell research free from federal restrictions. Though previous efforts to dedicate state funds to stem cell research have not been achieved in New York, newly-elected governor Eliot Spitzer has pledged to push for passage of a $2 billion, 10-year bond initiative for research and development, about half of which would be set aside for stem cell research. He has also proposed a law to ensure the legality of embryonic stem cell research within New York State.

Massachusetts: In June of 2005, the Massachusetts legislature overturned the governor's veto of a bill backing stem cell research in the state. The law allows for creation of embryonic stem cells, including those from cloned embryos, and establishes regulatory oversight on several levels while explicitly prohibiting reproductive cloning.

[8] Joseph J. Seneca and Will Irving, *The Economic Benefits of the New Jersey Stem Cell Research Initiative,* Office of the Governor, Trenton, September 2005.

Though the law does not provide public funding for embryonic stem cell research, it has encouraged private initiatives by removing uncertainty about the legality of such research. For example, last year Harvard University announced the creation of a privately-funded, multimillion-dollar program to create cloned human embryos that are sources of medically promising stem cells. This collaborative effort will involve several Harvard-affiliated medical research centers, the New York Stem Cell Foundation, and Columbia University.

Wisconsin: In Wisconsin, where human embryonic stem cells were first isolated, a $750 million initiative is underway to establish the state as a key player in biomedical and embryonic stem cell research. About half the money has been dedicated to the Wisconsin Institute for Discovery, a massive interdisciplinary research institute located at the University of Wisconsin. Another $134 million has been allocated for a second center that would help bring basic research discoveries to clinical fruition at a more rapid pace. Finally, $132 million has been pledged for a research facility at the Medical College of Wisconsin and Children's Hospital that will focus on infectious disease control, cardiovascular illnesses, and bioengineering. Wisconsin's goal is to capture 10 percent of the stem cell research market by 2015, and its Department of Commerce is actively recruiting stem cell research firms. In December 2006, CellCura Inc., a Norwegian biotechnology company, announced it was opening an office in Madison to have access to ongoing stem cell research. CellCura is the fourth stem cell company to start or locate in Wisconsin over the past two years.

Other state initiatives: In the November 2006 election, *Missouri* voters approved an initiative that ensures Missourians will have access to any stem cell research and cures

that are allowed under federal law and available to other Americans. A study by researchers at the University of Missouri estimates that new private funding promised for stem cell research in the state will add about $1.25 billion to gross state product over the next 25 years as well as $47 million in new state tax revenues.[9]

The *Illinois* Regenerative Medicine Institute, located in the Department of Health, was created in 2005 and is responsible for awarding $10 million annually to state research facilities conducting stem cell research. A bill introduced in the Illinois legislature last December seeks an additional $25 million a year for stem cell research. In *Connecticut*, a law passed in 2005 appropriated $30 million for conducting embryonic or human adult stem cell research. And the University of *Colorado* recently established the Charles C. Gates Regenerative Medicine and Stem Cell Biology Program with substantial private funding to increase the amount of stem cell research already under way at the School of Medicine. The School made national news last summer by luring away a team of stem cell researchers from Texas.

*How Texas stacks up in the biotechnology industry*

Acknowledging its economic development potential, in October 2004 Texas Governor Rick Perry announced that "biotechnology and life sciences" would be one of six industry clusters targeted by the state for future growth. He also pledged to use state resources, such as the Texas Enterprise Fund (TEF) and the Emerging Technology Fund (ETF) to help leverage private investment in this targeted industrial cluster.

[9] Joseph H. Haslag and Brian K. Long, *The Missouri Stem Cell Research and Cures Initiative: an Economic and Health Care Analysis*, August 2006.

The field of regenerative medical research, which includes all forms of stem cell research, is perceived as a critical element in biotech's future. In each legislative session since 2001, advocates have fought proposals to ban this promising research as well as funding for embryonic stem cell research. Since 2003, efforts have been undertaken to protect all forms of stem cell research in Texas despite the continued efforts by some legislators to impose restrictions or bans. At present, all forms of stem cell research remain legal. However, ongoing committee battles and floor fights, coupled with a lack of state funding for stem cell research, have created a cloud of uncertainty that threatens to take Texas out of the running as a major player in life sciences research and development.

Though the $200 million Emerging Technology fund, created to improve university research and increase collaboration between public and private sector, includes biotechnology as an "emerging technology," no specific funding is earmarked for stem cell research.[10] However, in 2005 the Texas Institute for Genomic Medicine—a public/private venture of Texas A&M University and Lexicon Genetics—received a $50 million grant from the Texas Enterprise Fund to conduct medical research and foster job growth in the life science industry.

Even without explicit state support for embryonic stem cell research, Texas possesses a sizeable biotechnology sector. According to the Texas Workforce Commission, the state is home to approximately 848 traditional biotech, biomedical research, business and government consortia, medical manufacturing companies, and world-class universities and research facilities employing more than 27,000 workers at an

[10] In February 2006, the ETF awarded a $2 million grant to Texas Tech University to help support its new International Center for Excellence in Agriculture Genomics and Biotechnology.

average annual salary of $77,558. A 2005 study by the Milken Institute ranked Dallas-Fort Worth as the 11th largest cluster in the life sciences (see Table 1).

## Table 1

## Biotech Clusters

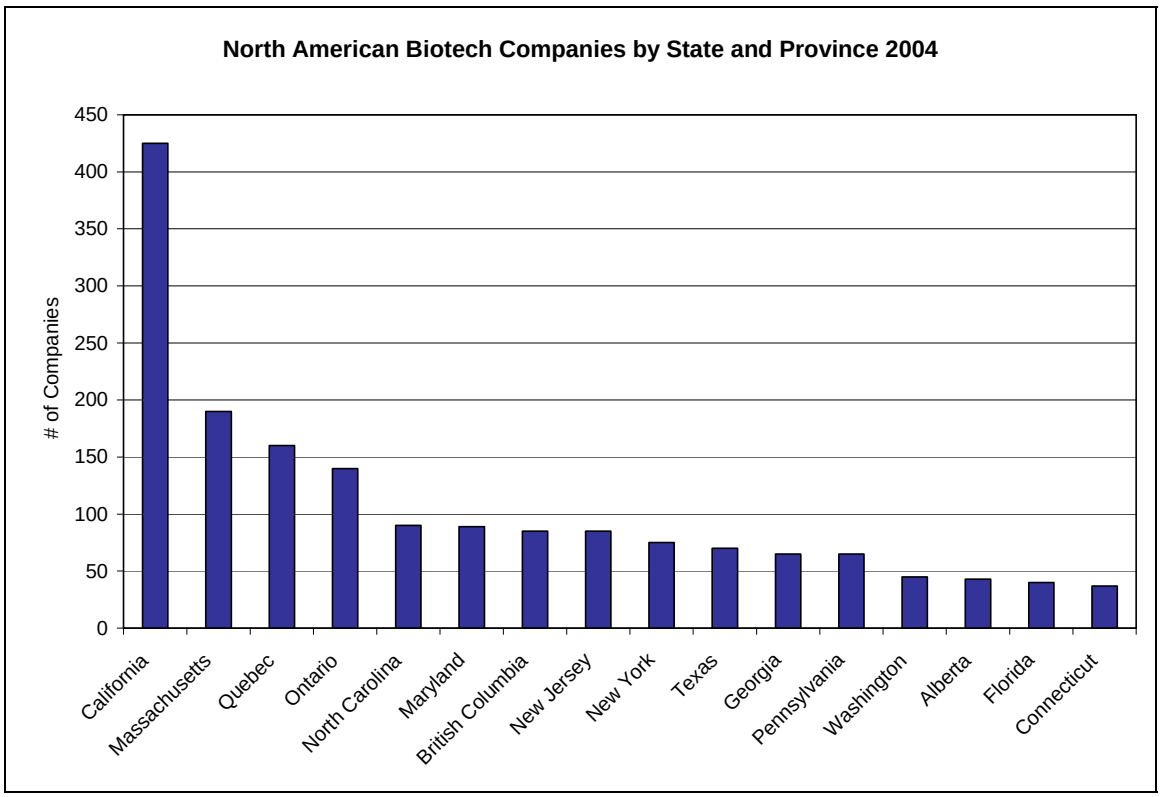
| Rank | Region | Score |
|---|---|---|
| 1. | Boston | 100.0 |
| 2. | San Francisco | 98.4 |
| 3. | Philadelphia/S. Jersey | 97.1 |
| 4. | New York/N. Jersey | 94.6 |
| 5. | Raleigh-Durham, NC | 91.1 |
| 6. | San Diego | 90.7 |
| 7. | Los Angeles | 87.0 |
| 8. | Minneapolis | 77.9 |
| 9. | Chicago | 75.9 |
| 10. | Seattle | 70.9 |
| **11.** | **Dallas/Fort Worth** | **55.2** |

Source: The Milken Institute, 2005.

In 2004, Texas ranked sixth in the nation for NIH awards, which are largely in the area of biotechnology, with $1.15 billion in grants. What's more, according to the Texas Higher Education Coordinating Board, in 2004 almost $39 million was spent on specialized biotechnology R&D at Texas public universities with the result that the University of Texas System ranks first in the world in the number and quality of biotechnology patents generated. And hoping to commercialize the results of its research in the biosciences, the University of Texas Southwestern Medical Center at Dallas is currently constructing three buildings adjacent to the campus to house biopharmaceutical and biodevice companies.

And yet, compared to California, Massachusetts and New York, Texas is currently a minor player in the biotechnology industry (see Figure 2).

## Figure 2




Source: Biotechnology Industry Organization.

*Assessing the current and potential economic impacts of biotechnology in Texas*

The total economic impact of an industry is greater than the value of its output. In order to assess total impacts, economists utilize input-output models, such as the IMPLAN developed by the Minnesota IMPLAN Group. Input-output models track how spending flows through a regional economy. The estimates include direct, indirect, and induced impacts.

Direct impacts are the result of a firm or collection of firms operating in a given industry procuring goods and services in the economy. For example, a research laboratory purchases supplies, testing equipment, and building support services. These

vendors and suppliers, in turn, purchase goods and services to support their local operations, thereby creating indirect effects. The laboratory-supplies-vendor hires employees, purchases office supplies, contracts with transportation services to deliver their goods, and hires professional service providers such as accountants. The induced impacts track the economic and fiscal effects of employees of the research lab, as well as these other vendors and suppliers, spending a portion of their earnings for goods and services.

Each of these impacts is adjusted to account only for purchases in the modeled economy. For example, if Petri dishes are made outside of Texas, the purchase of that particular good does not generate much secondary economic activity in the state. The remainder "leaks out" to other states or perhaps other nations. When added together, the sum of all of the activity from direct, indirect, and induced impacts is greater than the local proportion of spending by the research laboratory, which is the "multiplier effect."

The model estimates the total level of economic activity (transactions) supported by the base spending and resulting job and income impacts. Income impacts are categorized as labor income, which includes salaries, wages, benefits, and proprietors' income, and other property income. Other property income includes rents, royalties, corporate profits, dividends, and other income derived from direct, indirect, or induced spending. For example, an employee of the laboratory rents a house in Texas. The owner of the house realizes a portion of that rent as income available for spending.

Estimates of state and regional fiscal impacts are based on the IMPLAN model. The IMPLAN input/output model offers estimates of indirect business taxes, which include sales and use taxes, property taxes, permit and license fees, and other business

taxes paid to state and local entities. These estimates do not include franchise fees that may be paid directly by the firms in the modeled industries.

In assessing the current economic and fiscal impacts of the biotechnology industry, we have combined two industries from the North American Industrial Classification System: (1) NAICS 3254, Pharmaceutical and medicine manufacturing and (2) NAICS 5417102, Research and development in the life sciences.[11] This is a fairly narrow definition of the biotechnology technology industry as it excludes medical equipment manufacturers as well as medical and diagnostic labs. It also excludes university-based R&D in the life sciences.[12]

In assessing the size of the biotechnology industry, we have relied on data for 2004 available from the IMPLAN model with an adjustment for that model's industry aggregation scheme. To separate research and development in the life sciences from other R&D activities in the engineering, social, and physical sciences, we examined data from the 2002 Economic Census.[13]

As shown in Table 2, Texas fares poorly in total output and employment versus the nation as a whole with just under three percent of total output and only 2.3 percent of employment. When we consider that Texas accounts for about eight percent of the nation's population and 7.8 percent of its gross domestic product, the state's

[11] NAICS 5417102 only records R&D activities when the location is a stand-alone facility. Though NAICS is ostensibly a manufacturing classification, if a research facility is located at the manufacturing site the R&D activities are recorded in that industry.

[12] Other studies, such as those conducted by the Milken Institute and Battelle, use a broader definition of biotechnology encompassing between 13 and 27 industrial classifications. Naturally, the economic impacts from a more broadly-defined cluster are much larger than those incorporated in this analysis.

[13] In 2002, research and development in the life sciences represented about 27% of all R&D activities in Texas and about 41% of all R&D activities in the U.S. Our assumption is that the proportion of all output and employment for R&D activities in the life sciences remained effectively constant between 2002 and 2004.

biotechnology sector—as defined in this report—is remarkably small. That also means the industry possesses tremendous growth potential in the state of Texas.

## Table 2

**Receipts (output) and Employment**
**Biotechnology Sector, 2004**

| | U.S. | Texas | Texas % of U.S. |
|---|---|---|---|
| Receipts | $ 308,033,736,000 | $ 8,990,763,000 | 2.9% |
| Employment | 631,975 | 14,720 | 2.3% |

Source: IMPLAN, U.S. Economic Census

The U.S. biotech industry grew at a compound annual growth rate of 14.5 % percent. If we assume that growth rate continues for the next decade, biotech will be a $1 trillion industry by 2014. If Texas simply retains its current market share of 2.9 percent, the state's biotech industry will grow to $30.4 billion by 2014. An industry of this size will contribute $42.5 billion to state economic activity and support 112,000 direct, indirect and induced jobs. State and local tax receipts would increase by $632 million annually.

Given that biotechnology has been targeted as a growth industry for the state, presumably its share of the national market will be larger in the years head. ***If Texas' share of the industry should grow from 2.9 percent to 6 percent by 2014, we'll be looking at a $62.5 billion biotechnology sector. An industry of this magnitude would have a tremendous economic impact. According to IMPLAN, a $62.5 billion biotech industry would contribute $87.4 billion to state economic activity and support over 230,000 direct, indirect, and induced jobs (compared to 33,000 today) paying over***

***$12.8 billion in salaries, wages, benefits and proprietors' income.[14] In addition, property income from rents, royalties, dividends and corporate profits would rise to almost $7 billion and state and local indirect business tax revenues would increase to $1.3 billion.***

***In order to achieve growth of this order, Texas must create a legislative and regulatory environment that encourages researchers and industry to remain in the state. That means passing a law or referendum similar to that of the state of Missouri ensuring state policy toward stem cell research, including embryonic stem cells, is no more restrictive than that at the national level. A more restrictive environment could have the undesirable affect of "chasing" talented researchers away from Texas, as happened at the Baylor College of Medicine last year, or making it extremely difficult to recruit new researchers and biotech companies into the state.***

In addition, Texas will have to invest more of its own resources into biotechnology, including stem cell research, as many other states are doing. Governor Rick Perry announced in his 2007 State-of-the State address that he would spearhead a $3 billion state effort over the next decade in a bid to eradicate cancer. The project will combine efforts of the Lance Armstrong Foundation and the Susan G. Komen Foundation with research conducted by private companies, state universities, medical schools and the University of Texas M.D. Anderson Cancer Center. The governor stated that "In addition to giving Texans easy access to the most cutting-edge cancer treatments, the fund will draw high-tech companies and well-paying jobs to the state."

[14] The actual impacts of a $62.5 billion biotechnology industry in Texas could be larger. If the state were to become more competitive in the biotechnology sector, new businesses supplying goods and services to this industry would be created or move to the state thereby decreasing economic leakage and expanding the indirect and induced economic impacts.

Stem cell research, including embryonic stem cell research, must be an integral part of this important initiative. Early research has provided strong evidence that the study of embryonic stem cells can help scientists learn how cancer cells operate and grow. Moreover, proof-of-concept studies have already shown that embryonic stem cells can be used to fight and repair cancer-damaged tissue.[15]

*A worse case scenario: Legal restrictions on stem cell research in Texas*

A bill has been introduced in the 80th Regular Session (the current session) of the Texas legislature that would prohibit the use of state money for embryonic stem cell research. Should this proposal become law, the economic consequences for the state would be extremely negative. Not only would biotech companies be reluctant to locate or expand here, a flight of top researchers would likely follow the passage of such legislation.

Because of continuing political battles, and a lack of specific public funding for embryonic stem cell research, Texas is already having problems holding on to some of its best talent. On January 1st, Dennis Roop, formerly a professor of molecular biology and cellular biology at the Baylor College of Medicine in Houston, assumed the Charles C. Gates chair in stem cell biology at the University of Colorado School of Medicine. He will head a new program in regenerative medicine and will be joined by four other faculty members from Baylor.

Limitations on stem cell research could have negative consequences for the entire medical/industrial complex in Texas if researchers, grant-givers, and venture capitalists

[15] Research scientists at the University of Minnesota recently reported they had utilized human embryonic stem cells to kill cancer cells.

shy away from Texas because of concerns that government-imposed restrictions might spread to other areas of research and medical practice. At present, the Texas Medical Center in Houston is the world's largest, with 42 member institutions, 74,000 employees and an annual economic impact in excess of $7 billion.[16] UT Southwestern in Dallas is another medical behemoth, supporting about 22,000 jobs across the region with a local economic impact of over $2 billion in 2002.[17] Growth of these world-class institutions would be hampered if restrictions are imposed on stem cell research, especially embryonic stem cell research.

In short, ***an industry that has the potential to support more than 230,000 jobs in Texas, generate $88 billion in economic activity, and provide over $1.3 billion in state and local tax revenue would be put at risk should the legislature impose restrictions on stem cell research above and beyond any federal restrictions.*** And, the state could forget about becoming a major global player in the fast-growing biosciences and the economic and fiscal benefits that would have been realized.

*What Texas needs today, at a minimum, to ensure the future of stem cell research and biotechnology*

Given the competing demands on the state budget for the 2008-2009 biennium, and the opposition of some legislators to stem cell research and the funding of same, the passage of a stem cell initiative is highly unlikely. But in order to remove the uncertainty about Texas' legal and regulatory position as regards stem cell research, including the

[16] Federal Reserve Bank of Dallas, Houston Branch, *Economic Impact of the Texas Medical Center on Southeast Texas*, October 2001 and Texas Medical Center.
[17] UT Southwestern Medical Center, *http://www.utsouthwestern.edu/utsw/cda/dept23608/files/83933.html*

embryonic variety, it is imperative that safe haven legislation be considered and passed in the current legislative session.

California can serve as a model. In 2002, California became the first state to enact a safe haven for stem cell research, including the use of somatic cell nuclear transfer (or SCNT) to derive human embryonic stem cells.[18] One such bill is Senate Bill 253, which declares that "the policy of the state shall be that research involving the derivation and use of human embryonic stem cells, human embryonic germ cells, and human adult stem cells from any sources, including somatic cell nuclear transplantation, shall be permitted, as specified." Texas needs a similar statute if it is to attract and retain the human talent and financial resources that will enable the state to become a national and global leader in the biosciences.

*Conclusion*

The Texas economy has outperformed the U.S. economy in just about every year since 1960. In the 1960s and 1970s, rising energy prices precipitated an unprecedented boom that created millions of new jobs, pushing the state's per capita income above the national average for the first time ever. When oil prices fell in the mid-1980s, job growth shifted to the "information technology sector" comprised of industries such as computers, electronic components, communications equipment and services, data processing and software. These industries still dominate the Texas economy.

Texas' growth in the 60s and 70s came about by exploiting the state's natural resources, while several decades of rising expenditures on national defense helped launch

[18] It should be noted that in 1997, California became the first state to enact a prohibition against reproductive human cloning. Many other states have followed.

many of the new technologies commercialized in the 80s and 90s. Today, there is a broad consensus among scientists and futurists that biotechnology is the "next wave" that will not only improve the planet's quality-of-life but also create millions of new high-paying jobs.

According to a 2006 poll undertaken by Research!America, more than 90 percent of Texans view medical research as critical to the state's economic future while 78 percent support the use of state financial incentives to attract new scientific research laboratories and companies. What's more, 55 percent of Texans support embryonic stem cell research.

***If Texas is to be a leader in the biosciences, with all the anticipated health and economic benefits that will follow, we must create a hospitable environment for research and development. At a minimum, Texas needs to be known as a "safe harbor" for regenerative medical research, including embryonic stem cell research. And if Texas really wants to become a major player in the global bioscience arena, it should consider investing some of its own resources into this cutting-edge research.***