THE GEORGIA LIFE SCIENCES INDUSTRY ANALYSIS **2011**

Shaping Infinity

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Major contributor to *Shaping Infinity*
Lorena Akioka, Editor

From the President of Georgia Bio

Georgia Bio (GaBio) welcomes you to the 2011 *Shaping Infinity*, the Georgia Life Sciences Industry Analysis. This year's report, the fifth in a series, demonstrates the enormous significance of life sciences innovation to Georgia's economic growth. Life sciences industry employment has remained steady, earning it a description as "recession resistant," and the economic impact of the industry increased substantially, jumping 22 percent over the past two years.

The life sciences industry and university research, plus the U.S. Centers for Disease Control and Prevention, have a $23 billion annual economic impact on Georgia and employ more than 100,000 people. The industry's impact alone is nearly $20 billion, employing more than 75,000 people in high-paying, rewarding careers. Through the worst years of the economic recession, employment in Georgia's life sciences industry actually increased slightly, a remarkable achievement considering that total statewide employment for all industries dropped by nearly seven percent. Georgia's life sciences industry also pays very well with an average salary of $64,500, which is 50 percent higher than the average of $42,902 for all industries.

The Georgia Life Sciences Industry Analysis 2011 was produced by the University of Georgia's Selig Center for Economic Growth in the Terry College of Business. Selig Center Director Dr. Jeffrey Humphreys conducted the economic impact study. The report also includes data on 319 companies and measures the progress of an industry that Dr. Humphreys describes as "both a pillar and driver of the state's economy."

In addition, *Shaping Infinity* includes commentary from industry, academic and government leaders. Governor **Nathan Deal** is featured along with Georgia Department of Economic Development Commissioner **Chris Cummiskey** and Center of Innovation for Life Sciences Director **Stacy Williams Shukar**, Ph.D.

From academia, University of Georgia President **Michael F. Adams**, Ph.D., and Georgia Health Sciences University President **Ricardo Azziz**, M.D., MPH, M.B.A., highlight major initiatives at their renowned research institutions; and from industry, Arbor Pharmaceuticals President and CEO **Ed Schutter** discusses his fast-growing, innovative company.

Georgia Bio is the private, non-profit association representing pharmaceutical, biotechnology and medical device companies, medical centers, universities, and other life sciences-related organizations in Georgia.

We are proud to work with the Selig Center and this year's sponsors—The University of Georgia and the Georgia Department of Economic Development—to bring you this analysis of the significance of our state's life sciences industry, a source of high-paying jobs and the only sector in Georgia whose professionals are dedicated to improving the health and well-being of people, animals, and the environment.

Charles Craig, President
Georgia Bio
www.gabio.org

Committed to Growing the Biosciences in Georgia

The Honorable Nathan Deal
Governor of Georgia

When I became Governor in January 2011, I promised the people of Georgia that I would do everything in my power to create jobs and restore the opportunities lost during the recent recession. While the road to recovery is long, the biosciences industry in the state has not lost momentum and continues to lead other industry sectors in activity, innovation and opportunities.

Public and private investment in global health research and development has resulted in thousands of jobs in medicine, research, public health and education in Georgia and has had an economic impact in the billions. Over the years, Georgia has put considerable effort into creating the kind of environment that not only sustains, but encourages, scientific discovery, commercialization and business success, and I intend to continue that focus.

For example, the Georgia Research Alliance has been one of our most formidable bioscience assets for the past 21 years. This unique entity was created to attract technology companies to the state by building the infrastructure these companies have to have: top scientific talent, premiere facilities, and funding opportunities. GRA leverages the state's university resources for the business community in order to grow jobs and investment in the state.

By any measure, the GRA has been an unqualified success, recruiting scores of world-renowned scientists and fueling the launch of more than 150 companies and two dozen centers of research excellence. In its first 19 years, the GRA leveraged $525 million in state funding into $2.6 billion of additional federal and private investment.

The recent move of the Georgia Research Alliance, as well as that of the Georgia Cancer Coalition, to Georgia's Department of Economic Development is a positive move for the biosciences industry in Georgia and for companies considering our state. It enlarges the scope of GRA's economic development role and leverages the mission and resources of our Centers of Innovation program, which connects high growth-potential Georgia companies with university research and industry expertise. The services of these entities are much more interconnected and accessible to the business sector through this restructuring.

What's more, they will be better able to leverage Georgia's other assets for bioscience companies: a vast and growing pool of talent, existing R&D networks and funding sources to tap into, a global supply chain tailored to the specific needs of the industry, and an outstanding, affordable quality of life. More than 300 companies like CIBA Vision, Elan, Merial, Immucor, and Quintiles are already enjoying these advantages and thriving here.

As Governor, I am committed to ensuring our citizens—both private and corporate—have access to opportunities for growth and success. The biosciences industry undisputedly provides those, and so we will continue to examine our competitive package to identify new ways that ensure Georgia remains the crossroads of global health.

Executive Summary

In good as well as tough economic times, the companies that comprise Georgia's life sciences industry are dependable sources of high-quality jobs. From 2007 to 2009, the number of workers employed in Georgia's core life sciences industries increased by 1.3 percent, or by 198 jobs. Although small, the gain is remarkable, considering that total statewide employment for all industries dropped by 6.9 percent. Surgical instruments manufacturing, medical laboratories, and blood and organ banks account for much of the job growth. Meanwhile, the number of life sciences establishments rose by 14.1 percent and average annual pay rose by 3 percent.

Georgia's life sciences industry pays very well: the average annual salary was $64,509 in 2009. Indeed, every life sciences subsector pays better than the statewide average of $42,902 for all industries. Pharmaceutical and medicine manufacturing was the highest paying subsector at $93,397 per year, followed by electro-medical apparatus manufacturing at $90,537 per year. Research and development in biotechnology ranked third, paying $73,515 annually.

Although Georgia's life sciences industries added jobs as a group, some vital subsectors suffered significant job losses: pharmaceutical manufacturing lost 3.9 percent of its jobs; surgical appliances and supplies manufacturing lost 2 percent of its jobs; and biotechnology lost 1.6 percent of its jobs. Employment in the state's small electro-medical apparatus manufacturing sector droppeds nearly 80 percent from 2007. The diagnostic imaging centers subsector shed 5.4 percent of its jobs.

Economic Impact Highlights

The Selig Center's economic impact estimates show that life sciences firms generate substantial annual economic impacts for the people who live, work, and do business in the state. Overall, the statewide economic impacts of the life sciences industries in 2009 include:

- 17,926 jobs in life sciences companies;
- 75,077 jobs in all industries (including life sciences);
- $19.5 billion in output (sales);
- $7.5 billion in state GDP;
- $4.4 billion in labor income (earnings); and
- $496 million in tax revenues for state and local governments.

In addition, life sciences research at the state's colleges and universities generated 16,393 jobs (on- and off-campus); $1.8 billion in output (sales); $1 billion in state GDP; $754 million in income (earnings); and $68 million in tax revenues for state and local governments.

The Atlanta-based CDC also contributed substantially to the state's economy by generating 7,551 jobs; $1.7 billion in output (sales); $1.4 billion in state GDP; $1 billion in income (earnings); and $63 million in tax revenues for state and local governments.

In total, life sciences companies, academic R&D, and the CDC yielded:

- 35,043 direct jobs (0.8 percent of all jobs in Georgia);
- 105,420 total jobs (2.5 percent of all jobs in Georgia);
- $22.9 billion in output (sales);
- $9.9 billion in state GDP (2.5 percent of Georgia's GDP);
- $6.2 billion in income (earnings); and
- $627 million in tax revenues for state and local governments.

On average, for every direct job created by the life sciences, an additional two jobs are created in other industries. In other words, one job out of every 40 in Georgia owes its existence to either the life sciences industry, or to life sciences research and development, or the presence of the CDC in Atlanta.

Survey Highlights

The Selig Center identified 319 life sciences companies in Georgia. Data for 69 (21.6 percent) of the contacted companies were obtained from the completed surveys and data for 128 (40 percent) companies were obtained from publicly available sources.

Geographically, life sciences firms are clustered around Atlanta, Athens and Augusta. Atlanta (specifically Marietta and Alpharetta) is the prime location for pharmaceutical firms, but a number of these firms also are located in Athens. Atlanta and Athens are also popular home bases for biotechnology and bioinformatics companies. Medical devices and health IT firms tend to locate in the Atlanta area, specifically in Alpharetta, Norcross, and Kennesaw. Augusta is a hub for diagnostic firms, with smaller clusters present in Atlanta and Alpharetta. Athens and Augusta have the largest concentration of agricultural life sciences firms. Biofuels companies are located in nonmetro areas around Albany, Camilla, Dublin, and Waycross.

Georgia's life sciences industry is relatively young, with 40 percent of the covered companies founded in the last decade. Due to the severity of the Great Recession and subdued post-crisis recovery, the pace of company formation slowed down in both 2009 and 2010. Indeed, the number of companies founded within the last two years was the lowest since 1995. Over 80 percent of respondents reported Georgia as the state where their company was founded, with the largest number founded in either Atlanta or Athens.

The 2011 survey respondents have 259 products under development, with 179 awaiting FDA approval. Respondents reported that 178 products were marketed in 2011, and more are in the pipeline.

Labor Force

Most survey respondents do not anticipate any employment changes in 2011, with only a couple of firms anticipating employment reduction. Overall, the responding companies anticipate adding 288 staffers to their payroll this year. Many companies plan to hire Ph.D. and master's level scientists, but manufacturing workers can expect to see the largest number of new jobs. Biotechnology and other life sciences R&D firms will create most of the new jobs.

Finding and hiring skilled technicians and specialized managers was singled out as the most important labor force factor impacting the operations of life sciences companies. While the availability of skilled technicians was generally regarded as a strongpoint of operating in Georgia, opinions were split on the availability of specialized managers. The availability of skilled researchers—considered critical to the operations of nearly 60 percent of the responding companies—also was considered a strongpoint.

Financing

The distribution of companies according to their Georgia-generated revenues has remained fairly constant since 2006, with about 72 percent of companies falling within the lowest range of $10 million or less. The majority of the companies that generated income fell into the $1 million to $5 million range, but it should be noted that half the responding companies operated at a loss.

Responding life sciences companies raised $1.1 billion since their inception, and the largest sum—$911 million—was raised by life sciences R&D companies (including biotechnology). Manufacturing firms raised $144.5 million. If the data are separated by product, however, then pharmaceutical, biologics, and diagnostic firms raised the most capital ($632.6 million), followed by medical devices firms ($449.6 million), platform technology and general research technology firms ($23.7 million), and industrial, agricultural and biofuels firms ($4.1 million).

Founders, family, and friends were the main source of funding of the firms responding to the survey. In addition, grants provided financing to 55 percent of the respondents, private equity/partnerships to 32 percent, and venture capital funding backed 24 percent of them.

The amount of venture capital invested in Georgia's life sciences firms climbed steadily from $20.3 million in 1995 to $71.2 million in 2005. In 2007, a record year for venture capital investment in Georgia, biotech and medical devices firms reported $104.2 million venture capital investment. In 2010,

$71.2 million of venture capital investment was reported. Most respondents said that access to capital was a critical factor impacting their operations in Georgia.

Georgia's Business Climate

Life sciences companies identified quality of life, cost of living, and labor force issues as the most important factors for their operations. Infrastructure, access to capital, and the availability of service providers also were deemed crucial. While the cost of living, quality of life, and the availability of skilled researchers were considered strengths for Georgia, the availability of skilled managers and technicians received a mixed vote. Infrastructure and access to capital were even more problematic. In fact, survey respondents noted that access to capital was a major weakness in Georgia. Traffic congestion, transportation issues, and the high cost of energy were singled out as pressing infrastructure concerns by over 40 percent of respondents.

The 2011 Georgia Life Sciences Industry Survey was sent to 319 life sciences companies, and 69 of them answered the survey. Data for 128 additional companies were obtained from publicly available sources.

The principal author thanks the Selig Center's data analyst Stephen Kuzniak for his expertise in administering the online version of the survey.

Life Sciences Industry Overview

The life sciences industry uses modern biological techniques and supporting technologies with a goal to improve human and animal health, address threats to the environment, improve crop production, contain emerging and existing diseases, and improve currently used manufacturing technologies. These industries also utilize a specialized workforce, manufacturing procedures and facilities, and often require targeted funding.

This broad definition encompasses biotechnology, pharmaceuticals, diagnostics and medical devices branches, as well as the agricultural, biofuels and bioenergy industries, as they all are a part of the state's life sciences base that reaches from the high tech labs at the leading universities to manufacturing facilities scattered around the state.

General Trends

The number of workers employed in the life sciences industry in Georgia increased between 2007 and 2009, driven primarily by employment increases in the relatively large surgical instruments manufacturing sector, medical laboratories, and in blood and organ banks. The increase in total employment in life sciences amounted to 1.3 percent (or 198 employees). Although the industry gained employees overall, some vital sectors suffered significant losses: most notably, pharmaceutical manufacturing, the second largest in employment size, lost 3.9 percent of its workforce (127 employees).

Employment also shrank in the relatively large surgical appliances and supplies manufacturing sector (2 percent or 46 jobs), and in biotechnology (1.6 percent or 27 jobs). Employment in the tiny electromedical apparatus manufacturing sector fell to 49 employees, down nearly 80 percent from 2007. Diagnostic imaging centers lost 5.4 percent of its workforce (75 jobs).

Despite the employment losses, the life sciences industry as a whole fared much better than the overall economy in the state. Total employment in the life sciences in Georgia increased by 0.9 percent in 2008 and 0.5 percent in 2009, which amounted to a 1.3 percent increase between 2007 and 2009. At the same time, the U.S. life sciences sector increased its employment by 1.6 percent. These increases are remarkable, considering that the U.S. and Georgia suffered respective employment drops of 5 percent and 6.9 percent during that period.

The 348 new jobs, and the increase in the number of companies in surgical and medical instrument manufacturing are certainly most exciting. But the news is not all bad for the tiny electromedical apparatus manufacturing sector: although employment dropped from 242 to 49, the number of firms increased from 8 to 17. Also, the average salary jumped by 44.5 percent. The increased number of establishments and increasing wages may signal the arrival of a new crop of medical devices manufacturing firms.

The number of establishments in all life sciences industries increased from 2007 to 2009 and amounted to an overall rise of 14.1 percent. Average annual pay also increased by 3 percent in the life sciences as a whole, although it dropped

in surgical and medical instruments manufacturing, surgical appliances and supplies manufacturing, and in irradiation apparatus manufacturing.

As a rule, life sciences professionals are well paid. Those in pharmaceutical manufacturing reported the highest average annual salary ($93,397) in 2009, followed by $90,537 in electro-medical apparatus manufacturing. Annual pay in biotechnology ranks third ($73,515). Salaries in blood and organ banks, diagnostic imaging centers and medical labs range from $51,003 in diagnostic imaging centers to $44,354 in blood and organ banks.

Employment in the life sciences is a small fraction of total employment, accounting for less than 1 percent of all jobs in Georgia and the U.S., however, the fact that the relative size of life sciences industry increased in 2009 suggests resilience in the midst of economic crisis. Among individual life sciences industries in Georgia, medical and diagnostic labs, surgical appliances and supplies manufacturing, and blood and organ banks are closest to the national average in their relative share of jobs. Although the relative size of the life sciences industries statewide is smaller than the U.S. average, employment in biotechnology, diagnostic imaging centers, and medical and diagnostic laboratories in Athens, Macon, and Atlanta surpassed the national average in recent years.

Economic Impact

The life sciences industry is both a pillar of and a driver of the state's economy that translates into jobs, higher incomes, greater production of goods and services, and higher revenue collections for state and local government.

The statewide economic impacts of the life sciences industries in 2009 were:

- 17,926 jobs in life sciences companies;
- 75,077 jobs in all industries (including life sciences);
- $19.5 billion in output (sales);
- $7.5 billion in state GDP;
- $4.4 billion in labor income (earnings); and
- $496 million in tax revenues for state and local governments.

Table 1
The Life Sciences Industry in Georgia, 2009

	Establishments		Employment		Average Annual Pay	
	Number	2007-2009 Change	Number	2007-2009 Change	Amount ($)	2007-2009 Change
Pharmaceutical, medicine mfg.	53	8.2	3,135	-3.9	93,397	4.2
Electromedical apparatus mfg.	17	112.5	49	-79.8	90,537	44.5
Surgical, medical instrument mfg.	24	118.2	1,093	46.7	67,752	-4.6
Surgical appliance, supplies mfg.	62	17.0	2,250	-2.0	61,963	-3.8
R&D in biotechnology	126	23.5	1,709	-1.6	73,515	9.6
Medical laboratories	270	12.5	4,014	3.9	50,707	9.4
Diagnostic imaging centers	196	2.1	1,323	-5.4	51,003	2.6
Blood and organ banks	29	7.4	1,580	11.7	44,354	-1.2
Irradiation apparatus mfg.	9	28.6	NA	0.0	NA	0.0
Core life sciences industry total	786	14.1	15,153	1.3	64,509	3.0
Agricultural life sciences total	83	NA	2,773	NA	NA	NA

Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2011.

In addition, life sciences research at the state's colleges and universities generated the following impacts:

- 16,393 jobs (on- and off-campus);
- $1.8 billion in output (sales);
- $1 billion in state GDP;
- $754 million in income (earnings); and
- $68 million in tax revenues for state and local governments.

Also noteworthy, the Atlanta-based CDC generated:

- 7,551 jobs;
- 13,950 total jobs impact;
- $1.7 billion in output (sales);
- $1.4 billion in state GDP;
- $1 billion in income (earnings); and
- $63 million in tax revenues for state and local governments.

In total, the economic impact of life sciences on Georgia's economy in 2009 amounted to 35,043 direct jobs (0.8 percent of all jobs in Georgia); 105,420 total jobs (2.5 percent of all jobs in Georgia); $22.9 billion in output (sales); $9.9 billion in state GDP (2.5 percent of Georgia's GDP); $6.2 billion in income (earnings); and $627 million in tax revenues for state and local governments. On average, for every direct job created by the life sciences, an additional two jobs are created in other industries. So, one job out of every 40 in the state owes its existence to either the life sciences industry, or to life sciences research and development, or the presence of the CDC in Atlanta.

The economic impact of Georgia's life sciences industries is most easily understood in terms of its effects on employment. In 2009, Georgia's life sciences supported 75,077 full- and part-time jobs. Of the 2009 total employment impact, 17,926 jobs represent direct employment in life sciences industries or the direct economic impact; 57,151 jobs constitute the indirect and induced effect of direct employment (spending), or the multiplier (re-spending) impact. Dividing the 2009 total job impact (75,077 jobs) by the direct job impact (17,926 jobs) yields an average multiplier value of 4.2. On average, for every job created directly by life sciences industries, there are an additional 3.2 jobs that exist because of spending related to core life science industries. The high employment multiplier reflects both above-average salaries in many life sciences occupations as well as a relatively high degree of interaction between life sciences industries and the state's overall economy.

The core life sciences group of industries accounts for 66 percent of the total employment impact of life sciences industries, or 49,382 of the 75,077 jobs. Within the core group of life sciences industries, medical laboratories have the largest direct employment impact (4,014), but due to its very high employment multiplier (7.1), the pharmaceutical and medicine sector generates the largest total employment impact (22,107 jobs).

The agricultural life sciences group of industries accounts for 34 percent of the total employment impact, or 25,695 of the 75,077 jobs. Within this group, other basic organic chemical manufacturing has the largest direct employment impact, but due to high multiplier effects, other oilseed processing has the largest total economic impact.

In addition to the employment impacts of the life science industries themselves, academic research and development generates a substantial employment impact. In 2009, the direct and total employment impacts of life sciences academic research and development were 9,566 jobs and 16,393 jobs, respectively. The job multiplier for academic research and development is 1.7, which is considerably lower than the average multiplier of 4.2 for the state's life sciences industries, reflecting a lesser degree of interaction with the local economy (as well as lower salaries) than is true of life sciences industries as a whole.

Altogether, the total employment impact of the life sciences industries (75,077 jobs), academic research and development (16,393 jobs), and the CDC (13,950 jobs) equals 105,420 jobs, or 2.5 percent of total statewide employment in 2009. So Georgia's life sciences industries directly or indirectly accounted for 2.5 percent of the state's total employment (4.3 million jobs), or about one out of every 40 jobs.

Measured in the simplest and broadest possible terms, the total output impact of Georgia's life sciences industries was $19.5 billion in 2009, or 22 percent higher than the $16 billion impact estimated for 2007. Of the $19.5 billion output impact, $11.5 billion is direct spending by the companies that comprise the life sciences industries, while $8 billion represents the indirect and induced effects of re-spending or multiplier effect (i.e., the difference between output impact and direct spending). The average output multiplier is 1.69, obtained by dividing the total output impact ($19.5 billion) by direct spending ($11.5 billion). On average, therefore, every dollar of direct spending by life sciences companies generates an additional 69

Table 2
Employment Impact of Life Sciences Industries
on Georgia's Economy in 2009

Industry Sector	NAICS Code	Direct Employment (jobs)	Total Employment Impact (jobs)
Core Life Sciences Industries			
Pharmaceutical and medicine manufacturing	325400	3,135	22,107
Electromedical apparatus manufacturing	334510	49	168
Surgical and medical instrument manufacturing	339112	1,093	2,961
Surgical appliance and supplies manufacturing	339113	2,250	5,496
Research and development	541710	1,709	3,954
Medical laboratories	621511	4,014	8,528
Diagnostic imaging centers	621512	1,323	2,811
Blood and organ banks	621991	1,580	3,357
Total core industries		15,153	49,382
Agricultural Life Sciences Industries			
Wet corn milling	311221	0	0
Soybean processing	311222	194	3,836
Other oilseed processing	311223	316	6,249
Ethyl alcohol manufacturing	325193	241	1,437
Other basic organic chemical manufacturing	325199	820	4,890
Cellulosic organic fiber manufacturing	325221	107	318
Nitrogenous fertilizer manufacturing	325311	245	2,144
Phosphatic fertilizer manufacturing	325312	0	0
Fertilizer, mixing only	325314	256	2,240
Pesticide and other ag. chemicals	325320	594	4,581
Total agricultural life sciences industries		2,773	25,695
Grand total, life sciences industries		17,926	75,077

Notes:

The U.S. Bureau of Labor Statistics provided estimates of direct employment, but to preserve confidentiality, direct employment for soybean processing, other oilseed processing, ethyl alcohol manufacturing, and cellousic organic fiber manufacturing were not disclosed. The reported values for these industries were imputed by the Selig Center based on the number of establishments (which was disclosed), data disclosed at other levels of industrial aggregation, and national averages regarding employment per establishment.

Employment includes both full-time and part-time jobs. The Selig Center estimated total employment impacts using the IMPLAN V3 Software System, provided by the Minnesota IMPLAN Group. The region was defined as the state of Georgia.

Source: Selig Center for Economic Growth, Terry College of Business, University of Georgia.

cents for Georgia's economy. Thus, for all life sciences industries, the output impact is 1.69 times greater than initial direct spending. Output multipliers that exceed 1.5 are considered to be relatively strong: all of Georgia's life sciences industries have output multipliers that are 1.5 or higher.

The core life sciences industries generate an output impact of $10.2 billion, or 52 percent of the $19.5 billion total output impact. Pharmaceutical and medicine manufacturing accounts for a major portion—$6.1 billion, or 60 percent—of the output impact. Agricultural life sciences industries generate an output impact of $9.3 billion, or 48 percent of the total output impact. It's worth noting that Georgia is a leader in developments in specialized plant breeding and plant-based fuel products.

According to the National Science Foundation, direct spending for academic life sciences research and development was $853 million in FY 2009, which includes $38 million in expenditures in bioengineering/biomedical engineering. Academic R&D spending therefore generated a total output impact of $1.8 billion. The output multiplier was very strong—2.1. The total output impact of the Atlanta-based CDC was $1.7 billion in 2009, and the output multiplier also was a hefty 1.8.

In total, the output impact of the life science industries ($19.5 billion), academic research and development ($1.8 billion), and the CDC ($1.7 billion) was $22.9 billion, which is larger than the output impact generated by the University System of Georgia ($12.7 billion in 2009), but smaller than that of Georgia's forestry industry ($27.2 billion).

State GDP (value added) impacts exclude expenditures related to foreign and domestic trade. Consequently, they provide a much more accurate measure of the actual economic benefits flowing to businesses and households in Georgia than the more inclusive output impacts. In 2009, the state GDP impact for Georgia's life sciences industries was $7.5 billion. In addition to that amount, $853 million in academic spending for life sciences R&D generated $1 billion, and the CDC generated $1.4 billion in state GDP. Altogether, this amounted to $9.9 billion, or approximately 2.5 percent of Georgia's 2009 state GDP.

Georgia's life sciences industries generated $4.4 billion in labor income impacts in 2009, and life sciences academic research and development generated $754 million in labor income. In addition, the CDC contributed another $1 billion in labor income to the state's economy in 2009, and thus the three groups' combined economic impact on labor income was $6.2 billion.

The impact of Georgia's life sciences industries on tax collections by state and local governments was $496 million. In addition to this amount, life sciences academic research and development and the CDC generated tax collections of $68 million and $63 million, respectively.

The distribution of the employment impacts generated by core life sciences industries shows that the impacts are heavily concentrated in three sectors of Georgia's economy: services (67.3 percent); manufacturing (14.4 percent); and trade (13.2 percent) account for high percentages of the total employment impact attributable to life sciences' spending. Services (49.5 percent), trade (17.1 percent), manufacturing (12.5 percent) and TIPU (12.4 percent) primarily account for most of the total employment impact attributable to spending by agricultural life sciences companies.

Direct employment in the life sciences industries was essentially the same in 2009 as it was in 2007: 17,926 jobs in 2009 versus 17,941 jobs in 2007. On the surface, this finding may not be too encouraging, but retaining virtually all of the jobs is quite impressive given the heavy job losses experienced by most of the state's industries during the Great Recession. On an annual average basis, the state's total employment across all industries declined by 6 percent between 2007 and 2009. That's not to say that the economic activity in life sciences is recession proof—some industries within the life sciences group of companies shrank sharply, but as a group, life sciences industries were recession resistant.

Although direct employment held steady, the Selig Center's estimates show that direct spending associated with Georgia's life sciences companies increased substantially, climbing by 22 percent between 2007 and 2009. Since inflation was very modest during this period, Georgia's life sciences companies were producing substantially more without adding to their workforces. It also should be noted that shifts in the composition of industries that comprise the life sciences might have boosted the economic impact estimates.

Comparing the 2007 and 2009 total impact estimates shows that there were substantial increases in the overall economic impacts of life sciences companies whether measured in terms of employment, output, GDP, or labor income. For example, between 2007 and 2009, the total output impact of Georgia's life sciences companies rose by 22 percent. Similarly,

Table 3
Direct Spending, Output, State GDP, and Labor Income Impact of Life Sciences Industries on Georgia's Economy in 2009 (in 2009 dollars)

Industry Sector	Direct Spending	Total Output Impact	Total State GDP Impact	Total Labor Income Impact
Core Life Sciences Industries				
Pharmaceutical & medicine manufacturing	3,473,727,016	6,145,564,716	2,720,389,389	1,525,845,258
Electromedical apparatus manufacturing	24,376,808	41,630,078	18,443,103	11,322,679
Surgical & medical instrument manufacturing	350,396,096	594,204,100	320,375,592	184,555,865
Surgical appliance & supplies manufacturing	677,611,968	1,110,916,340	644,193,096	338,285,450
Research & development	233,885,872	498,359,889	280,410,600	212,398,615
Medical laboratories	539,856,320	1,070,688,421	625,558,153	417,123,185
Diagnostic imaging centers	177,934,704	352,895,068	206,181,730	137,482,309
Blood & organ banks	212,499,488	421,838,390	246,233,633	164,188,982
Total core industries	5,690,288,272	10,236,097,002	5,061,785,296	2,991,202,343
Agricultural Life Sciences Industries				
Wet corn milling	0	0	0	0
Soybean processing	895,297,600	1,417,794,630	325,664,270	187,800,455
Other oilseed processing	1,458,319,744	2,307,397,379	530,463,513	305,901,770
Ethyl alcohol manufacturing	378,991,552	560,886,487	148,590,773	86,853,553
Other basic organic chemical manufacturing	1,289,514,880	1,908,410,539	505,578,591	295,518,329
Cellulosic organic fiber manufacturing	66,110,384	97,323,460	28,231,038	18,735,714
Nitrogenous fertilizer manufacturing	408,578,176	713,549,093	202,964,312	112,055,064
Phosphatic fertilizer manufacturing	0	0	0	0
Fertilizer, mixing only	426,922,528	745,586,014	212,076,998	117,086,111
Pesticide & other ag. chemicals	915,374,656	1,519,551,243	489,119,464	254,374,363
Total agricultural life sciences industries	5,839,109,520	9,270,498,845	2,442,688,959	1,378,325,359
Grand total, life sciences industries	11,529,397,792	19,506,595,847	7,504,474,255	4,369,527,702

Notes: Impacts were estimated by the IMPLAN V3 Software System based on the estimates of direct employment reported in Table 2. The region was defined as the state of Georgia. Output refers to the value of total production (business sales or gross receipts) including domestic and foreign trade. State GDP, or value added, includes employee compensation, proprietary income, other property income, and indirect business taxes. Labor income includes both the total payroll costs (including fringe benefits) of workers who are paid by employers and payments received by self-employed individuals.

Source: Selig Center for Economic Growth, Terry College of Business, University of Georgia.

Table 4
Impact of Georgia's Life Sciences Industry on Tax Collections by State and Local Government in 2009 (in 2009 dollars)

Industry Sector	Total State and Local Tax Impact
Core Life Sciences Industries	
Pharmaceutical and medicine manufacturing	166,946,127
Electromedical apparatus manufacturing	1,172,197
Surgical and medical instrument manufacturing	17,672,860
Surgical appliance and supplies manufacturing	30,129,489
Research and development	17,364,725
Medical laboratories	36,317,238
Diagnostic imaging centers	11,970,032
Blood and organ banks	14,308,556
Total core industries	295,881,224
Agricultural Life Sciences Industries	
Wet corn milling	0
Soybean processing	29,204,544
Other oilseed processing	47,529,092
Ethyl alcohol manufacturing	12,854,168
Other basic organic chemical manufacturing	43,736,180
Cellulosic organic fiber manufacturing	1,928,759
Nitrogenous fertilizer manufacturing	15,522,654
Phosphatic fertilizer manufacturing	0
Fertilizer, mixing only	16,219,589
Pesticide and other ag. chemicals	33,159,894
Total agricultural life sciences industries	200,154,880
Grand total, life sciences industries	496,036,104

Notes: Tax impacts were estimated by the IMPLAN V3 Software System, based on the estimates of direct employment reported in Table 2. The region was defined as the state of Georgia.

Source: Selig Center for Economic Growth, Terry College of Business, University of Georgia.

Table 5
Economic Impact of Georgia's Core Life Sciences Industries
by Impacted Industry in 2009
(in 2009 dollars)

Impacted Industry Sector	Total Output Impact	Total Employment Impact	Distribution of Employment Impact (percent)
Agriculture	9,879,333	89	0.2
Mining	1,087,2444	0.0	
Construction	40,580,476	436	0.9
Manufacturing	4,724,164,940	7,135	14.4
Transportation, Information, Public Utilities	285,379,629	1,563	3.2
Trade	757,579,987	6,515	13.2
Services	4,353,429,653	33,224	67.3
Government	63,995,741	416	0.8
Total, All Industries	10,236,097,003	49,382	100.0

Notes: Excludes impacts generated by agricultural life sciences industries, which are reported in Table 6. Output refers to the value of total production (business sales or gross receipts) including domestic and foreign trade. Employment includes both full-time and part-time jobs.

Source: Selig Center for Economic Growth, Terry College of Business, University of Georgia.

Table 6
Economic Impact of Georgia's Agricultural Life Sciences Industries
by Impacted Industry in 2009
(in 2009 dollars)

Impacted Industry Sector	Total Output Impact	Total Employment Impact	Distribution of Employment Impact (percent)
Agriculture	101,588,297	1,309	5.1
Mining	4,884,787	14	0.1
Construction	43,133,158	468	1.8
Manufacturing	6,032,070,029	3,210	12.5
Transportation, Information, Public Utilities	750,534,980	3,194	12.4
Trade	601,449,021	4,386	17.1
Services	1,666,160,838	12,717	49.5
Government	70,677,734	397	1.5
Total, All Industries	9,270,498,844	25,695	100.0

Notes: See Table 5. Output and employment impacts were estimated by the IMPLAN V3 Software System..

Source: Selig Center for Economic Growth, Terry College of Business, University of Georgia.

Table 7
Economic Impacts of Life Sciences Academic R&D and the CDC on Georgia's Economy in 2009

Impacted Category	Economic Impacts R&D	CDC
Direct employment (jobs)	9,566	7,551
Total employment impact (jobs)	16,393	13,950
Direct spending ($ 2009)	852,603,000	900,569,216
Total output impact ($ 2009)	1,752,877,518	1,653,887,268
Total state GDP impact ($ 2009)	1,037,673,174	1,359,997,924
Total labor income impact ($ 2009)	754,089,555	1,048,556,335
Total state & local government tax impact ($ 2009)	67,790,972	63,119,138

Notes:
Direct spending for academic R&D obtained from Ronda Britt, Survey Manager, Higher Education R&D Survey, National Science Foundation. The total includes estimates for academic R&D expenditures in Life Sciences ($814,814,000) plus academic R&D expenditures in bioengineering/biomedical engineering ($37,789,000).

Direct employment for the CDC was estimated from information reported on the CDC's website. For 2009, the CDC reported a total of 10,488 government employees, of which 72 percent (7,551) are located at the Atlanta headquarters.

Employment includes both full-time and part-time jobs. Output refers to the value of total production (business sales or gross receipts) including domestic and foreign trade. State GDP, or value added, includes employee compensation, proprietary income, other property income, and indirect business taxes. Labor income includes both the total payroll costs (including fringe benefits) of workers who are paid by employers and payments received by self-employed individuals.

Source: Selig Center for Economic Growth, Terry College of Business, University of Georgia.

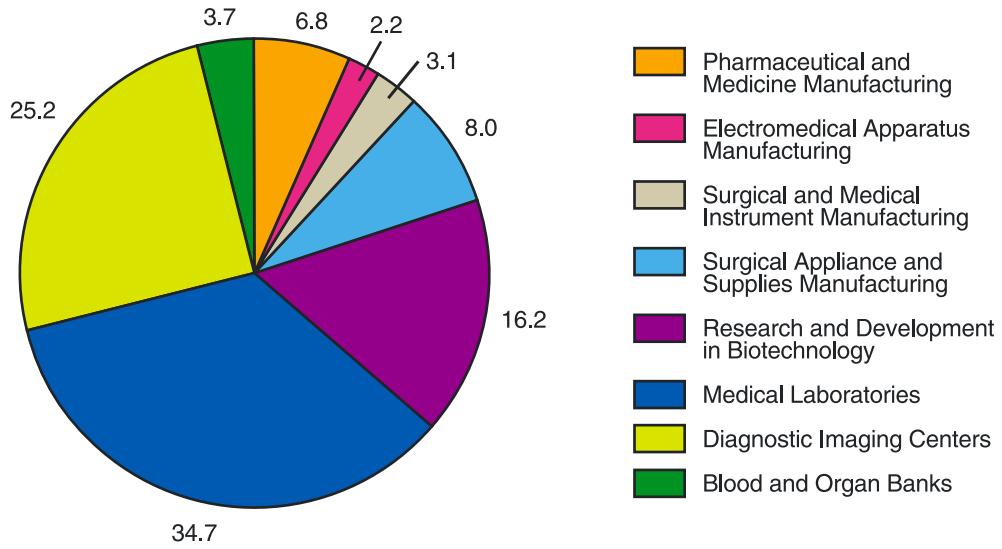
the economic impact measured in terms of Georgia's GDP was 21 percent higher in 2009 than in 2007. These benefits helped to offset some of the devastation wrought by the recession and helped to support Georgia's economic recovery.

Finally, the Selig Center's previous impact estimates for academic research and development—reported in the 2009 edition of *Shaping Infinity*—should not be compared directly to these new estimates because the earlier numbers exclude impacts from spending for bioengineering/biomedical engineering. After adjustment, it appears that total direct spending was about 18 percent higher in 2009 than it was in 2006; the employment impact was about 6 percent higher; the impact on output was about 28 percent higher; and the impact on GDP was about 24 percent higher. Life sciences academic R&D therefore was on an upswing though Georgia's overall economy was not.

2011 Survey Overview

Life sciences companies develop and manufacture drugs, diagnostics, medical devices, and biological substances, and provide related services to other companies or consumers. The areas of focus and product applications include, among others, human and animal health, environment, agriculture, and bioenergy.

Life Sciences Establishments by Industry, 2009
(percent)



Source: Based on U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2011.

Table 8
Life Sciences Companies by Industry and Primary Product, 2011

	Manufacturing	R&D	Biotechnology	Medical, Diagnostic Labs/ Blood, Organ Banks	Sales/ Services/ Other	Total
Pharmaceuticals/ biopharmaceuticals	28	12	15	1	11	67
Diagnostics	9	2	1	12	4	28
Biologics	9	2	8	0	1	30
Medical devices	40	6	7	2	13	68
Platform technology/ discovery	0	2	2	0	0	4
Industrial/environmental	6	0	1	0	4	11
Agricultural	10	2	2	1	1	16
Biofuel/bioenergy	5	0	1	0	1	7
General research technologies	1	4	1	0	1	7
Services/other	7	4	1	3	13	28

Based on 197 covered companies; 194 responses.

Medical and diagnostic laboratories comprise 60 percent of companies active in Georgia's life sciences industry, with biotechnology contributing 16.2 percent, medical devices and supplies manufacturers 13.3 percent, and pharmaceutical manufacturing firms providing 6.8 percent.

Pharmaceutical manufacturing firms (including biologics and diagnostics manufacturing), and medical devices manufacturing companies are the largest groups covered by the Georgia Life Sciences Industry Survey (46 and 40 companies, respectively). Biotechnology and life sciences R&D firms also are well represented (45 companies). Medical and diagnostic labs are covered, but relative to this group's size in Georgia, they are underrepresented.

For this analysis, the Selig Center for Economic Growth identified 319 life sciences companies in Georgia. Sixty-nine (21.6 percent) of the contacted companies responded to the survey. Data for 128 additional companies were obtained from publicly available sources.

Table 9
Life Sciences Companies in Georgia, by Location, 2011

Location	Number of Companies
Atlanta MSA	
Alpharetta	26
Atlanta	74
Buford	5
Decatur	3
Duluth	13
Kennesaw	11
Marietta	20
Norcross	23
Lawrenceville	6
Roswell	6
Suwanee	4
Tucker	5
Winder	4
Woodstock	4
Other	31
Albany	5
Athens	26
Augusta	15
Brunswick	1
Columbus	4
Dalton	1
Gainesville	5
Hinesville	1
Macon	5
Rome	1
Savannah	1
Valdosta	2
Other areas	16
Total	319

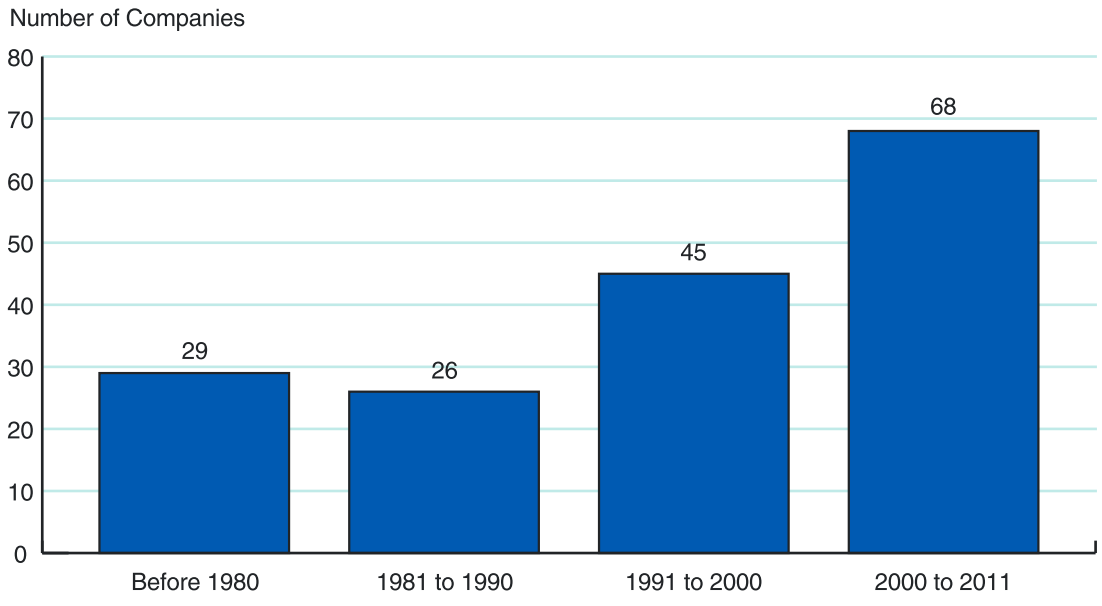
Atlanta (specifically Marietta and Alpharetta) is the prime location for pharmaceutical firms, but some are located in Athens, too. Athens and Atlanta are also favored by many biotechnology and bioinformatics companies. Medical devices and health IT firms tend to locate in metro Atlanta, specifically in Alpharetta, Norcross, and Kennesaw, while life sciences companies specializing in industrial and environmental applications tend to cluster in Norcross. Augusta is home for diagnostic firms, with smaller clusters present in Atlanta and Alpharetta. Athens and Augusta have the largest concentration of agricultural life sciences firms. Not surprisingly, biofuels companies are located in non-metro areas around Albany, Camilla, Dublin, and Waycross.

The largest group of covered companies (68 companies, 40 percent) was founded in the last decade, but the pace of company formation slowed down in 2009 and 2010. In fact, the number of companies founded within the last two years was the lowest since 1995. Data show that 2001 and 2008 were the peak years for life science companies founding (with 11 and 10 companies created, respectively). Within the group of 69 responding companies, 30 have been active for over 10 years. Most of the respondents (42 companies, or 71 percent) said their firms had reached the growth/development stage, while 28 percent (17 companies) were classified as startups. One company reported plans to quit altogether, however.

Over 80 percent of respondents said their company was founded in Georgia, with Atlanta, Alpharetta, Norcross, Marietta, and Athens topping the list for company headquarters. The rest were founded in other states, especially New Jersey, California, New York, Pennsylvania, Minnesota, and Illinois. Three of the surveyed companies were headquartered in Germany.

In 2010, Georgia had a larger share of food scientists, microbiologists, and epidemiologists within its workforce than the U.S. average. Among Georgia's MSAs, Athens boasts almost four times the national average of life sciences professionals in its labor force. Within individual occupations, Atlanta has more microbiologists, but Albany, Savannah, Augusta, and Brunswick have more environmental scientists. Augusta also has a relatively large group of chemical technicians. The share of biological technicians in Gainesville is over three times the national average.

Georgia's Life Sciences Companies by Year of Founding



Based on 197 covered companies; 168 responses.

In terms of numbers, Georgia is the sixth most popular for microbiologists, whose median salary ranks third in the country. Georgia's group of epidemiologists ranks ninth in size among the states. Among life sciences occupations in the state, biochemists, microbiologists, and hydrologists report the highest median annual salaries, which in turn are among the highest in the country (rank 1,3, 4, respectively, among states for which data are available).

Government institutions are the largest employer of life scientists, followed by life sciences R&D firms, and colleges and universities. Life scientists also work in pharmaceutical manufacturing, hospitals, engineering, and testing services.

Table 10
Life Sciences Professionals in Georgia's Labor Force, 2010

	Estimated Total Employment*	Median Annual Salary ($)	Location Quotient**
Food scientists and technologists	380	46,800	1.225
Soil and plant scientists	90	57,420	0.262
Biochemists and biophysicists	120	97,020	0.178
Microbiologists	640	81,480	1.185
Biological scientists, all other	670	67,990	0.748
Conservation scientists	210	57,610	0.377
Foresters	250	54,230	0.886
Epidemiologists	150	56,670	1.052
Medical scientists, except epidemiologists	680	63,760	0.247
Life scientists, all other	40	81,800	0.132
Chemists	1,440	70,350	0.609
Environmental scientists, specialists, incl. health	1,590	49,640	0.658
Hydrologists	90	88,350	0.423
Agricultural and food science technicians	340	29,660	0.685
Biological technicians	2,150	40,420	0.998
Chemical technicians	1,280	41,220	0.733
Environmental science, protection technicians, incl. health	520	40,370	0.616
Forensic science technicians	170	41,770	0.462
Forest and conservation technicians	270	39,650	0.287

*Rounded to the nearest 10 (excludes self-employed).

**National rate=1. Location quotient of 2.0 indicatees that an occupation accounts for twice the share of employment in the area than it does nationally, and a location quotient of 0.5 indicates that the area's share of employment is half the national share.

Source: U.S. Department of Labor, Bureau of Labor Statistics, May 2010 State Occupational Employment and Wage Estimates.

Trends in Employment and Occupations

Georgia's life sciences industry is a varied field of companies that range from manufacturing plants employing more than a thousand workers to small start-up firms with a very small staff. The 2011 survey group of covered companies includes a mix of small ones—with fewer than 10 employees—that comprise the core of the industry (29 percent) together with larger firms (with between 21 and 50 staffers) that make up 28 percent of the total. Close to 11 percent of companies hire more than 100 employees, including nine that had more than 250 staffers.

Although most respondents do not anticipate any employment changes in 2011, only a couple of firms anticipate cutting jobs. Responding companies that expect to add jobs indicate they will hire Ph.D. and M.S. level scientists (32 new positions). But manufacturing workers will see the largest number of new jobs (55). Two companies plan to reduce the number of scientists and manufacturing workers on their payroll, however. The largest number of new jobs will be added in biotechnology and other life sciences R&D firms. Broken out by product, the largest increase in employment is anticipated in pharmaceutical and medical devices firms, followed by employment increases in industrial, agricultural, and biofuels/bioenergy firms.

Finding and hiring skilled technicians and specialized managers was singled out as the most important labor force factor impacting the operations of life sciences companies in Georgia. While the availability of skilled technicians was generally considered a strongpoint in Georgia, opinion was split on the availability of specialized managers in the state.

The availability of skilled researchers, on the other hand, is considered very important or critical to the operations of nearly 60 percent of the responding companies, and most saw this as either a strongpoint or an issue of no concern in Georgia. In fact, the availability of researchers received the smallest number of negative responses, and should be considered a bright star in the life sciences industry labor force in the state.

Life sciences companies tend to locate in metropolitan areas, close to academic research institutions, whose strength is

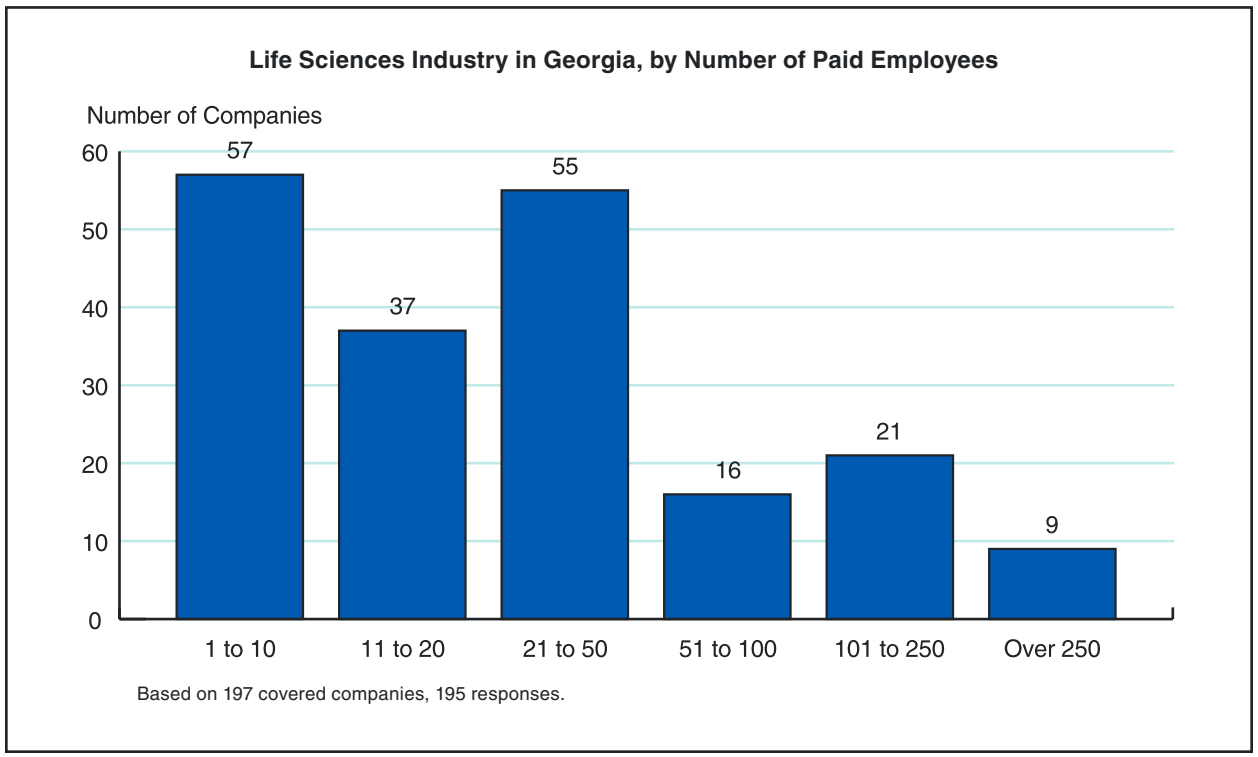


Table 11
Anticipated Number of New Hires, 2011

	Number of Jobs
Manufacturing workers	55
Sales/marketing	52
Office support	35
Bench technologists	34
Ph.D./M.S. scientists	32
Senior management	26
Management	21
Regulatory/legal	17
Other	16
Total	288

Based on 50 responses to the 2011 Survey.

pivotal for R&D. The number of life sciences degrees granted, levels of funding, and the number of patents are some of the most relevant measures.

The relative share of life sciences master's and doctoral degrees granted by Georgia's colleges and universities is higher than the U.S. average. In the case of life sciences doctorates, that share is larger than in both the U.S. as a whole, and the Southeast (higher by 4.3 percent and 4.5 percent, respectively).

Within individual disciplines, the proportion of bachelor's degrees granted in biological and biomedical sciences exceeds the U.S. and the Southeast averages. The share of associate's degrees granted in agriculture is also slightly higher than both the U.S. and the Southeast averages.

Among R&D inputs, academic R&D expenditures per $1,000 of GDP exceed the national average, while federal, state, and business funded research expenditures per individuals employed in science and engineering occupations fall below. Venture capital investment as well as academic patents awarded per 1,000 science and engineering doctorate holders in academia also fall below the national average.

Among the companies covered by the survey, 11 percent (21 companies) reported R&D as their primary industry, but another 35 companies identified it as their secondary industry. Close to 30 percent (56 companies) of the 197 companies covered by the survey are involved in research and development. Respondents to the 2011 survey, who are active in life sciences research, rated Georgia's business appeal as average, giving it a grade of 3.1 on a 5-point scale.

The survey also shows that infrastructure, availability of skilled technicians, and proximity to academic institutions are crucial factors in the operations of life sciences companies. The proximity to academic institutions was considered a definite strength in Georgia by most of the executives, and none considered it a weakness. The access to capital and government incentives, infrastructure, skilled manufacturing labor, and the state's image, however, rated poorly and received the largest number of negative votes.

Life sciences companies most often depend on universities for the use of university facilities, contract research, and licensing/patents, so it is no surprise that among 69 responding companies, 40 reported university affiliations. The University of Georgia and the Georgia Institute of Technology have ties to 11 responding companies each, followed by Emory University, Georgia Health Sciences University, Georgia State University, Mercer University, and Abraham Baldwin Agricultural College. Respondents also reported cooperation with 11 out-of-state institutions.

Table 12
Degrees Granted in Life Sciences, by Field, in Georgia, 2008-2009

	Total Life Sciences	Agriculture	Natural Resources/ Conservation	Biological/ Biomedical Sciences	Health/ Related Clinical Sciences
Associate	3,145	104	34	---	3,007
Bachelor's	5,348	245	129	2,085	2,889
Master's	1,988	70	59	221	1,638
Doctor's	371	19	14	172	166
			Life Sciences Degrees (Percent of Total Degrees)		
Georgia					
Associate	21.9	0.7	0.2	0.0	20.9
Bachelor's	13.2	0.6	0.3	5.2	7.1
Master's	13.2	0.5	0.4	1.5	10.9
Doctor's	33.7	1.7	1.3	15.6	15.1
United States					
Associate	22.0	0.6	0.2	0.3	21.0
Bachelor's	14.1	0.9	0.6	5.0	7.5
Master's	11.7	0.3	0.4	1.5	9.5
Doctor's	29.3	1.1	1.0	11.3	15.9
Southeast					
Associate	24.1	0.4	0.1	0.1	23.5
Bachelor's	14.7	1.0	0.5	5.0	8.2
Master's	13.5	0.5	0.4	1.6	11.0
Doctor's	32.1	1.8	1.1	11.1	18.1

Source: National Center for Education Statistics, 2008-2009.

Table 13
Labor Force Availability in Georgia, 2011
(number of responses)

	Importance to Operations					
Availability	Critical	% Valid Response	Moderate	% Valid Response	Not Important	% Valid Response
Researchers	37	59.7	25	40.3	0	0.0
Technicians	45	72.6	17	27.4	0	0.0
Managers	42	66.7	20	31.7	1	1.6
Manufacturing labor	25	39.7	24	38.1	14	22.2

	Weakness or Strength in Georgia			
	Weakness	% Valid Response	Strength	% Valid Response
Researchers	8	21.1	22	19.3
Technicians	10	14.3	17	39.3
Managers	12	17.9	11	30.4
Manufacturing labor	14	26.4	8	15.1

Based on 65 valid responses to the 2011 Survey.

Table 14
University Affiliations of Life Sciences Companies in Georgia, 2011

	Number of Companies	Type of Cooperation
The University of Georgia	11	Facilities, license/patents, contract research
Georgia Institute of Technology	11	Facilities, license/patents, commercialization
Emory University	8	License/patents, contract research
Georgia Health Sciences University	3	Contract research, facilities
Georgia State University	2	Facilities
Mercer University	2	Contract research
Abraham Baldwin Agricultural College	1	Other
Out of state	11	Contract research, facilities, commercialization

Source: Based on 67 responses to the 2011 Survey.

(continued on page 30)

Industry Insight

Special Articles Contributed by University and Industry Leaders

Location Georgia: A Competitive Advantage for Bioscience

Chris Cummiskey
Commissioner
Georgia Department of Economic Development

Georgia's commitment to growing its biosciences industry has never been stronger. The Georgia Department of Economic Development has worked hard to raise Georgia's banner as the crossroads of global health, and in response an increasing number of companies are knocking on our door to find out more about the assets we offer for the biosciences.

Over the last five years we've welcomed companies involved in drug discovery, clinical trials, drug testing, and manufacturing to the state. Exciting discoveries are coming out of our research universities and seeing full-fledged commercialization. And we're attracting some of the world's top scientific talent.

All of this is no accident. Once they weigh our advantages against cost, companies realize that there's nowhere else in the country where they can be as successful. High-value companies recognize high value when they see it, and we take care to make sure Georgia's value is highly visible.

The outstanding assets we offer to biosciences companies make our job easy. We recognize that these companies thrive when they can tap into an existing network of resources. The Georgia Research Alliance (GRA), the Georgia Center of Innovation for Life Sciences, Georgia Bio and the Georgia Cancer Coalition are just a few of the organizations that partner to connect companies to research, expertise, funding and facilities.

In fact, partnership in Georgia is not just a buzzword. Business-focused partnerships are part and parcel of the communities of Augusta and of the Innovation Crescent, a 13-county region from Atlanta to Augusta dedicated to grow-

ing its biosciences sector. It's also endemic among our universities, which have formed numerous collaborations, often including companies, to further discovery and commercialization.

Workforce is a top priority for the industry, and biosciences companies in Georgia are assured of a steady supply of talented workers emerging from our GRA research universities: Georgia Institute of Technology, The University of Georgia, Emory University, Georgia State University, Clark Atlanta University, and Georgia Health Sciences University. Workers can also receive free training from our innovative, award-winning program Georgia Quick Start, which has developed and implemented customized training plans for companies like Quintiles, UCB, and Dendreon.

Georgia also offers logistics advantages no other state can provide. As the hub of the Southeast, the fastest-growing region of the nation, we provide direct access to points around the world through our ports and Hartsfield-Jackson Atlanta International Airport, facilitating products with a short shelf life. These portals have large cold storage facilities and vast experience in handling healthcare products.

The state has enhanced its environment for the biosciences with targeted financial resources such as the GRA Venture Fund, R&D tax credit, and Quality Jobs tax credit. Georgia also has a business-friendly six percent corporate income tax rate and a Single Factor Gross Receipts apportionment formula.

We have a very healthy existing biosciences community—a rich mix of pharmaceutical, medical devices, diagnostic and medical supply companies; emerging biosciences companies; contract laboratory, preclinical and clinical research organizations; world-class public and private institutions and universities; and a thriving healthcare IT sector. Included in this community are the headquarters of world-renowned organizations like the American Cancer Society, Carter Center, Arthritis Foundation, and CARE. The U.S. Centers for Disease Control and Prevention (CDC) is also in Georgia.

Understanding that companies can choose to locate or expand anywhere in the world, Governor Nathan Deal has charged us to maintain and grow Georgia's competitive edge. To that end, the Department of Economic Development is partnering with the Georgia Chamber of Commerce to consider the current and future needs of various industry sectors, including health care and technology.

This comprehensive program, called the Georgia Competitiveness Initiative, focuses on certain strategic issues that affect industry: infrastructure, innovation, education and workforce development, business climate, trade, and government efficiency. We are engaging communities and companies around the state in this process, and its long-range outcome will ensure Georgia continues to be the best choice for biosciences.

Industry Insight

Arbor Pharmaceuticals Improving Lives by Advancing Medicine

Ed Schutter, RPh, MBA
President and CEO
Arbor Pharmaceuticals, Inc.

The leaders and management of Arbor Pharmaceuticals have a long-standing history of building companies in the life sciences industry—all based in Atlanta, Georgia. Many of the members of our team formerly worked for companies like Sciele or Solvay Pharmaceuticals—helping to build them from $100 million to $500 million or over $1 billion, respectively. Both of these companies have since been acquired and their new owners (Shionogi and Abbott) no longer maintain corporate offices in Atlanta. The Arbor Board is comprised of several Directors who have founded, created and led pharmaceutical companies ranging in value from several hundred millions to over $8 billion in market value. Thus, we are composed of individuals who have a wealth of experience in all facets of the industry, and we share a common goal of building the largest private pharmaceutical company in the United States—while keeping our organization based in Atlanta. Our vision also includes partnering with the local discovery centers and universities on selected projects, to keep many of these innovations and their future impact on the economy here in Georgia.

Arbor Pharmaceuticals was originally started in Raleigh, North Carolina and was acquired by the current owners in April 2010. The company moved to Atlanta in November of last year. At the time of acquisition, the company had twelve employees and was generating less than $3 million in annual revenue. We have now grown to over 150 employees, own or

are currently the U.S. agent for 11 NDAs or ANDAs and expect to reach $120 million in sales in 2011. We also have three products in late-stage clinical development and have recently filed our first NDA (new drug application) with the FDA. Arbor's marketed and pipeline prescription products are focused in the areas of pediatrics, cardiovascular, respiratory and acute care. Our intention is to add more products in these core areas, while remaining opportunistic to other specialty areas. The diversification of our portfolio will serve to fuel our growth while mitigating our risk.

Currently, Arbor's goal is to acquire marketed prescription products, while successfully bringing our development-stage products to the market. As everyone in our industry knows, the cost to bring a new prescription product "from bench to bedside" averages several hundred million dollars or more, so it is imperative that we raise our level of annual revenue to fund our product development. Thus, our initial focus is on acquiring additional marketed assets. When we do acquire or in-license development assets, we have to be very selective, making sure that they have a high chance of success and an affordable pathway to market. This has led us to focus primarily on 505(b)(2) type NDA applications or new chemical entities (NCEs) that have been previously approved and marketed outside the U.S. As we grow our revenue, we will also grow our ability to take on selective development of riskier and potentially more rewarding projects.

Arbor's goal of becoming the largest private pharmaceutical company in the U.S. is quite ambitious. To achieve this, we will one day have to exceed several billion dollars in sales. Keeping this lofty objective in mind is what drives our daily sense of urgency: to achieve our sales targets, keep our development projects on a condensed timeline, find new and exciting opportunities and improve lives by bringing innovative medicines to the market. The entire Arbor organization is proud of our accomplishments, of the products that we currently market, and the projects that we have in development. I am personally very proud of our team and confident that they have the experience, talent, and desire to achieve our collective goal.

Industry Insight

Committed to Building the Knowledge Economy

Michael F. Adams, Ph.D.
President
The University of Georgia

The state of Georgia is poised for an unprecedented economic boom based on the health sciences and the attendant research and development that develop in those areas. But like all good things, claiming that advantage will take hard work and commitment to a shared vision.

Collaboration to address needs and cooperation to work toward common goals—that is what is needed if Georgia is to succeed. The medical partnership that opened this year between the University of Georgia and the Georgia Health Sciences University (formerly the Medical College of Georgia) is a small-scale example of what can—indeed, must—happen if Georgia is to capitalize on the potential that exists here.

About five years ago, the leadership at MCG and UGA discussed the need for the University System of Georgia to produce more physicians to meet this state's critical need for access to health care. We committed to a plan that could address that need: a medical campus in Athens under the auspices of UGA and GHSU. In the fall of 2010, the first 40 medical students enrolled in the partnership, and in the fall of 2012 we will occupy the former Navy Supply Corps School in Athens and begin developing a full-scale Health Sciences Campus.

I am optimistic because this state has almost all the elements of those areas around the country that were leading the way economically before the downturn and have fared better than the rest of the country during it—such areas as Route 128 in Boston; Austin, Texas; Silicon Valley; and the Research Triangle in North Carolina. We have major research universities, a strong regional university component and the intellectual capital they bring. We have access to transportation. We have a strong technical college presence. We have an educated populace.

What we have lacked, historically, and what we need today is a vision at the state level that supports the economic activity of what Willis Potts, former chair of the Board of Regents, calls the Concept Age and what I like to call the Knowledge Age. The Research Triangle was not an accident—it grew out of an intentional strategy hatched in the 1950s.

Georgia stands on the cusp of creating that kind of strategy, and reaping the rewards, right here, right now. What will that take? It's simple to express, but more difficult to put into action: unanimous commitment to an economic development strategy. Unless all the players involved, unless all the constituencies represented, unless all the agencies involved can come to substantive agreement on a plan to attract the kind of business, industry and jobs we say we want, we will remain where we are.

At UGA, we stand ready to offer whatever we have for the good of this cause. In fact, much is already in place—the medical partnership; engineering programs; a greater focus on graduate and professional education; the Georgia BioBusiness Center, the Applied Genetic Technology Center and other knowledge-based business applications; and a dedicated economic development effort.

Community-based economic development plus technology-based economic development creates a better place for everyone to live. UGA provides all the necessary functions to assist communities to become vibrant. I believe that in decades to come, this period of academic expansion at the University of Georgia will be seen as a critical element of a boom in economic development. This state can ride the wave of the knowledge economy—if it chooses to do so.

But that kind of success—the success of the Research Triangle, of Silicon Valley, of Boston, and Austin—does not happen by accident. There were conscious decisions in those areas decades ago to capitalize on the nexus of intellectual prowess amassed on the campuses in those areas.

I believe with our current leadership at the state level, in the private sector as represented by Georgia Bio and the universities' ongoing commitment to supporting this type of economic development, Georgia has the potential to do something extraordinary in the coming decade and transform this economy.

Industry Insight

Georgia Health Sciences University's Competitive Edge: Collaboration

Ricardo Azziz, M.D., MPH, MBA
President and CEO
Georgia Health Sciences University and
Georgia Health Sciences Health System

No industry has escaped the long reach of the current economic downturn: certainly not education; certainly not the discovery and innovation sector; and certainly not health care. For Georgia Health Sciences University, an academic health center with a tripartite mission involving health professions and biomedical education, scientific discovery, and clinical care, the prevailing economy and its concomitant challenges represent a triple threat. But as once-stable revenue streams continue to dwindle and demands on higher education, industry, and the public sector rise, new growth opportunities emerge.

How is Georgia Health Sciences University taking advantage of these opportunities? We have quickly adapted to change. We are altering outdated and insular silo-based approaches to problem solving. Plus, we are harnessing the power of collaboration. It is these imperatives that stand at the heart of Georgia Health Sciences University's transformation into a thriving and horizontally and vertically integrated academic health center, one of only two such resources in the state of Georgia—a transformation that was heralded by changing the names of our university and our health system to reflect the true scope of our organizational reach.

GSHU is much more than a university. We are also a large corporation and economic engine. And while the Georgia Health Sciences Health System is a separate corporate entity, both our health system and our university are advanced by an integrated leadership team with a shared vision for the future. That vision involves becoming a globally recognized research university and academic health center, while transforming the region into a health care and biomedical research destination.

We are doing this by building bridges within and beyond the walls of our enterprise, robust collaborations focused on

synergizing and ensuring competitiveness in new and innovative ways. For example, our research collaboration with the Savannah River National Laboratory resulted in the development of a novel approach for drug delivery, porous-walled hollow glass microspheres, which recently received a prestigious R&D100 award from *R&D Magazine*. In addition, our development of regional campuses in Albany, Savannah/Brunswick, Rome, and Athens has significantly extended the reach of our educational programs but is also providing a network of partner organizations that can be leveraged to create more opportunities for clinical trials and biomedical research collaborations.

GHSU is engaged close to home, collaborating with fellow research universities across the state, such as Georgia Tech, Georgia State, and the University of Georgia, but we are also engaged globally as well, working, for example, on collaborative cancer research programs in Peru through our CerviCusco project and in Nigeria through a partnership with the World Health Organization.

Even within our own walls, we are driving collaboration, most notably through our Discovery Institutes initiative, a multi-million dollar program to speed the process of turning research breakthroughs into medical treatments. At present, GHSU is home to six institutes—Brain and Behavior, Cardiovascular, Diabetes and Obesity, Child Health, Immunotherapy, Education, and Vision Science—that operate under a formal structure that encourages researchers and clinicians to collaborate on translational research. Launched in 2008, the initiative is yielding impressive results in gains in research funding and in the generation of important discoveries focused on the illnesses and diseases that negatively impact the quality of life of Georgians and other citizens of the world.

These internal and external collaborations better position GHSU to compete for research funding. For example, GHSU has moved to the top ten in funding from the American Heart Association. Additionally, GHSU researchers received two National Institutes of Health Program Project grants this year totaling approximately $20 million in new funding for cardiovascular research. This increased funding results in more jobs. According to a recent report by noted economist Dr. Everett Ehrlich, National Institutes of Health funding in 2010 led to the creation of nearly 500,000 jobs nationwide (12,576 of those in Georgia) and produced more than $68 billion in new economic activity across the country.

At present, GHSU has an overall $2.1 billion direct annual economic impact on the Georgia economy. When the downstream impact of our workforce, industry, and affiliated providers is factored in, GHSU's economic impact on the state of Georgia exceeds $8 billion annually. But we are not resting on our laurels. We have our organizational sights set on doubling our research funding and increasing our direct annual economic impact to $3 billion, while continuing to produce well educated and highly trained health professionals and biomedical scientists to meet prevailing and emerging health care challenges.

GHSU's mission—leading Georgia and the world to better health—specifically refers to our efforts to improve the health status and quality of life of the people we serve. But GHSU also leads Georgia and the world to better economic health, building a stronger state for future generations. While others speak of managing change, GHSU is focused on leading transformation.

Industry Insight

Georgia's Centers of Innovation Support Bioscience's Role in the State's Economy

Stacy Williams Shuker
Director
Georgia Center of Innovation - Life Sciences

The Georgia Centers of Innovation (COI) are a critical part of the state's economic development strategy. They are designed to accelerate the growth of technology-based companies and cover the six strategic industries identified by the Commission for a New Georgia. The six Centers of Innovation are: agribusiness, aerospace, energy, life sciences, logistics, and manufacturing.

Under Governor Nathan Deal, the Centers have been integrated with the Georgia Research Alliance (GRA) in order to maximize and streamline their impact on business growth in the state. Both programs are housed in the Georgia Department of Economic Development. The Centers of Innovation program is also strengthened by its affiliation with the One-Georgia Authority and the entire University System of Georgia, including research universities and technical colleges. Each center is hosted by a university or technical college to further leverage the relationship between Georgia's academic and industry partners.

Each center provides statewide strategic industry expertise by serving as a comprehensive source of information about its area of focus. Tangible services include providing access for businesses to university-level research and development; product commercialization; industry-specific business counsel; significant networking opportunities; and connecting clients to potential investor networks. While many of the core services are similar in concept throughout the entire program, each center brings specialty services, including industry specific contacts and knowledge, to the table.

The COI program provides a vital piece to a wide array of services already provided through GDEcD. Its small business resources and services offer the direct assistance needed for businesses to succeed. The Centers of Innovation are also close partners with GDEcD's industry recruitment and expansion division. Visit *www.georgiainnovation.org* to learn more.

The Center of Innovation for Life Sciences (COI-LS) directly serves Georgia's life sciences industry through access to expertise and resources. It also serves as a connecting resource for the wide array of experts who are vital to bringing a life science innovation to market. As the COI-LS moves to its new home at Georgia State University, it continues to reach across the state's vast network of life sciences infrastructure hosted in our university system to provide industry access to cutting-edge resources and expertise.

However, all of the Georgia Centers of Innovation have interests that overlap with Georgia's life sciences industry. As Georgia Bio's mission has evolved to mirror BIO International's mission to heal, fuel and feed the world, the Centers for Agribusiness, Energy, and Manufacturing certainly find a home in our community devoted to biotech products and medical devices. Our Centers for Logistics and Aerospace are also a part of the biosciences industry from a biofuels and cold chain logistics perspective.

The COI-LS will continue to administer the Georgia Life Sciences Team-Up Network, a virtual community of professionals in the Georgia life sciences industry who advance product development, support company creation, announce employment opportunities, and solve problems. Participants with backgrounds in science, business, law, regulation, marketing, manufacturing or logistics are welcome to join and contribute. The GLS Team-Up Network also hosts the most comprehensive calendar in the state for life sciences and health IT-related events. Visit *www.team-up.ning.com* to become part of this growing statewide community.

(Continued from page 17)

Companies and Products

Among R&D firms covered by the survey, the largest group produced pharmaceuticals and biopharmaceuticals. The two second-largest groups produced medical devices, platform technology, and general research technology. Among biotechnology firms, pharmaceuticals and biopharmaceuticals were the most common products, followed by biologics, and medical devices.

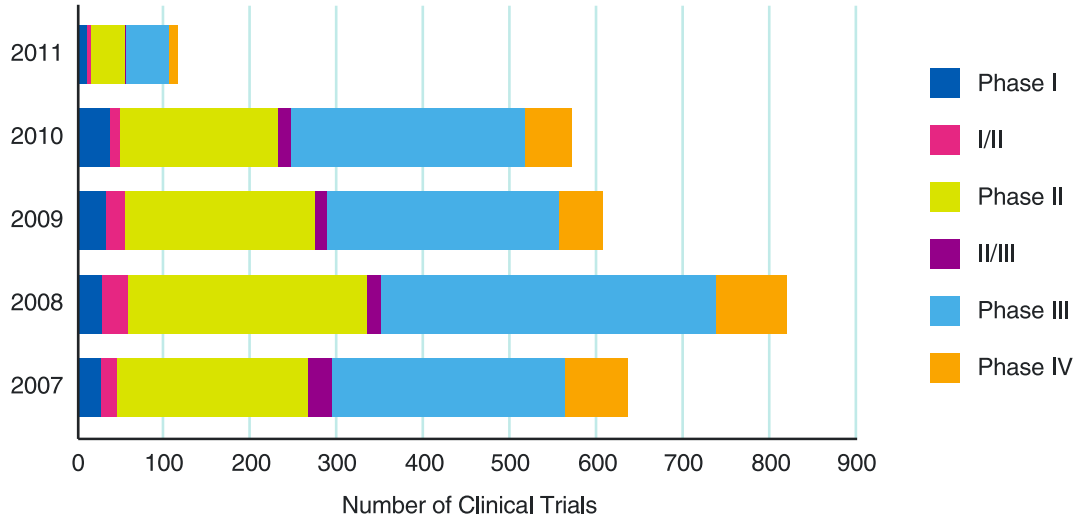
With a large group of Georgia's R&D and biotechnology firms involved in the development of therapeutic products, clinical trials play an important role in the life sciences industry in the state. In 2011, there are a total of 1,382 clinical trials active in Georgia. (Georgia ranks 10 in population, but 14 in the number of clinical trials.) When counted by the year received, however, Georgia landed a peak of 910 clinical trials in 2008, but the number subsequently dropped to 726 in 2009, and to 663 in 2010.

In all, the 2011 survey respondents have 259 products under development or pending approval, 179 of which require FDA approval. Fortunately, the product pipeline headed to the FDA is fairly well stocked, with a high number of products in the earliest stages of development. Only a fraction of products in R&D eventually make it into pre-clinical and clinical trials, however. Survey respondents also reported that 178 products are on the market.

Among respondents to the survey, 23 companies rated Georgia's R&D appeal as "average," but 14 others felt it was "appealing," and nine called it "very appealing." Two companies rated Georgia as not appealing to R&D companies, and 11 companies said it had little appeal. Overall, Georgia's R&D appeal was rated slightly above average on the scale from 1 to 5. Executives of companies active in life sciences R&D gave Georgia an average grade, however, which mirrors the National Science Foundation findings that Georgia has great universities and researchers, but is weaker in the R&D business environment.

Of the 94 firms that declared manufacturing as their primary industry, medical devices were declared most often as the primary product. Pharmaceuticals were the second largest group, followed by agricultural products, diagnostics, and biologics.

Nine of the manufacturing firms declared R&D as their secondary industry, and seven were also involved in biotechnology. Out of the manufacturing R&D firms, medical devices



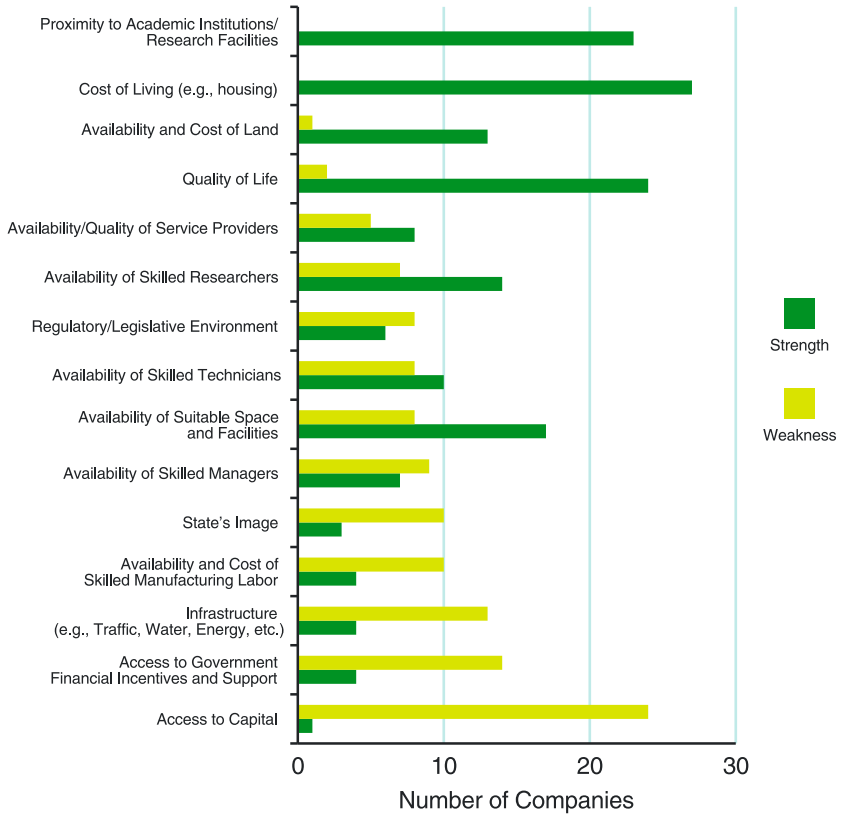
Source: Based on U.S. National Institutes of Health, Clinical Trials Database.

Table 15
Products By Stage of Development

Subject to FDA Approval		Other Products	
R&D	86	R&D	69
Preclinical	29	In approval process	11
IND	13	In development	80
Phase I	21	Marketed	75
Phase II	20		
Phase III	10		
In development	179		
Marketed	103		

Based on 69 responding companies.

Strengths and Weaknesses of Georgia's Business Environment for Compnies Active in R&D and Biotechnology



Source: Based on 69 responding companies, 28 responses.

production was most common, but diagnostics, biologics and pharmaceuticals were also mentioned. Among biotech manufacturing firms, diagnostics, biologics, agricultural products and biofuels were the main products.

Medical devices manufacturing firms covered by the survey tend to be younger than pharmaceutical manufacturing firms, with most founded after 2000. The majority of manufacturing plants employ from 21 to 50 workers. Fifteen have labor forces of 101-250 employees, and six have more than 250 employees.

Sixty-three percent (53 firms) of Georgia's life sciences manufacturing firms report less than $10 million in Georgia-generated revenues. In general, pharmaceutical firms did the best, and more of them report revenues of $500 million or more.

Availability of skilled technicians, managers, and manufacturing labor were the most important factors for the manufacturing companies in Georgia. More respondents considered all of these factors a weakness in Georgia, but in total, most were neutral on this issue. The availability and cost of land, proximity to academic institutions and research facilities, and suitable space and facilities were considered strengths of Georgia's business environment. Manufacturers, however, gave Georgia's business environment an average grade.

Funding

Twenty-six of the 197 covered companies are publicly traded. Overall, the distribution of companies according to their Georgia-generated revenues remained fairly constant since 2006, with about 72 percent of companies, for which data was available, falling within the lowest range of $10 million or less. In terms of income, 26 of the 52 responding companies operated at a loss. But most of those that did generate income said they made between $1 million and $5 million.

The operations of life sciences firms whose new products require FDA approval differ from other companies in terms of high development costs and a lengthy approval process. Since this entire process takes an average of 15 years before the product hits the market, access to capital is a major obstacle. This is true especially for young companies with no marketed products. Since so many companies are both young, and are involved in pharmaceutical research and development, the financing challenge is even more pronounced.

Gleaned from 40 responses, the surveyed companies reported that they raised a total of $1.1 billion since their inception. The largest sum, $911 million, was raised by life sciences R&D companies (including biotechnology). Broken out by product, pharmaceutical, biologics, and diagnostic firms raised the most capital ($632.6 million). Medical devices firms also raised a hefty $449.6 million. Platform technology and general research technology firms raised $23.7 million, while industrial, agricultural and biofuels firms raised $4.1 million. Although founders, family and friends were the primary source of funding, grants, private equity, partnerships and venture capital funding also were vital.

By the end of the first quarter 2011, survey respondents had raised $68.4 million, with an additional $115.3 million expected by year's end. Firms in the pharmaceutical/biologics/diagnostic group accounted for the bulk of that sum—$68.4 million. In addition, medical devices firms raised $10.5 million.

In 2011, partnerships were the primary source of funding for 62 percent of respondents. Fifty-four percent of respondents depended on grants and angel capital, while 38 percent cited venture capital as their main funding source. Meanwhile, three life sciences companies are expected to go public by the end of 2011.

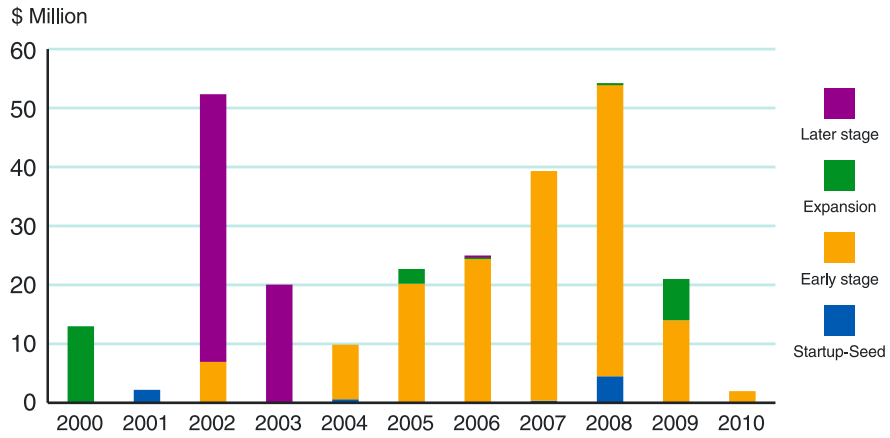
The amount of venture capital invested in Georgia's life sciences firms climbed from $20.3 million in 1995 to $71.2 million in 2010. The five-year average climbed from $35.7 million in 2000, to $54.6 million in 2005, and reached $70.5 million in 2010. In 2007, a record year for venture capital investment in Georgia, biotech and medical devices firms reported $104.2 million in venture capital investment. The most recent data available (2010) reports $71.2 million in VC investment, $2 million in biotech, and a landmark $69.2 million in medical devices—the second highest venture capital investment in Georgia's medical devices industry since 1995.

The amount of venture capital invested in biotechnology in the state climbed steadily from 2004 ($9.9 million) to 2008 ($54.2 million) but dropped off dramatically in 2009 and 2010. Nationally, venture capital invested in biotech firms also dropped in 2008 and 2009, but steadied in 2010, while venture

Venture Capital Investment in Georgia's Life Sciences Industry, 2000-2010

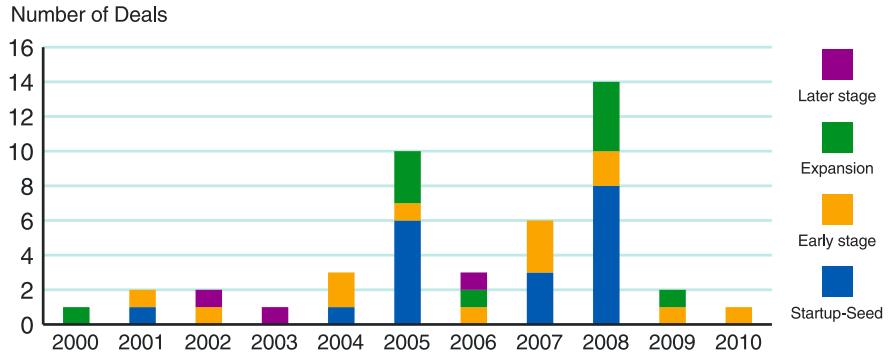
Source: Selig Center for Economic Growth, based on PriceWaterhouseCoopers, Money Tree Report, 2011.

Venture Capital Invested in Georgia's Biotechnology Firms, By Stage



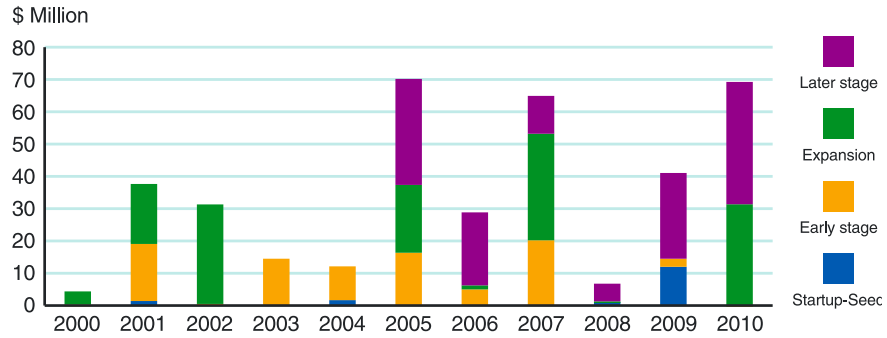
Source: Selig Center for Economic Growth, based on PriceWaterhouseCoopers, Money Tree Report, 2011.

Number of Biotechnology Venture Capital Financing Deals in Georgia, 2000-2010



Source: Selig Center for Economic Growth, based on PriceWaterhouseCoopers, Money Tree Report, 2011.

Venture Capital Invested in Georgia's Medical Devices Firms, By Stage



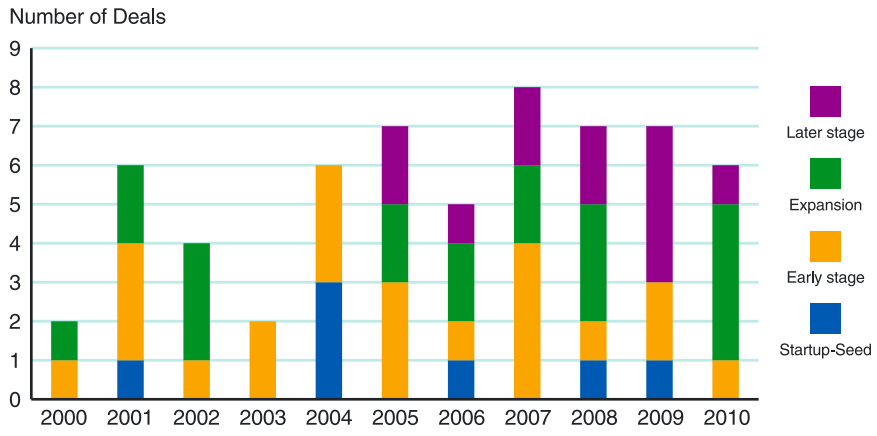
Source: Selig Center for Economic Growth, based on PriceWaterhouseCoopers, Money Tree Report, 2011.

capital invested in medical devices firms dropped in each of the last three years.

Most of the venture capital dollars invested in Georgia biotechnology firms came from early stage funding. In terms of the number of financing deals, however, startups claimed the record. The average sum of venture capital invested in Georgia biotech firms climbed from $5 million in 1995-2000 to $10.2 million in 2000-2005 but dropped to $4.6 million between 2006 and 2010 compared to the U.S. averages of $6.3 million, $10.3 million, and $9.2 million, respectively.

In the meanwhile, Georgia's medical devices firms had three outstanding years in raising venture capital between 2005 and 2010. In 2009, these companies raised a record sum of startup capital, and that was followed by significant expansion and late stage investment in 2010. The amount of money per deal increased from an average of $3.1 million in 1995-2000, to a $5.9 million average in 2000-2005, and topped at an average of $7.1 million in 2005-2010. At the same time, the U.S. average was $4.3 million, $7.2 million, and $8.1 million, respectively.

Number of Medical Devices Venture Capital Financing Deals in Georgia, 2000-2010



Source: Selig Center for Economic Growth, based on PriceWaterhouseCoopers, Money Tree Report, 2011.

Typically, the amount of investment per deal in devices firms was smaller than in biotechnology firms, but medical devices companies had more deals.

Access to capital was cited by 37 (57.9 percent) of the respondents as very important or crucial to their operations in Georgia, while 33 (51 percent) of the respondents considered access to government incentives as critically important, too. Access to capital was a hot button: 29 respondents considered it a weakness in Georgia, and only 4 considered it a strongpoint. (The rest were neutral.) The same group of respondents regarded access to government support somewhat more positively: 35 respondents considered it a strongpoint or an issue of no concern, and 28 saw it as a weakness.

Georgia's Business Climate

The quality of life, cost of living, and labor force issues top the list of factors that are the most important factors impacting operations of life sciences companies in Georgia. Infrastructure, access to capital, and the availability of service providers are also crucial. While the cost of living, quality of life and the availability of skilled researchers were cited as strengths in Georgia, the availability of skilled managers and technicians received a mixed vote. The availability of service providers received very few negative votes, but infrastructure and access to capital were more problematic. In fact, most respondents said that access to capital was one of Georgia's weaknesses.

Traffic congestion, transportation, and the high cost of energy were singled out as the most pressing infrastructure concerns by over 40 percent of respondents. The availability and cost of water and the airport were matters of concern to close to 20 percent of respondents.

In all, the group of 62 respondents ranked Georgia highly as a location of company headquarters, but rated the state's R&D appeal as average, and manufacturing appeal as below average. ❖

Table 16
Factors Relevant to Life Science Companies' Operations in Georgia

	Number of Responses	Percent of Valid Responses
Crucial/ Very Important		
Quality of life	55	87.3
Cost of living (e.g. housing)	46	75.4
Availability of skilled technicians	45	72.6
Availability of skilled managers	42	66.7
Infrastructure (e.g. traffic, energy, etc.)	40	61.5
Availability of skilled researchers	37	59.7
Access to capital	37	57.8
Availability/quality of service providers	36	57.1
Proximity to academic institutions and facilities	35	56.5
Regulatory/legislative environment	34	55.7
Availability of suitable space, facilities	35	55.6
Access to government financial incentives, support	33	51.6
Availability /cost of skilled manufacturing labor	25	39.7
State's image	19	30.6
Availability/cost of land	17	26.6
Slightly or Not Important		
Availability/cost of land	35	54.7
Availability /cost of skilled manufacturing labor	21	33.3
State's image	14	22.6
Access to government financial incentives/support	14	21.9
Access to capital	11	17.2
Regulatory/legislative environment	9	14.8
Availability/quality of service providers	9	14.3
Availability of suitable space and facilities	7	11.1
Availability of skilled researchers	6	9.7
Infrastructure (e.g. traffic, energy, etc.)	5	7.7
Proximity to academic institutions and facilities	4	6.5
Availability of skilled managers	4	6.3
Quality of life	2	3.2
Cost of living (e.g. housing)	1	1.6
Availability of skilled technicians	1	1.6

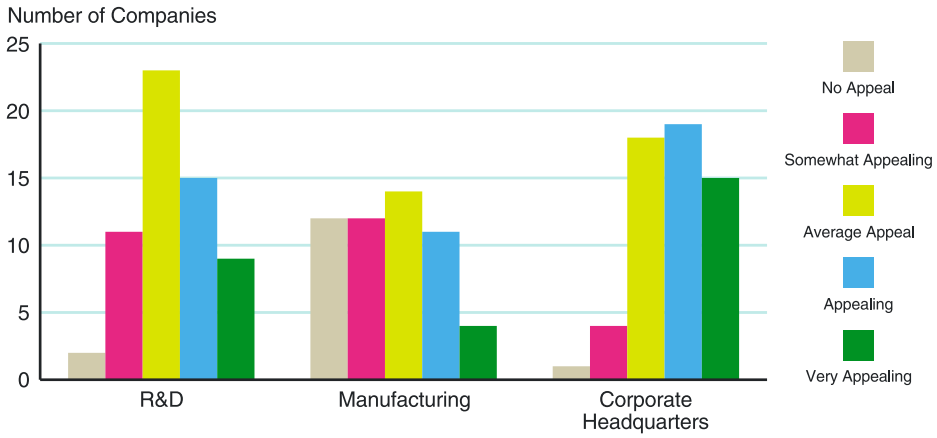
Based on 65 valid responses to the 2011 survey.

Table 17
Factors Impacting Life Sciences Companies' Operations in Georgia

	Not Important	Slightly Important	Moderately Important	Very Important	Extremely Important/ Critical
Proximity to academic institutions	2	2	23	27	8
Availability of skilled researchers	0	6	19	29	8
Availability of skilled technicians	0	1	16	31	14
Availability of skilled managers	1	3	17	32	10
Availability and cost of skilled manufacturing labor	14	7	17	21	4
Availability and cost of land	19	16	12	14	3
Availability of suitable space and facilities	3	4	21	32	3
Availability/quality of service providers	3	6	18	34	2
Regulatory/legislative environment	3	6	18	23	11
Access to capital	6	5	16	18	19
Access to government financial incentives/support	5	9	17	25	8
Quality of life	1	1	6	37	18
Cost of living	0	1	14	41	5
Infrastructure (e.g., traffic, water, energy)	2	3	20	37	3
State's image	6	8	29	13	6
Other	0	0	0	1	1

Based on 65 valid responses to the 2011 survey.

Georgia's Business Appeal



Based on 69 responding companies, 62 responses.

Appendix

LIST OF COMPANIES

Company	Location	Product/Focus
1st America Prescription Drugs	Valdosta	PHARM, DEV
3dmd, LLC	Atlanta	HEALTH IT
3M Company	Atlanta	DEV
A & L Shielding, Inc.	Rome	DEV
Abare Enterprises, Inc.	Forsyth	DEV
Abbott Laboratories	Lizella	PHARM
Abbott Products, Inc.	Marietta	PHARM
Abeome, Inc.	Athens	BIOTECH, PHARM, R&D
Access Product Marketing, LLC/Can-Am Care	Alpharetta	PHARM, DEV
Acella Pharmaceuticals, LLC	Alpharetta	PHARM
Adaptive Mobility Systems, Inc.	Norcross	DEV
Aderans Research Institute	Marietta	PHARM, BIOPHARM
Advanced Applications Inst./National Diagnostics	Atlanta	PHARM, DIAG
Advanced Bio-Technologies	Suwanee	PHARM
Advanced Technology Pharmaceuticals Corporation	Dacula	PHARM
AerovectRx Corporation	Atlanta	PHARM
Agra-Med International, LLC	Cleveland	BIOL
Agri Biofuels, Inc.	Camilla	BIOFUELS
Agrinostics, Inc.	Watkinsville	AGR
Ajay North America, LLC	Powder Springs	PHARM, AGR
Alaven Pharmaceutical, LLC	Marietta	PHARM
Algae Bioenergy Solutions	Augusta	BIOFUELS
Alimera Sciences, Inc.	Alpharetta	PHARM
Alliance Bio-Medical	Duluth	R&D, PHARM, SERV
Alpha Omega Company USA, Inc.	Alpharetta	DEV
Altea Therapeutics	Atlanta	BIOTECH, PHARM
Alterra Bioenergy	Gordon	BIOFUELS
Altiris/Metastatix	Atlanta	PHARM
Ambit Corporation	Gainesville	DEV
Amendia, Inc.	Marietta	DEV
American Biosurgical, LLC	Norcross	DEV
Ana-Gen Technologies, Inc.	Duluth	BIOL
Analytical Development, Inc.	Lawrenceville	DEV
Angionics	Athens	BIOTECH, PHARM
Any Test, Inc.	Kennesaw	DIAG
Apeliotus Technologies, Inc.	Atlanta	DEV, PHARM
Applied PhytoGenetics, Inc. (APGEN)	Athens	IND, AGR

Company	Location	Product/Focus
AptoTec	Athens	BIOPHARM, AGR
Aqua Solutions, Inc.	Jasper	LAB EQUIP
Arbor Pharmaceuticals, Inc.	Atlanta	PHARM
Archaea Solutions	Tyrone	ENV
Argent Diagnostics, Inc.	Athens	R&D
Aruna Biomedical	Athens	BIOTECH, R&D
Ascio Pharmaceuticals, Inc.	Alpharetta	PHARM
Athens Research and Technology, Inc.	Athens	DIAG, BIOL
Atlanta Biologicals, Inc.	Lawrenceville	BIOTECH, BIOL
Atlanta Catheter Therapies	Atlanta	DEV, R&D
Atlanta Center for Medical Research	Atlanta	PHARM, BIOPHARM, R&D
Atlanta Health Care Services	Atlanta	DEV, SERV
Atlanta Pathology Professional Association	Atlanta	DIAG
Atlanta Research Laboratory Supplies, Inc.	Atlanta	DEV, IND, AGR, R&D
Augusta Laboratory, Inc.	Augusta	DIAG
AuraZyme Pharmaceuticals, Inc.	Kennesaw	MED EQUIP
Axion Biosystems	Atlanta	DEV, sR&D
Axona/Axotect	Atlanta	R&D
Bacterial Barcodes	Athens	R&D
Bard Medical Division (C.R. Bard)	Covington	DEV
Bard Urological Division (C.R. Bard)	Covington	DEV
Bayer Cropscience, LP	Woodbine	AGR
Best Vascular/Novoste Corporation	Norcross	DEV
Bimeco Group	Tyrone	DEV
Biofisica, Inc.	Grayson	DEV
Biomass Innovations, LLC	Nahunta	BIOL
Biomedical Consultant Group, Inc.	Albany	BIOMED
Bioniche Animal Health USA, Inc.	Bogart	AGR, BIOL
Bio-Plus, Inc.	Madison	AGR, BIOFUELS
BioStrategies	Marietta	BIOPHARM
Biosystems America, Inc.	Cumming	BIOTECH, PHARM, DIAG
Brettech Alternative Fuel, Inc.	Tifton	BIOFUELS
Bristol-Myers Squibb	Atlanta	PHARM
Bruder Healthcare Company	Alpharetta	DEV
Burdox, Inc.	Griffin	DEV
C A P S Pharmacy	Norcross	PHARM
C2 Biofuels, Inc.	Atlanta	BIOFUELS
Caire, Inc.	Ball Ground	DEV
Cardiac Regeneration Technologies, LLC	Woodstock	DEV
CardioMEMS, Inc.	Atlanta	DEV
Carticept Medical, Inc.	Alpharetta	BIOTECH, DEV
Cell Constructs	Atlanta	PHARM, BIOL

Company	Location	Product/Focus
Cellutions, Inc.	Duluth	BIOTECH
CeloNova BioSciences	Peachtree City	DEV
Celtaxsys, Inc.	Atlanta	BIOPHARM
Century Systems, Inc.	Atlanta	PHARM
Cerebral Vascular Applications, Inc.	Duluth	DEV
ChemoCore, Inc.	Atlanta	BIOTECH
CIBA Vision Corporation	Duluth	DEV
CIS Biotech, Inc.	Atlanta	BIOTECH
Clinical Laboratory Services	Winder	DIAG
CorMatrix Cardiovascular	Alpharetta	BIOTECH, DEV
Covidien/Kendall Healthcare	Augusta	DEV
Cptmed, Inc.	Duluth	DEV
CryoLife, Inc.	Kennesaw	BIOTECH, BIOL, DEV, R&D
Curaxis Pharmaceutical Corporation	Alpharetta	BIOPHARM
Cytometry Specialists, Inc.	Alpharetta	DIAG
D S M Nutritional Products, Inc.	Pendergrass	PHARM
Dendreon	Union City	BIOTECH
Doctors Laboratory, Inc.	Valdosta	DIAG
Dornier MedTech America	Kennesaw	DEV
Dynamic Adsorbents, Inc.	Norcross	IND, CHEM
Eckert&Ziegler Analytics, Inc.	Atlanta	LAB EQUIP
ECO Solutions, LLC	Chatsworth	BIOFUELS
Effcon Laboratories, Inc.	Marietta	PHARM, DEV, R&D
EKA Chemicals, Inc.	Augusta	IND
Elan Holdings, Inc. (Elan drug delivery)	Gainesville	PHARM
Elanco	Augusta	AGR, PHARM
Elekta Holdings US, Inc.	Norcross	HEALTH
Encompass Pharmaceutical Services, Inc.	Norcross	PHARM, SERV
EndoChoice	Alpharetta	DEV
Envisionier Medical Technologies	Woodstock	DIAG, DEV, R&D
Enzymatic Deinking Technologies, LLC (EDT)	Norcross	IND, CHEM
EPD Pharma Solutions	Alpharetta	PHARM, BIOPHARM, R&D
Equinox Chemicals, LLC	Albany	CHEM
ERBE USA, Inc.	Marietta	DEV
ERMI, Inc.	Atlanta	DEV
Essential Consultants, Inc.	Atlanta	SERV
Ethicon	Cornerlia	DEV
Evirx	Athens	DEV
ExtRx Corporation	Roswell	PHARM, R&D
Facet Technologies, LLC (Div. of Matria Healthcare)	Kennesaw	DEV
Femasys	Suwanee	DEV
First United Ethanol	Camilla	BIOFUELS

Company	Location	Product/Focus
FOB Synthesis, Inc.	Kennesaw	PHARM, R&D
Fortec Medical	Norcross	DEV
GE Healthcare	Atlanta	PHARM
Gene Probe, Inc.	Atlanta	BIOINFO
GeneCure Biotechnologies	Norcross	BIOTECH
Genentech	Atlanta	PHARM
Genesis Technologies International, Inc.	Lawrenceville	IND
Genzyme Corporation/Sanofi-Aventis	Roswell	BIOTECH
Geoplasma, Inc.	Atlanta	BIOFUELS
Georgia Alternative Fuels, LLC	Dublin	BIOFUELS
Georgia Biofuels Corporation	Loganville	BIOFUELS
Georgia Biomass	Waycross	BIOFUELS
GeoVax, Inc.	Smyrna	BIOTECH, PHARM
GF Health Products, Inc.	Atlanta	DEV
Given Imaging, Inc.	Duluth	DIAG
GLASS HORSE PROJECT, LLC	Athens	HI
GlaxoSmithKline, LLC	Columbus	PHARM
Glycosensors and Diagnostics, LLC	Athens	BIOTECH, BIOPHARM, R&D
Grace Labs, LLC	Decatur	DIAG
Guided Therapeutics	Norcross	DEV
Gulmay Medical, Inc.	Buford	DEV
Health Discovery Corporation	Savannah	DIAG
Healthtronics Laboratory Solutions	Augusta	DIAG
HEIncorporated/AMMI, Inc.	Martinez	DEV
Hibernation Therapeutics	Macon	MEDTECH
Histology Services Company	Stone Mountain	DIAG
Hothead Technologies, Inc.	Atlanta	DEV
HOWMEDICA OSTEONICS	Newnan	DEV
Ht Orthotripsy Management Company	Alpharetta	DEV
ICON Interventional Systems®	Atlanta	DEV
Iconic Therapeutics, Inc.	Atlanta	BIOTECH, PHARM
Imiren Pharmaceuticals, Inc.	Forest Park	PHARM, BIOL
Immucor, Inc.	Norcross	DIAG, BIOL
Inhibikase Therapeutics, Inc.	Atlanta	BIOTECH, PHARM, R&D
Inhibitex, Inc.	Alpharetta	BIOTECH, BIOPHARM
Innogenetics, Inc.	Alpharetta	DIAG, DEV, AGR
Innovation Factory	Atlanta	DEV
Insectigen	Athens	BIOTECH, AGR
Integrated Science Systems	Augusta	DIAG, R&D
International Plant Nutrition	Norcross	AGR
InVasc Therapeutics, Inc.	Tucker	BIOTECH, PHARM
KB Visions/Kaswan, Inc.	Atlanta	PHARM

Company	Location	Product/Focus
Kiel Laboratories, Inc.	Gainesville	PHARM, DEV
Kimberly-Clark	Roswell	DEV
KPS Technologies	Atlanta	BIOL, DIAG
Laboratory Corporation of America	Columbus	DIAG
Lee Laboratories/BD	Grayson	DIAG, DEV, IND
Lexicor Medical Technolgies	Augusta	DEV, DIAG
Life Alarm Services, Inc.	Augusta	DEV
Logos Nutritionals/Preventive Therapeutics, Inc.	Snellville	PHARM
LumaMed	Johns Creek	DIAG, DEV
Luminomics, Inc.	Augusta	PHARM, R&D
McKesson Information Solutions, LLC	Alpharetta	SERV, HI
MD Innovate, Inc.	Decatur	DEV
Mddatacor, Inc.	Alpharetta	SERV, HI
Medical Device Development Group, LLC	Atlanta	DEV
Medical Device Marketing	Atlanta	DEV
Medical Edge Technologies, Inc.	Atlanta	DEV
Medical Neurogenetics, LLC	Atlanta	DIAG
Medical Specialty Innovations	Alpharetta	MED EQUIP
Meditech	Atlanta	HI
MedQuest Associates	Alpharetta	DIAG
Medshape Solutions	Atlanta	DEV, R&D
Medtronic, Inc.	Atlanta	DEV
Merial Limited	Duluth	BIOL, AGR
Merial Select	Gainesville	PHARM, BIOL, AGR
Metabolic Testing Services, Inc.	Atlanta	DIAG
Metametrix, Inc.	Duluth	DIAG
Metro Vascular, PC	Decatur	DIAG
Micro-Macro International, Inc.	Athens	DIAG, AGR
Microtek Medical Holdings, Inc.	Alpharetta	DEV
Middle Georgia Biofuels, Inc.	Dublin	BIOFUELS
Mikart, Inc.	Atlanta	PHARM
Millennium Cryogenics, Inc.	Athens	BOB
MiMedx Group, Inc.	Marietta	DEV, BIOMATERIALS
Molecular Therapeutics, LLC	Athens	PHARM
Mölnlycke Health Care U.S.	Norcross	MED EQUIP
Monsanto Company	Augusta	AGR
Myelotec	Roswell	DEV
Nanli Laser Supply, LLC	Atlanta	DEV
Nanomist systems, LLC	Macon	IND
National Diagnostics, Inc.	Atlanta	DIAG
NDC Health Corporation	Atlanta	HI, SERV
Neural Signals, Inc.	Duluth	DEV

Company	Location	Product/Focus
NeuroMatrix Group/Southern Neurophysiology, LLC	Alpharetta	DIAG, HI, SERV
NeurOP	Atlanta	BIOTECH, PHARM
NeuroTrials Research, Inc.	Atlanta	PHARM, DEV, SERV
Newton Laboratories, Inc.	Conyers	PHARM
Noramco, Inc.	Athens	PHARM
North American Bioproducts	Duluth	IND
Octogen Pharmacal Co., Inc/Pharmacal	Cumming	PHARM
Omega Bio-Tek, Inc.	Norcross	DIAG, DEV
Omni International, Inc.	Kennesaw	R&D, IND
Oncose, Inc.	Athens	DIAG, R&D
Opti Medical Systems	Roswell	DEV
P3 Laboratories	Winder	R&D, DIAG
Pajunk Medical Systems, LP	Norcross	DEV
Parexel	Lawrenceville	BIOPHARM, SERV
Pathens Inc.	Athens	BIOTECH
Pathogen Control Associates	Norcross	ENV
Peat Fuel Company	Ludowici	BIOFUELS
Pfeiffer Pharmaceuticals	Atlanta	PHARM
Pfizer	Atlanta	AGR
Planteco Environmental Consultants	Athens	SERV, IND
Plasma Surgical, Inc.	Roswell	DEV
Porex Porous Products Group/Porex Technologies	Fairburn	DEV, EQUIP
Poultry Specialties, Inc.	Marietta	AGR
Prayon, Inc.	Augusta	IND, AGR
Premier Research Atlanta, Inc.	Marietta	HI
Prentiss, Inc.	Sandersville	AGR
Prizm Medical, Inc.	Oakwood	DEV
Q Care International, LLC	Marietta	DEV
Quality Assurance Service Corporation	Augusta	DIAG
Quest Diagnostics	Tucker	DIAG
Quintiles Laboratories Limited	Marietta	DIAG
Rad Source Technologies, Inc.	Suwanee	DEV
Range Fuels Soperton Plant, LLC	Soperton	BIOFUELS
RayBiotech, Inc.	Norcross	BIOTECH, BIOL
Reach Health, Inc.	Alpharetta	HI
Recombinant Peptide Technologies, LLC (rPeptide)	Bogart	BIOTECH
Relax-A-Cizor Products, Inc.	Atlanta	DEV
Research Think Tank, Inc.	Buford	DIAG, R&D, SERV
Respironics, Inc. (Philips)	Kennesaw	DEV
Retinalabs	Atlanta	DEV
Revogenex, Inc.	Winder	PHARM
RFD Technology	Atlanta	DEV

Company	Location	Product/Focus
RFS Pharma	Tucker	PHARM
Rhodia, Inc.	Winder	IND, CHEM
RITA Medical Systems, Inc./Angiodynamics	Manchester	DEV
S S S Company	Atlanta	PHARM
SaluMedica, LLC	Atlanta	DEV
Salutria Pharmaceuticals, LLC	Alpharetta	BIOTECH, PHARM
Sanofi-Aventis	Atlanta	PHARM SALES
Sanuwave Services, LLC	Alpharetta	DEV
Schering-Plough/Merck	Suwanee	PHARM
Scientific Adsorbents (Div. of Apyron Technologies, Inc.)	Atlanta	IND
Sebacia, Inc.	Duluth	PHARM
Sebia, Inc.	Norcross	R&D, LAB EQUIP
Sector Electronics, LLC	Marietta	DEV
Sero-Immuno Diagnostics	Tucker	DIAG
Shionogi, Inc./formerly Sciele Pharma, Inc. (formerly First Horizon Pharmaceutical Corp.)	Atlanta	PHARM SALES
Siemens Healthcare Diagnostics	Atlanta	DIAG, BIOL, DEV
Siemens Medical Solutions USA, Inc., Ultrasound Division	Alpharetta	DEV
Sigvaris, Inc.	Peachtree City	DEV
Skalar	Buford	LAB EQUIP
Slainte Bioceuticals	Marietta	PHARM, BIOTECH
Sleepmed, Inc.	Jonesboro	DIAG
Sleepmed, Inc.	Kennesaw	DIAG
Smisson Cartledge Biomedical	Macon	BIOTECH, BIOL, DEV
Smithkline Beecham Corporation	Columbus	DIAG
SMO-USA, Inc.	Canton	R&D, SERV
Snowden Pencer, Inc.	Tucker	DEV
SoloHealth	Duluth	DEV
Solvay Pharmaceuticals, Inc./ Abbotts Products, Inc.	Marietta	PHARM, DEV, DIAG
Southeast Regional Research Group, Inc.	Columbus	R&D, SERV
Splash Medical Devices, LLC	Atlanta	DEV
Sriya Innovations, Inc.	Kennesaw	IND, BIOFUELS
SSL Americas, Inc./part of Reckitt Benckiser	Norcross	PHARM
Sterimed, Inc.	Cartersville	DEV
Stradis Medical, LLC	Lawrenceville	DEV
Stryker CMF/Porex Surgical, Inc.	Newnan	DEV
Sub-Micro	Atlanta	DEV
Summit Industries, Inc.	Marietta	PHARM, AGR
Sunbelt Medical Services, Inc.	Sardis	SERV
Surgical Biologics, LLC	Kennesaw	DEV
Synageva Biopharma (formerly Avigenics)	Athens	BIOTECH, PHARM

Company	Location	Product/Focus
Syntermed, Inc.	Atlanta	HI
TAP Pharmaceuticals (Takeda Pharmaceuticals North America)	Atlanta	PHARM
Technical Products, Inc. of Georgia, USA	Lawerenceville	MED EQUIP
Technology Resource International Corporation (TRI)	Alpharetta	DEV
The Nutrasweet Company	Augusta	FOOD
Theragenics Corporation	Buford	PHARM, DEV
Thione International, Inc.	Atlanta	PHARM
Throwleigh Technologies, LLC	Ball Ground	DEV
Tissue Regeneration Technologies, LLC	Woodstock	DEV
Transfusion & Transplantation Technologies, Inc.	Atlanta	DEV, DIAG, BIOL
Trs Labs, Inc.	Athens	PHARM, DIAG
UCB, Inc.	Smyrna	PHARM
Unimed Pharmaceuticals	Marietta	PHARM
Unisplint Corporation	Norcross	DEV
UPPI-PET/Triad Isotopes	Macon	NUC MED
Velocity Medical Solutions, LLC	Atlanta	HI
VersaPharm, Inc.	Marietta	PHARM
Viacyte/BresaGen, Inc./Novocell, Inc.	Athens	BIOTECH, BIOL, BIOPHARM
Visioneering Technologies, Inc.	Alpharetta	BIOTECH, R&D, DEV
Vitalabs, Inc.	Jonesboro	PHARM
Vitamin Derivatives, Inc.	Winterville	PHARM, AGR
Vivebio, LLC	Norcross	BIOTECH, BIOL
Vivonetics, Inc.	Atlanta	R&D
Waters Agricultural Labs	Camilla	AGR
Wellpharm, LLC	Canton	PHARM
Wetland & Ecological Consultants	Woodstock	ENV
Wingo, Inc.	Cleveland	BIOL
Wuxi Apptec Inc/Viro-Med Laboratories, Inc.	Marietta	DIAG, BIOL
Wynden Pharmaceuticals, LLC	Marietta	PHARM
Xytex Corporation	Augusta	BOB, SERV, DIAG
Z Technologies, LLC	Atlanta	DEV
Zenda Technologies	Roswell	BIOTECH, DEV, R&D
Zirus, Inc.	Buford	BIOTECH

AGR	Agricultural, food, nutrition (human and animal)
BIOFUELS	Biofuels, bioenergy
BIOL	Biologics
BIOPHARM	Biopharmaceuticals
BIOTECH	Biotechnology
BOB	Blood and Organ Banks
CHEM	Chemical
DEV	Medical devices and technology
DIAG	Diagnostics
ENV	Environmental
HI	Health Informatics
IND	Industrial
LAB EQUIP	Laboratory equipment and supplies
MED EQUIP	Medical equipment and supplies
NUC MED	Nuclear medicine
PHARM	Pharmaceutical, biopharmaceutical, therapeutics (including veterinary)
R&D	Research and development, platform technolocy, product discovery
SERV	Services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