



Shaping Infinity

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THE GEORGIA LIFE SCIENCES
INDUSTRY ANALYSIS 2012

Shaping Infinity

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in Graphic Design for the 2011 *Shaping Infinity*.

From the President of Georgia Bio

Georgia Bio (GaBio) welcomes you to the 2012 *Shaping Infinity*, the Georgia Life Sciences Industry Analysis. This year's report, the sixth in a series, demonstrates the enormous significance of life sciences innovation to Georgia's economic growth. One out of every 40 jobs in Georgia is tied to the life sciences industry. During the Great Recession, employment was stable, helping to offset the decline in jobs across all other industry sectors.

The life sciences industry and university research, plus the U.S. Centers for Disease Control and Prevention, have a \$20 billion annual economic impact on Georgia and employ more than 94,000 people. The industry's impact alone is nearly \$17 billion, employing more than 65,000 people in high-paying, rewarding careers. From 2007 to 2010, employment in Georgia's life sciences industry actually increased slightly, a remarkable achievement considering that total statewide employment for all industries declined by 8 percent. Georgia's life sciences industry pays nearly \$5.6 billion in salaries and more than \$550 million a year in state and local taxes.

The Georgia Life Sciences Industry Analysis 2012 was produced by the University of Georgia's Selig Center for Economic Growth in the Terry College of Business. Selig Center Director Jeffrey Humphreys, Ph.D., conducted the economic impact study. "The fundamental finding of this study," Dr. Humphreys said, "is that Georgia's life sciences companies contribute substantial economic activity to Georgia."

In addition, *Shaping Infinity* includes commentary from industry and government leaders. Georgia Department of Economic Development Commissioner **Chris Cummiskey** writes about the addition of Baxter International to the state's life sciences landscape. Others featured are **Greg Duncan**, President of UCB's North American Operations; and **Charles Wilmer**, M.D., Piedmont Heart Institute's Board Chairman of Innovation.

GaBio is the private, non-profit association representing pharmaceutical, biotechnology and medical devices 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 sponsor—The University of Georgia—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

Executive Summary

In good as well as tough economic times, the companies that comprise Georgia's life sciences industry (as a group) are dependable sources of high-paying jobs. From 2007 to 2010, the number of workers employed in Georgia's life sciences industry held relatively steady, increasing by 1.5 percent. Although small, even a 1.5 percent gain in life sciences jobs is remarkable, considering that total statewide employment for all industries dropped by 7.9 percent. Although Georgia's life sciences industry added jobs as a group, one vital subsector—electro-medical apparatus manufacturing—lost nearly two out of every three jobs. Jobs were also lost in biotechnology and pharmaceutical manufacturing. From 2007 to 2010, the number of establishments in Georgia's life sciences core increased by 17.9 percent. In contrast, the state's economy lost 1.4 percent of establishments across all industries. Similarly, total wages paid by the life sciences core rose by 4.4 percent compared to a 4.2 percent drop for all the industries in the state.

The analysis shows that sustained efforts to grow and foster the development of Georgia's life sciences proved their worth during the Great Recession and during the sub-par economic recovery that has persisted in its wake. Recent developments indicate that the prospects for Georgia's life sciences cluster are improving. The announcement that Baxter International will locate a new biopharmaceutical manufacturing facility that will employ 1,500 workers demonstrates that life sciences will continue to be a force behind the growth of Georgia's economy. The Baxter project alone will expand direct employment in Georgia's core life sciences group of companies by about 10 percent.

Georgia's life sciences industry pays extremely well, with the average annual salary of \$64,473 in 2010, which is 47 percent higher than the statewide average for all industries of \$43,899. Indeed, all life sciences subsectors pay better than the average for all industries. Pharmaceutical and medicine manufacturing pays the highest at \$94,363 per year. Electromedical apparatus manufacturing was second at \$91,803 per year, followed by biotech R&D at \$72,789 annually. The lowest paying

subsector was blood and organ banks—\$44,477 per year.

Economic Impact Highlights

Given the high salaries in many life sciences sectors, it is not surprising that life sciences firms generate substantial annual economic impacts for the people who live, work, and do business in Georgia. The statewide economic impacts of the life sciences industries in 2010 were:

- 18,025 jobs in life sciences companies;
- 65,337 jobs in all industries (including life sciences);
- \$16.7 billion in output (sales);
- \$6.9 billion in state GDP;
- \$3.8 billion in labor income (earnings); and
- \$417 million in tax revenues for state and local governments.

In addition, life sciences research at the state's colleges and universities generated 14,282 jobs (on- and off-campus); \$1.6 billion in output (sales); \$1 billion in state GDP; \$700 million in income (earnings); and \$73 million in tax revenues for state and local governments.

The Atlanta-based CDC contributed substantially to the state's economy by generating 7,551 jobs (and a total job impact of 13,950); \$1.7 billion in output (sales); \$1.4 billion in state GDP; \$1.1 billion in income (earnings); and \$66 million in tax revenues for state and local governments.

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

- 33,359 direct jobs (0.9 percent of all jobs in Georgia);
- 94,106 total jobs (2.5 percent of all jobs in Georgia);
- \$20 billion in output (sales);
- \$9.3 billion in state GDP (2.3 percent of Georgia's GDP);
- \$5.6 billion in income (earnings); and
- \$557 million in tax revenues for state and local governments.

On average, for every direct job created by life sciences, an additional 1.8 jobs are created in other industries. In other

words, 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.

Degrees Granted

The above-average job growth and high salaries in life sciences occupations have attracted the attention of college students, too. Indeed, a rising proportion of life sciences degrees granted by the University System of Georgia shows growing interest in these professions. In 2011, for instance, 16.5 percent of degrees granted by USG institutions were in life sciences professions compared to 15.5 percent in 2007. That higher proportion reflects faster growth in the number of life sciences degrees granted (29 percent) than in the overall number of degrees granted (21 percent). From 2007 to 2011, life sciences engineering saw the fastest growth (up 64 percent), but health professions accounted for the largest increase in the number of life sciences degrees granted.

Patents

Patent activity is a good measure of innovation and the potential for growth in technology-based industries. The number of all utility patents issued to Georgians increased by 47.5 percent between 2007 and 2011, which exceeds the 36.6 percent gain posted by the nation as a whole. The number of patents in life sciences-related fields increased at a much faster pace than the overall number of patents, but the increase in Georgia was slightly lower than for the U.S.—a 49.7 percent gain in Georgia versus 51.5 percent for the nation. Among academic institutions, Emory University, The University of Georgia, and the Georgia Institute of Technology have produced the largest numbers of patents in the life sciences-related fields.

The average time from application to patent grant lengthened from two years in the 1980s to three years in the 2000s. But, towards the end of the last decade, the time lag between patent application and grant dropped very sharply to 1.5 years, and that resulted in a jump in the number of patents granted.

Meanwhile, life sciences-related patents have become more complex. For example, for patents applied for between 1974 and 1997, the average number of claims was 14.7 per patent compared to 21.8 claims per patent for patents applied for between 1998 and 2008.

R&D Activity

Compared to other states, Georgia seriously lags when it comes to R&D activity. That's alarming given that R&D based industries will be major drivers of global economic growth. The percentage of Georgia's GDP attributed to R&D is about half the national average, which is a critical weakness that Georgia must address. Academic R&D exceeds the U.S. average, however, and R&D expenditures in life sciences comprise the largest portion of Georgia's academic R&D. Hence, Georgia ranks 16 with respect to expenditures on life sciences R&D, and ranks fifth in academic research expenditures in bioengineering and biomedical engineering.

Funding

Obviously, R&D and innovation take money, so Georgia needs to further develop its venture capital markets. In 2011, the state ranked 11 nationally in terms of venture capital investment, or two places higher than where it was in 2010. But about 85 percent of the venture capital invested in Georgia companies comes from venture firms headquartered elsewhere. About one fourth of the venture capital was invested in life sciences firms.

Life sciences venture capital investment in Georgia was \$36.2 million in 2011, and that was a drastic drop from the \$80.8 million invested in 2010. In 2009 and 2008, life sciences venture capital in Georgia was \$62 million and \$53.9 million, respectively.

Georgia does well when it comes to entrepreneurial activity. But to continue to do so, Georgia needs an adequate supply of venture capital to fuel the growth of successful startups. All too often, Georgia-bred high tech companies leave just as they

are on the verge of achieving commercial success. When that happens, Georgia misses out on the big payoff in terms of jobs generated by our entrepreneurial talent.

Clinical Trials

The number of clinical trials is an important indicator of the strength of the life sciences industry. From 2008 to 2011, the number of clinical trial studies received for investigation in Georgia dropped by 18.6 percent, which was steeper than the 13.7 percent drop experienced nationally. Despite this setback, the number of trials per million residents was still higher in Georgia than in the nation as a whole. In 2012, there are 2,886 clinical trial studies active in Georgia. Phase III trials comprise the largest group—45 percent. Phase II trials account for 34 percent of the total.

Survey

In 2012, the Selig Center identified 363 life sciences companies that are active in Georgia. Data for 110 (31 percent) companies were obtained from completed 2012 questionnaires and data for an additional 29 non-responding companies were obtained from previous surveys. Thus, responses were gathered from 139 (39 percent) of life sciences firms included on the 2012 list. Data for the remaining 224 firms were gathered, when available, from publicly available sources.

Geographically, life sciences firms are clustered in and around Atlanta, Athens, and Augusta. Atlanta is the prime location for pharmaceutical firms, biotechnology and bioinfor-

matics companies, and medical devices and health IT firms. Athens is home to many biotechnology and bioinformatics companies, too. Augusta is a hub for diagnostic firms as well as agricultural life sciences firms. Biofuel companies are located in rural areas.

Georgia's life sciences industry is still relatively young, but 57 percent of the life sciences companies for which data was available have been in business over ten years. In 2012, over half of the companies within the largest groups—diagnostics, agricultural, devices, and biotechnology—have been in operation for a decade or more. Only 11 percent of companies have been active for less than three years, with the youngest firms concentrated in pharmaceuticals, biologics, biofuels, and R&D.

Over half of the companies for which employment data are available employed one to ten staffers. Biotechnology, biologics, and R&D firms tend to fall within the smallest employment range. Diagnostics and health IT companies tend to be somewhat larger. Georgia's largest life sciences firms—those with more than 100 employees—specialize in diagnostics, medical devices, and ACEI.



The principal author acknowledges the Selig Center's data analyst Stephen Kuzniak for his help with compiling the list of over 300 companies in the Appendix.

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 fields also utilize a specialized workforce, manufacturing procedures and facilities, and often require targeted funding.

This broad definition encompasses biotechnology, medical devices, pharmaceuticals, diagnostics, as well as the agricultural, biofuels, and bioenergy sectors, 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.

The 2010 annual data from the Bureau of Labor Statistics offers an opportunity to assess how the life sciences industry in Georgia weathered the economic storm brought about by the 2007-2009 recession. Although the recession technically ended in 2009, 2010 turned out to be a challenging year for many industries in Georgia.

As a whole, Georgia's life sciences industry weathered the recession much better than the state's economy as a whole. The industry recorded a 1.5 percent jump in the number of jobs, led by employment increases in medical devices manufacturing. At the same time, the state's employment dropped by 7.9 percent. Job losses in some of the life sciences sectors—most importantly, biotechnology—were more severe than the 2007-2010 average for the state, however. Although not exceeding the state average in losses, jobs were also lost in pharmaceutical manufacturing.

The number of life sciences establishments increased by 17.9 percent during this period, even as the state lost 1.4 percent of its establishments overall. Total wages paid by the life sciences industry jumped by 4.4 percent, compared to the average 4.2 percent drop in wages in the state's economy as a whole. Diagnostic imaging centers, however, were the only life sciences sector that lost jobs, companies, and wages.

Pharmaceuticals

Pharmaceutical and medicine manufacturing provided 20.4 percent of life sciences jobs in 2010. As a whole, this segment lost 5.3 percent or 173 jobs between 2007 and 2010. Most of the jobs were lost in pharmaceutical preparations manufacturing (the largest group), which dropped 13.6 percent, or 326 jobs since 2007. Some of these losses were offset by other pharmaceutical manufacturing, especially medicinal and botanical manufacturing as well as in-vitro diagnostic substances manufacturing, which together added 153 jobs between 2007 and 2010. Still, pharmaceutical manufacturing had more establishments in 2010 than in 2007.

Overall, this sector paid well, with an average annual salary that jumped from \$89,672 in 2007 to \$94,363 in 2010 (5.2 percent). Ironically, the sharpest increase (over 12 percent) was recorded in the job-losing pharmaceutical preparations manufacturing segment.

Devices Manufacturing

Medical devices manufacturing, which provided 23 percent of the state's life sciences industry jobs, increased employment by 7.2 percent between 2007 and 2010. The number of

Table 1
The Life Sciences Industry in Georgia, 2010

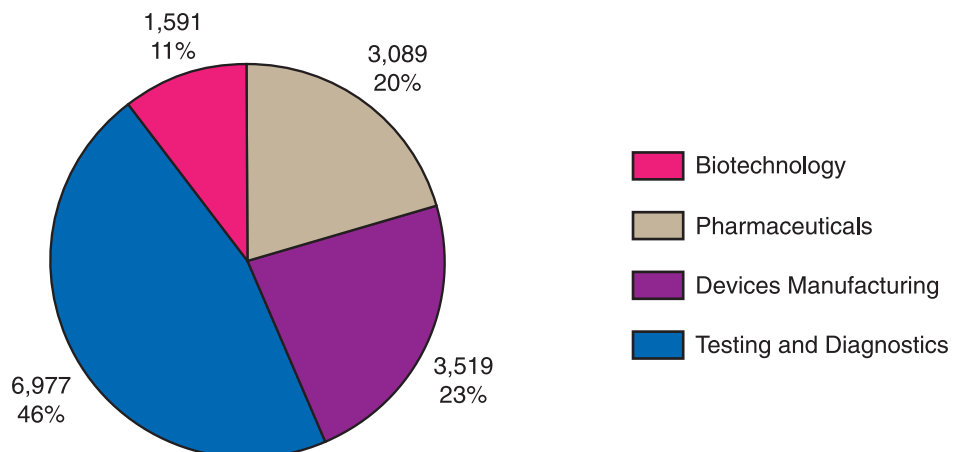
	Establishments		Employment		Total Wages*	
	Number	2007-2010 Change	Number	2007-2010 Change	Amount (\$)	2007-2010 Change
Pharmaceutical, medicine mfg.	54	10.2	3,089	-5.3	291,503	-0.3
Devices manufacturing						
Electromedical apparatus mfg.	22	175.0	83	-65.7	7,612	-49.8
Surgical, medical instrument mfg.	28	154.5	1,107	48.6	71,608	35.3
Surgical appliance, supplies mfg.	62	17.0	2,329	1.4	147,084	-0.6
Irradiation apparatus mfg.	10	42.9	NA	0.0	NA	0.0
Devices manufacturing total	122	54.4	3,519	7.2	226,304	4.8
R&D in biotechnology	129	26.5	1,591	-8.4	115,770	-0.6
Testing and diagnostics						
Medical laboratories	289	20.4	4,159	7.7	215,100	20.2
Diagnostic imaging centers	186	-3.1	1,338	-4.3	63,946	-8.0
Blood and organ banks	32	18.5	1,480	4.7	65,822	3.7
Testing and diagnostics total	507	10.5	6,977	4.5	344,868	10.6
Core life sciences industry total	812	17.9	15,176	1.5	978,445	4.4
Georgia, all industries	266,436	-1.4	3,753,934	-7.9	164,794	-4.2

NA Not available.

*Industry detail in thousands of dollars; Georgia total in millions.

Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, May 2012.

Employment in Georgia's Life Sciences Industry, 2010
By Sector, with Percent of Total



Source: Selig Center for Economic Growth, based on Bureau of Labor Statistics, Quarterly Census of Employment and Wages, May 2012.

Table 2
The Life Sciences Industry in Georgia,
Average Annual Wages, 2010

	Average Annual Wages*	
	Amount (\$)	2007-2010 Change
Pharmaceutical, medicine manufacturing	94,363	5.2
Devices manufacturing		
Electromedical apparatus	91,803	46.5
Surgical, medical instruments	64,677	-8.9
Surgical appliance, supplies	63,160	-2.0
Irradiation apparatus	ND	NA
Devices manufacturing average	64,309	-2.3
R&D in biotechnology	72,789	8.5
Testing and diagnostics		
Medical laboratories	51,715	11.6
Diagnostic imaging centers	47,780	-3.9
Blood and organ banks	44,477	-0.9
Testing and diagnostics average	49,429	5.8
Core life sciences industry average	64,473	2.9
Georgia, all industries	43,899	4.1

*In addition to salaries, wages include bonuses, stock options, severance pay, profit distributions, cash value of meals and lodging, tips and other gratuities. With few exceptions, all employees of covered firms are reported, including corporation officials, executives, supervisory personnel, production and sales workers, and clerical workers.

NA Not available.

ND Not disclosed.

Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, May 2012.

establishments increased by more than half, but total wages, not including suppressed data for irradiation apparatus manufacturing, increased more slowly (4.8 percent).

Average annual salaries jumped by half in the tiny electro-medical apparatus manufacturing sector, and, at \$91,803, was the highest among the medical devices sectors for which 2010 data are available. The annual salary in the medical devices and supplies manufacturing companies averaged \$64,309.

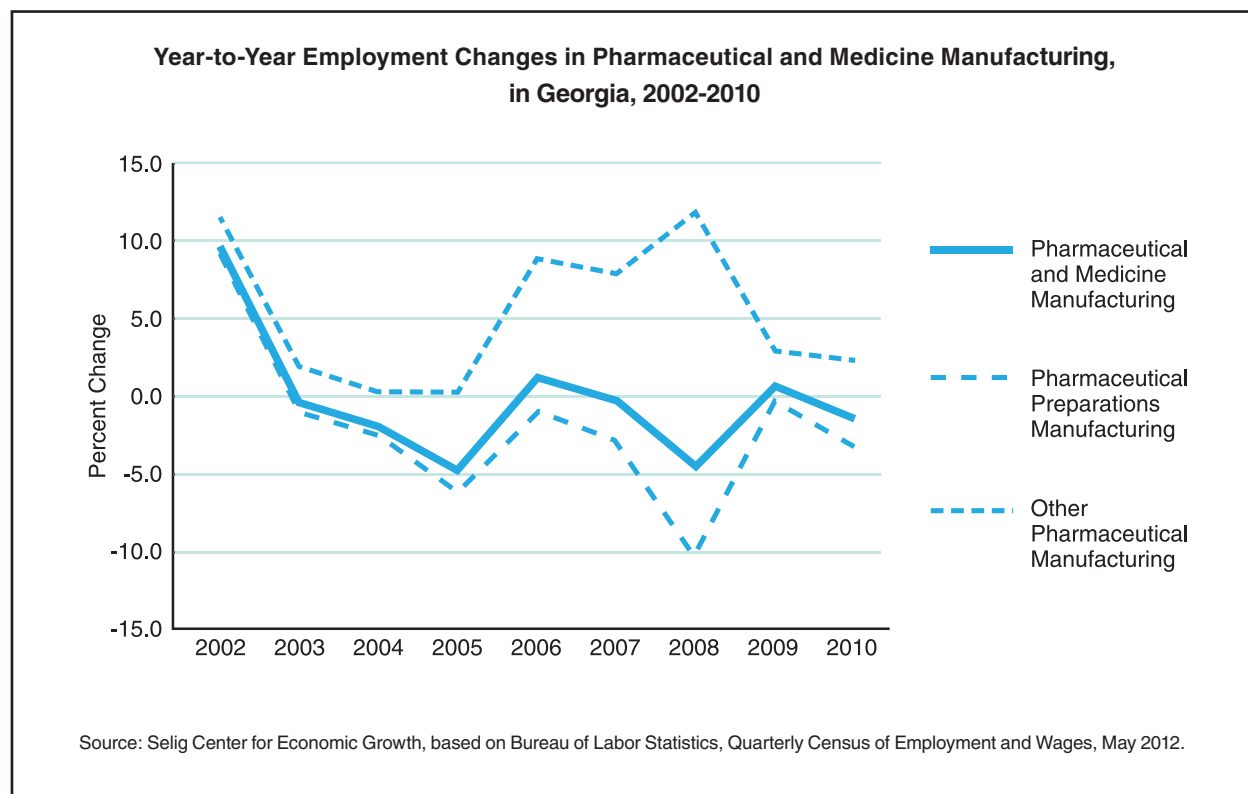
Biotechnology

With an employment of 1,591, biotechnology accounted for 10.5 percent of life sciences jobs in Georgia in 2010. Although the industry lost 145 jobs (8.4 percent) during the recession, the number of biotechnology establishments increased by 26.5 percent. Total wages paid by this sector remained virtually

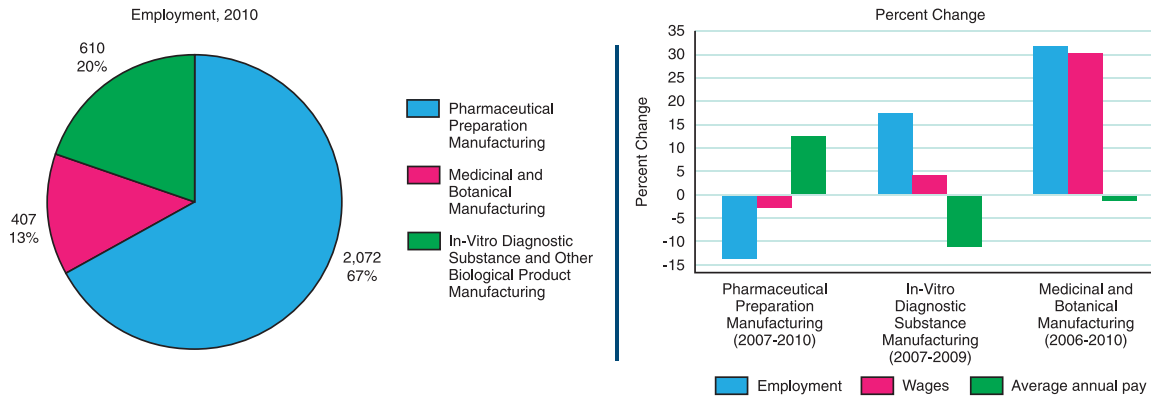
unchanged. On average, a job in biotechnology paid \$72,789 in 2010, one of the highest in life sciences.

Testing and Diagnostics

Medical and diagnostic labs, and blood and organ banks accounted for 6,977 or 46 percent of life sciences jobs in Georgia. As a whole, this group increased employment in Georgia by 4.5 percent between 2007 and 2010. The largest increase (297 jobs, or 7.7 percent) was reported in medical laboratories employment. Blood and organ banks added 66 jobs, or 4.7 percent, while employment in diagnostic imaging centers dropped by 4.3 percent (60 jobs). The number of testing and diagnostics laboratories increased by over 10 percent, led by growth in medical laboratories, which also reported the steepest (11.6 percent) increase in average annual salaries.

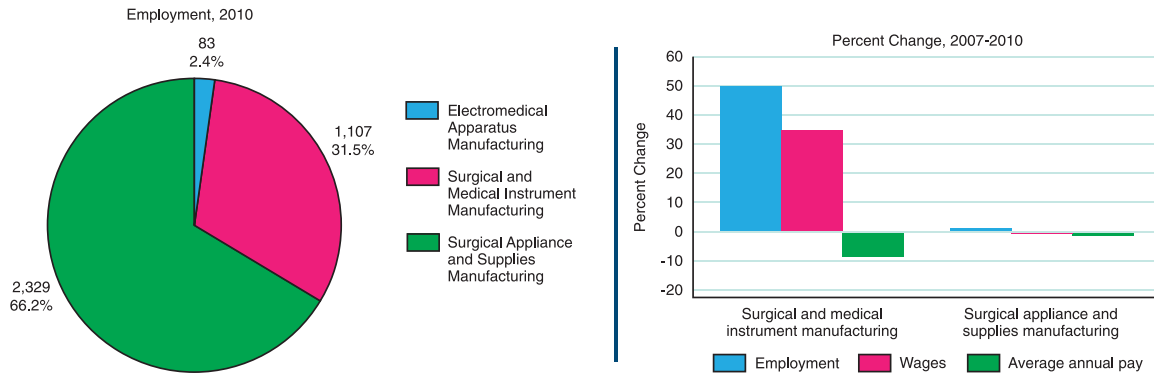


Pharmaceutical and Medicine Manufacturing Employment, Wages, and Average Annual Pay in Georgia, With Industry Detail



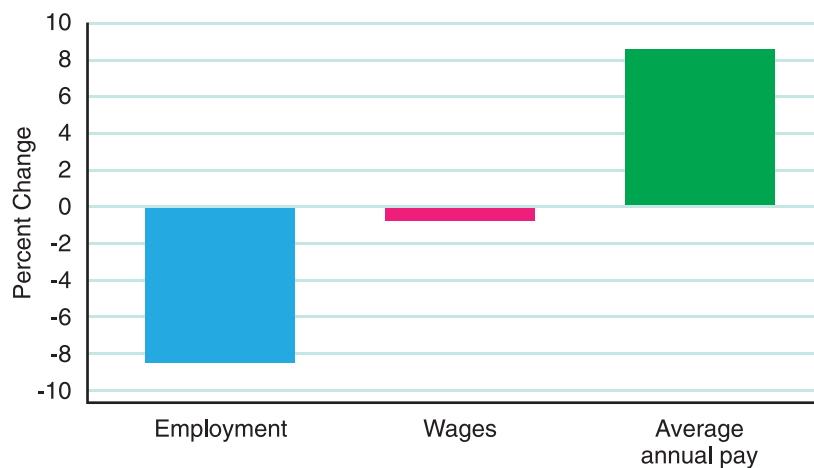
Source: Selig Center for Economic Growth, based on Bureau of Labor Statistics, Quarterly Census of Employment and Wages, May 2012.

Devices Manufacturing Employment, Wages, and Average Annual Pay in Georgia, With Industry Detail



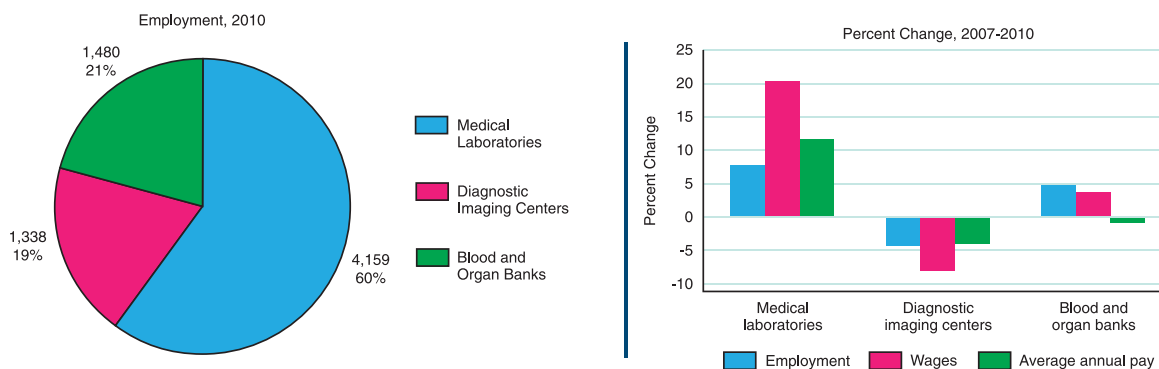
Source: Selig Center for Economic Growth, based on Bureau of Labor Statistics, Quarterly Census of Employment and Wages, May 2012.

Changes in Biotechnology's Employment, Wages, and Average Pay in Georgia, 2007-2010



Source: Selig Center for Economic Growth, based on Bureau of Labor Statistics, Quarterly Census of Employment and Wages, May 2012.

Testing and Diagnostics Employment, Wages, and Average Annual Pay in Georgia, With Industry Detail



Source: Selig Center for Economic Growth, based on Bureau of Labor Statistics, Quarterly Census of Employment and Wages, May 2012.

Economic Impact

Georgia's 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 life sciences industry also proved to be a very dependable source of employment during the recession, helping to cushion the state's overall economy against severe job losses in many other economic sectors.

The statewide economic impacts of the life sciences industry in 2010 were:

- 18,025 jobs in life sciences companies;
- 65,337 jobs in all industries (including life sciences);
- \$16.7 billion in output (sales);
- \$6.9 billion in state GDP;
- \$3.8 billion in labor income (earnings); and
- \$417 million in tax revenues for state and local governments.

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

- 14,282 jobs (on- and off-campus);
- \$1.6 billion in output (sales);
- \$977 million in state GDP;
- \$700 million in income (earnings); and
- \$73 million in tax revenues for state and local governments.

Moreover, the Atlanta-based CDC generated 7,551 jobs; 14,487 total jobs impact; \$1.7 billion in output (sales); \$1.4 billion in state GDP; \$1.1 billion in income (earnings); and \$66 million in tax revenues for state and local governments.

In total, the economic impact of life sciences on Georgia's economy in 2010 amounted to 33,359 direct jobs (0.9 percent of all jobs in Georgia); 94,106 total jobs (2.5 percent of all jobs in Georgia); \$20 billion in output (sales); \$9.3 billion in state GDP (2.3 percent of Georgia's GDP); \$5.6 billion in income (earnings); and \$557 million in tax revenues for state and local governments. On average, for every direct job created by the life sciences, an additional 1.8 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 to the presence of the CDC in Atlanta.

The economic impact of Georgia's life sciences industry probably is most easily understood in terms of its effects on employment. In 2010, Georgia's life sciences supported 65,337 full- and part-time jobs. Of the 2010 total employment impact, 18,025 jobs represent direct employment in life sciences industries or the direct economic impact; 47,312 jobs constitute the indirect and induced effect of direct employment (spending), or the multiplier (re-spending) impact. Dividing the 2010 total job impact (65,337 jobs) by the direct job impact (18,025 jobs) yields an average multiplier value of 3.6. On average, for every job created directly by the life sciences, there are an additional 2.6 jobs that exist because of spending related to core life science categories. The high employment multiplier reflects both above-average salaries in many life sciences occupations as well as a relatively high degree of interaction between the life sciences and the state's overall economy.

The core life sciences group accounts for 72 percent of the total employment impact of life sciences industries, or 47,270 of the 65,337 jobs. Within this core, medical labs have the largest direct employment impact (4,159), but due to its very high employment multiplier (6.2), the pharmaceuticals and medicine manufacturing sector generates the largest total employment impact (19,191 jobs).

The agricultural life sciences group accounts for 28 percent of the total employment impact, or 18,067 of the 65,337 jobs. Within this group, other basic organic chemical manufacturing has the largest direct employment impact, but multiplier effects are higher in several other industries.

In addition to the employment impacts of the life science industries themselves, academic research and development generates a substantial employment impact. In 2010, the direct and total employment impacts of life sciences academic research and development were 7,783 jobs and 14,282 jobs, respectively. The job multiplier for academic R&D is 1.8, which is half the average multiplier of 3.6 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 the life sciences industry as a whole.

Altogether, the total employment impact of the life sciences sectors (65,337 jobs), academic research and develop-

ment (14,282 jobs), and the CDC (14,487 jobs) equals 94,106 jobs, or 2.5 percent of the state's total employment in 2010. The combined direct employment impact of the life sciences industries (18,025 jobs), academic research and development (7,783 jobs), and the CDC (7,551 jobs) equals 33,359 jobs, or 0.9 percent of total statewide employment. That's one out of every 113 jobs that existed in Georgia in 2010.

Measured in the simplest and broadest possible terms, the total output impact of Georgia's life sciences industry was \$16.7 billion in 2010. Of this, \$10.5 billion is direct spending by the companies that comprise the industry, while \$6.2 billion represents the indirect and induced effects of re-spending or multiplier effect (the difference between output impact and direct spending). The average output multiplier is 1.6, obtained by dividing the total output impact (\$16.7 billion) by direct spending (\$10.5 billion). On average, therefore, every dollar of direct spending by life sciences companies generates an additional 60 cents for Georgia's economy. Thus, the life sciences industry's output impact is 1.6 times greater than initial direct spending. Output multipliers that exceed 1.5 are considered to be relatively strong: all of Georgia's core life sciences sectors have output multipliers that are 1.5 or higher.

The core life sciences fields generate an output impact of \$9.9 billion, or 59 percent of the \$16.7 billion total output impact. Pharmaceutical and medicine manufacturing accounts for a major portion—\$5.6 billion, or 57 percent—of the output impact. Agricultural life sciences sectors generate an output impact of \$6.8 billion, or 41 percent of the total output impact.

According to the National Science Foundation, direct spending for academic life sciences R&D was \$773 million in FY 2010, which includes \$39 million in expenditures in bioengineering/biomedical engineering. Academic R&D spending therefore generated a total output impact of \$1.6 billion. The output multiplier was very strong—2.1. The total output impact of the CDC was \$1.7 billion in 2010, and the output multiplier was a hefty 1.9.

In total, the output impact of the life sciences industry (\$16.7 billion), academic research and development (\$1.6 billion), and the CDC (\$1.7 billion) was \$20 billion, which is larger than the output impact generated by the University System of Georgia (\$12.6 billion in 2010), but smaller than that of Georgia's forestry industry (\$23.6 billion).

State GDP (value added) impacts exclude expenditures related to foreign and domestic trade. Consequently, they pro-

vide a much more accurate measure of the actual economic benefits flowing to businesses and households in Georgia than the more inclusive output impacts. In 2010, the state GDP impact for Georgia's life sciences industry was \$6.9 billion. In addition to that amount, \$773 million in academic spending for life sciences R&D generated \$977 million, and the CDC generated \$1.4 billion in state GDP. Altogether, this amounted to \$9.3 billion, or approximately 2.3 percent of Georgia's 2010 state GDP.

The life sciences industry generated \$3.8 billion in labor income impacts, and life sciences academic R&D generated \$700 million in labor income. In addition, the CDC contributed another \$1.1 billion in labor income to the state's economy in 2010, and thus the three groups' combined economic impact on labor income was \$5.6 billion.

The impact of Georgia's life sciences industry on tax collections by state and local governments was \$417 million. In addition to this amount, life sciences academic R&D and the CDC generated tax collections of \$73 million and \$66 million, respectively.

The distribution of the employment impacts generated by the core life sciences group shows that the impacts are heavily concentrated in three sectors of Georgia's economy: services (67.4 percent); manufacturing (15.5 percent); and trade (12.2 percent) account for high percentages of the total employment impact attributable to life sciences' spending. Services (49.1 percent), manufacturing (16.7 percent), trade (14.4 percent), and TIPU (11 percent) primarily account for most of the employment impact attributable to spending by agricultural life sciences companies.

Direct employment in the life sciences industry was essentially the same in 2010 as it was in 2007: 18,025 jobs in 2010 versus 17,941 jobs in 2007. On the surface, this finding may not be too encouraging, but retaining all of the industry's direct jobs is quite impressive given the heavy job losses experienced by most of the state's major industries during the Great Recession. 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 companies added small numbers of jobs even as most industries were retrenching. The recent announcement that Baxter International will locate a new biopharmaceutical

(continued on page 14)

Table 3
Employment Impact of the Life Sciences Industry
on Georgia's Economy in 2010

Industry Sector	NAICS Code	Direct Employment (jobs)	Total Employment Impact (jobs)	Employment Multiplier
Core Life Sciences				
Pharmaceutical and medicine manufacturing	325400	3,089	19,191	6.2
Electromedical apparatus manufacturing	334510	83	270	3.3
Irradiation apparatus manufacturing	334517	154	443	2.9
Surgical and medical instrument manufacturing	339112	1,107	2,975	2.7
Surgical appliance and supplies manufacturing	339113	2,329	5,767	2.5
Research and development	541710	1,591	3,695	2.3
Medical laboratories	621511	4,159	8,900	2.1
Diagnostic imaging centers	621512	1,338	2,863	2.1
Blood and organ banks	621991	1,480	3,167	2.1
Total core sectors		15,330	47,270	3.1
Agricultural Life Sciences				
Wet corn milling	311221	0	0	0
Soybean processing	311222	184	2,091	11.4
Other oilseed processing	311223	325	3,693	11.4
Ethyl alcohol manufacturing	325193	206	1,026	5.0
Other basic organic chemical manufacturing	325199	767	3,818	5.0
Cellulosic organic fiber manufacturing	325221	193	536	2.8
Nitrogenous fertilizer manufacturing	325311	243	1,814	7.5
Phosphatic fertilizer manufacturing	325312	0	0	0
Fertilizer, mixing only	325314	200	1,493	7.5
Pesticide and other ag. chemicals	325320	577	3,596	6.2
Total agricultural life sciences sectors		2,695	18,067	6.7
Grand total, life sciences industry		18,025	65,337	3.6

Notes:

The U.S. Bureau of Labor Statistics provided estimates of direct employment, but to preserve confidentiality, direct employment for irradiation apparatus manufacturing, soybean processing, other oilseed processing, ethyl alcohol manufacturing, and cellulosic 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.

Table 4
Direct Spending, Output, State GDP, and Labor Income Impact of
the Life Sciences Industry on Georgia's Economy in 2010
(2010 dollars)

Industry Sector	Direct Spending	Total Output Impact	Total State GDP Impact	Total Labor Income Impact	Output Multiplier
Core Life Sciences					
Pharmaceutical & medicine mfg.	3,485,829,536	5,642,630,615	2,621,673,745	1,332,779,561	1.62
Electromedical apparatus mfg.	35,935,480	62,016,431	28,643,605	17,503,355	1.73
Irradiation apparatus mfg.	60,961,684	102,459,680	41,952,568	26,161,622	1.68
Surgical & med. instrument mfg.	340,881,600	582,638,940	320,335,780	178,322,210	1.71
Surgical appliance & supplies mfg.	750,259,392	1,200,194,399	733,797,050	350,516,129	1.60
Research & development	216,417,264	469,637,442	273,751,216	204,891,355	2.17
Medical laboratories	536,711,104	1,078,960,784	647,492,037	439,517,143	2.01
Diagnostic imaging centers	172,666,384	347,114,585	208,305,750	141,397,919	2.01
Blood & organ banks	190,991,216	383,953,343	230,413,130	155,948,270	2.01
Total core sectors	5,790,653,660	9,869,606,219	5,106,364,881	2,847,037,564	1.70
Agricultural Life Sciences					
Wet corn milling	0	0	0	0	0
Soybean processing	748,732,352	1,002,554,449	186,216,899	103,153,986	1.34
Other oilseed processing	1,322,489,216	1,770,816,307	328,915,726	182,201,337	1.34
Ethyl alcohol mfg.	248,674,336	364,892,042	105,321,602	63,899,810	1.47
Other basic organic chem. mfg.	925,889,408	1,358,602,909	392,144,030	237,918,230	1.47
Cellulosic organic fiber mfg.	98,753,656	147,257,577	44,896,955	30,710,716	1.49
Nitrogenous fertilizer mfg.	317,983,104	551,958,849	170,878,296	96,364,830	1.74
Phosphatic fertilizer mfg.	0	0	0	0	0
Fertilizer, mixing only	261,714,480	454,287,091	140,640,561	79,312,610	1.74
Pesticide & other ag. chemicals	761,709,952	1,197,875,257	412,005,043	199,444,451	1.57
Total ag. life sciences sectors	4,685,946,504	6,848,244,481	1,781,019,112	993,005,970	1.46
Grand total, life sciences industry	10,476,600,164	16,717,850,700	6,887,383,993	3,840,043,534	1.60

Notes: Impacts were estimated by the IMPLAN V3 Software System based on the estimates of direct employment reported in Table 3. 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 5
Impact of Georgia's Life Sciences Industry on Tax Collections
by State and Local Government in 2010
(2010 dollars)

Industry Sector	Total State and Local Tax Impact
Core Life Sciences	
Pharmaceutical and medicine manufacturing	144,562,477
Electromedical apparatus manufacturing	1,737,998
Irradiation apparatus manufacturing	2,604,584
Surgical and medical instrument manufacturing	17,074,743
Surgical appliance and supplies manufacturing	30,957,605
Research and development	16,191,572
Medical laboratories	38,848,572
Diagnostic imaging centers	12,498,051
Blood and organ banks	13,824,450
Total core sectors	278,300,051
Agricultural Life Sciences	
Wet corn milling	0
Soybean processing	14,931,784
Other oilseed processing	26,374,077
Ethyl alcohol manufacturing	9,387,512
Other basic organic chemical manufacturing	34,952,534
Cellulosic organic fiber manufacturing	3,200,227
Nitrogenous fertilizer manufacturing	13,415,708
Phosphatic fertilizer manufacturing	0
Fertilizer, mixing only	11,041,735
Pesticide and other ag. chemicals	25,721,426
Total agricultural life sciences sectors	139,025,002
Grand total, life sciences industry	417,325,053

Notes: Tax impacts were estimated by the IMPLAN V3 Software System, based on the estimates of direct employment reported in Table 3. The region was defined as the state of Georgia.

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

Table 6
Economic Impact of Georgia's Core Life Sciences Group
by Impacted Sector in 2010
(2010 dollars)

Impacted Sector	Total Output Impact	Total Employment Impact	Distribution of Jobs
Agriculture	11,226,733	97	0.2
Mining	1,315,816	6	0.0
Construction	48,541,215	441	0.9
Manufacturing	4,871,943,972	7,347	15.5
Transportation, Information, Public Utilities	229,751,636	1,378	2.9
Trade	583,626,936	5,762	12.2
Services	4,055,923,362	31,842	67.4
Government	67,276,549	397	0.8
Total, All Sectors	9,869,606,220	47,270	100.0

Notes: Excludes impacts generated by agricultural life sciences industries, which are reported in Table 7. 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 7
Economic Impact of Georgia's Agricultural Life Sciences Group
by Impacted Sector in 2010
(2010 dollars)

Impacted Sector	Total Output Impact	Total Employment Impact	Distribution of Jobs
Agriculture	72,811,304	891	4.9
Mining	4,192,219	22	0.1
Construction	44,055,469	398	2.2
Manufacturing	4,827,127,718	3,016	16.7
Transportation, Information, Public Utilities	416,868,950	1,996	11.0
Trade	298,127,978	2,603	14.4
Services	1,132,383,860	8,869	49.1
Government	52,676,982	272	1.5
Total, All Sectors	6,848,244,480	18,067	100.0

Notes: See Table 6. 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 8
Economic Impacts of the
Life Sciences Industry, Academic R&D, and the CDC
on Georgia's Economy in 2010

Impacted Category	Economic Impacts		Combined Impacts of Life Sciences Industry, R&D, and CDC
	R&D	CDC	
Direct employment (jobs)	7,783	7,551	33,359
Total employment impact (jobs)	14,282	14,487	94,106
Direct spending	772,957,000	879,202,752	12,128,759,916
Total output impact	1,614,551,985	1,690,801,576	20,023,204,261
Total state GDP impact	976,751,357	1,387,868,022	9,252,003,372
Total labor income impact	700,131,833	1,076,350,252	5,616,525,619
Total state & local government tax impact	73,298,050	66,400,676	557,023,779

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 (\$733,753,000) plus academic R&D expenditures in bioengineering/biomedical engineering (\$39,204,000).

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.

(continued from page 8)

manufacturing facility near I-20 east of Atlanta will help to ensure that life sciences will be an important force powering the recovery.

Although direct employment the life sciences held steady, the Selig Center's estimates show that direct spending associated with Georgia's life sciences companies rose by 11 percent between 2007 and 2010. Since inflation was very modest during this period, Georgia's life sciences companies produced significantly more output using the same number of employees.

Comparing the 2007 and 2010 total impact estimates (which include both indirect and induced impacts) show that there were increases in the overall economic impacts of the life sciences companies whether measured in terms of employment, output, GDP, or labor income. For example, between 2007 and 2010, the total output impact of Georgia's life sci-

ences companies rose by 4 percent. More encouragingly, the economic impact measured in terms of Georgia's GDP was 11 percent higher in 2010 than in 2007. The substantial increase in production, but not in terms of jobs within the life sciences industries themselves, suggests that productivity gains were significant for these industries.

Finally, the Selig Center's previous impact estimates for academic research and development—reported in the 2011 edition of *Shaping Infinity*—should not be compared directly to these new estimates because the earlier numbers exclude impacts arising from spending for bioengineering/biomedical engineering. After adjustment, it appears that total direct spending was about 12 percent higher in 2010 than it was in 2006; the output impact was about 18 percent higher; and the impact on GDP was about 16 percent higher. The employment impact was about 8 percent lower, however.

Baxter International

In April, the Georgia Department of Economic Development and Governor Nathan Deal announced that Baxter International will locate a new biopharmaceutical manufacturing facility near I-20 east of Atlanta. According to the official press release, the new facility will employ approximately 1,500 people when fully operational in 2018. Total investment by the company will exceed \$1 billion. Baxter International also will open several plasma centers, but the approximate number of jobs at these centers was not announced. Nonetheless, based on information from many sources, the Selig Center estimates that about 300 people will work at the plasma centers. In all, the new biopharmaceutical manufacturing facility and the new plasma centers will create 1,800 direct jobs in Georgia's core life sciences industry by 2018. Thus, the Baxter project's direct employment equals 10 percent of the 18,025 direct jobs that currently exist in Georgia's life sciences industry. This mega project should ensure that life sciences industry will continue to power Georgia's economy.

Baxter International's economic impact will be substantial, as Table 9 shows. Although the impact estimates are for 2018, all dollar amounts are expressed in 2012 dollars.

Due to high salaries and significant interactions with the local economy, multiplier effects are extremely high in plasma manufacturing. The analysis therefore indicates that 1,500 direct jobs in plasma manufacturing will create a total economic impact on statewide employment of 7,886 jobs. Indeed, for every job created directly at Baxter International's new facility, an additional 4.3 jobs will be created in Georgia because of spending related to that direct job. The annual (recurring) economic impact of the new facility on Georgia's economy will be \$2.1 billion in output, \$927 million in state GDP, and \$547 in labor income. In addition to the impacts generated by the manufacturing facility, the annual economic impact of the new plasma centers will be \$83 million in output, \$49 million in state GDP, \$34 million in labor income, and 652 jobs. The Selig Center did not estimate the one-time impact of over \$1 billion in new investment by Baxter International, but it will be substantial and will be especially helpful to the state's beleaguered construction industry.

Table 9
Potential Annual Economic Impacts of the Baxter International Facility
(in 2012 dollars)

Category	Total Manufacturing and Plasma	Biopharm Manufacturing Facility	Plasma Centers
Direct employment (jobs)	1,800	1,500	300
Total employment impact (jobs)	8,538	7,886	652
Direct spending	1,212,288,000	1,171,385,000	40,903,000
Total output impact	2,147,954,000	2,064,834,000	83,120,000
Total state GDP impact	976,682,000	927,241,000	49,441,000
Total labor income impact	580,387,000	546,743,000	33,644,000
Total state & local government tax impact	62,574,000	59,602,000	2,972,000

Notes: Direct employment estimates, obtained from the Georgia Department of Economic Development, reflect employment in 2018 when Baxter International's new facility is projected to be fully operational. The total state and local government tax impact is not reduced to reflect special incentives granted by state and local governments to land the Baxter project. Thus, the actual amount of revenue collected will be lower than the amounts reported. The impact estimates include only the annual (recurring) economic impact of the operations of the manufacturing facility and the plasma centers, and do not include one-time impacts associated with initial capital investment (spending) by Baxter International.

Indicators Overview

Labor Force

When measured by employment, none of the life sciences sectors covered in this study was larger in relation to other industries in Georgia than the U.S. average, but several strong-points emerge on the local level. Compared to the national average, medical laboratories provide a relatively large share of jobs in Atlanta. A large portion of jobs in Athens is provided by diagnostic imaging centers and biotechnology firms. In

Brunswick and Gainesville, relatively large numbers of workers have jobs in medical and diagnostic labs, and medicine manufacturing, respectively.

The life sciences industry needs specialized and qualified labor, ranging from research scientists to manufacturing workers. In several previous annual surveys conducted by the Selig Center, industry executives voiced their concern over the difficulty of finding qualified managers and technicians.

Table 10
Life Sciences Occupations in Georgia,
Employment and Pay, 2011

	Employment		Location Quotient*	Average Annual Wages	
	Number	Relative Standard Error (%)		Dollars	Relative Standard Error (%)
Food scientists; technologists	640	21.1	1.80	51,240	1.8
Soil and plant scientists	90	28.8	0.26	71,290	2.6
Biochemists; biophysicists	610	3.2	0.83	52,240	12.8
Microbiologists	660	0.2	1.26	86,920	1.7
Biological scientists, all other	700	2.7	0.76	69,870	1.5
Conservation scientists	200	4.9	0.36	67,930	1.8
Foresters	230	22.2	0.88	58,630	3.0
Epidemiologists	130	0.0	0.95	59,620	1.4
Medical scientists, exc. epidemiologists	640	11.8	0.23	76,230	4.1
Chemists	1,360	5.5	0.58	73,460	2.6
Environmental scientists, specialists, incl. health	1,720	6.6	0.70	57,670	3.5
Hydrologists	70	14.0	0.33	87,520	3.9
Agricultural and food science techs	470	19.2	0.93	31,300	1.6
Biological technicians	810	4.3	0.38	40,310	2.0
Chemical technicians	1,430	6.5	0.81	43,820	3.0
Environmental science, protection technicians, incl. health	540	10.3	0.61	41,710	2.1
Forensic science technicians	250	0.2	0.68	40,870	1.0
Forest and conservation technicians	270	7.9	0.30	41,490	1.0
All occupations	3,779,250	0.3	1.0	42,590	0.4

The location quotient is the ratio of the area concentration of occupational employment to the national average concentration. A location quotient greater than one indicates the occupation has a higher share of employment than average, and a location quotient less than one indicates the occupation is less prevalent in the area than average.

Source: U.S. Department of Labor, Bureau of Labor Statistics, Occupational Employment Statistics, 2011.

In the most recent survey, conducted in 2011, the executives were satisfied with the supply of technicians, but the shortage of specialized managers was still apparent.

At the state level, compared to the U.S. average, Georgia is noted for a relatively large group of food scientists and microbiologists in its labor force. The relatively small number of biological technicians and medical scientists may signal potential shortages, however.

On a more local level, with its high number of diagnostic imaging centers, biotechnology firms, and healthcare establishments, Athens emerges as the metropolitan area with the most microbiologists, agricultural and food science technicians, and conservation scientists. The concentrations of professionals in these occupations exceed both the U.S. and metropolitan area averages, which is significant, since professionals in life sciences occupations tend to concentrate in metro areas.

The concentration of medical scientists and chemical technicians in Augusta also exceeds both U.S. and metro-

politan area averages. In Augusta, jobs provided by hospitals comprise a relatively large portion of the economy. In Albany, hospitals also play a larger role in the local economy than in the U.S. on average. The area also reports many environmental scientists in its labor force.

An analysis of life sciences degrees granted by institutions in the University System of Georgia shows the numbers increased from 15.5 percent of the overall total in 2007 to 16.5 percent in 2011. The new degrees granted in health professions contributed to the almost 30 percent increase in that field. The number of degrees in bioengineering, biomedical engineering, and natural resources and conservation increased at the fastest pace. The number of degrees granted in all of the life sciences-related fields increased faster than the system average.

According to data from the National Science Foundation, 24 percent of all science and engineering doctorates awarded in Georgia in 2008 were granted in life sciences, a percentage slightly below the 27 percent U.S. average.

Table 11
Life Sciences Degrees Conferred by
University System of Georgia Institutions, 2011

	Degrees Conferred, 2011			2007-2011 Percent Change		
	Undergrad	Graduate/ Professional	Total	Undergrad	Graduate/ Professional	Total
Agriculture, ag. operations and related sciences	338	107	445	30.5	16.3	26.8
Natural resources, conservation	180	69	249	60.7	4.5	39.9
Biological, biomedical sciences	1,765	260	2,025	22.6	17.6	21.9
Health professions and related programs	4,413	1,580	5,993	26.2	34.9	28.4
Life sciences engineering total	218	98	316	78.7	38.0	63.7
Bioengineering, biomed engineering	155	44	199	70.3	18.9	55.5
Other life sciences engineering*	63	54	117	103.2	58.8	80.0
Life sciences totals	6,914	2,114	9,028	28.3	30.4	28.8
System totals	40,867	13,988	54,855	19.6	25.5	21.1
*Includes environmental health, agricultural, biochemical, and bio-systems engineering.						
Source: University System of Georgia, Degrees and Awards Conferred, FY 2007-2011.						

Patents

The number of granted patents is a useful measure of economic activity and innovation. The number of all utility patents issued to Georgians increased by 47.5 percent between 2007 and 2011, compared to 36.6 percent for the U.S. as a whole. The number of patents in life sciences-related fields increased at a much faster pace, but the increase in Georgia was slightly lower than in the U.S. as a whole (49.7 percent in Georgia compared to 51.5 percent in the U.S.).

The number of Georgia patents granted in the life sciences climbed from 177 in 2007 to 265 in 2011, and constituted

12.2 percent of all patents granted in Georgia during that period. In the U.S. as a whole, 15.4 percent of all patents granted during that time were related to life sciences.

Firms and universities are the main originators of life sciences patents in Georgia. Between 1990 and 2010, 60 percent of life sciences patents were granted to Georgia firms, added to by 30 percent of patents granted to Georgia's universities. Among academic institutions, Emory University, The University of Georgia, and Georgia Institute of Technology have produced the largest numbers of patents in life sciences-related fields.

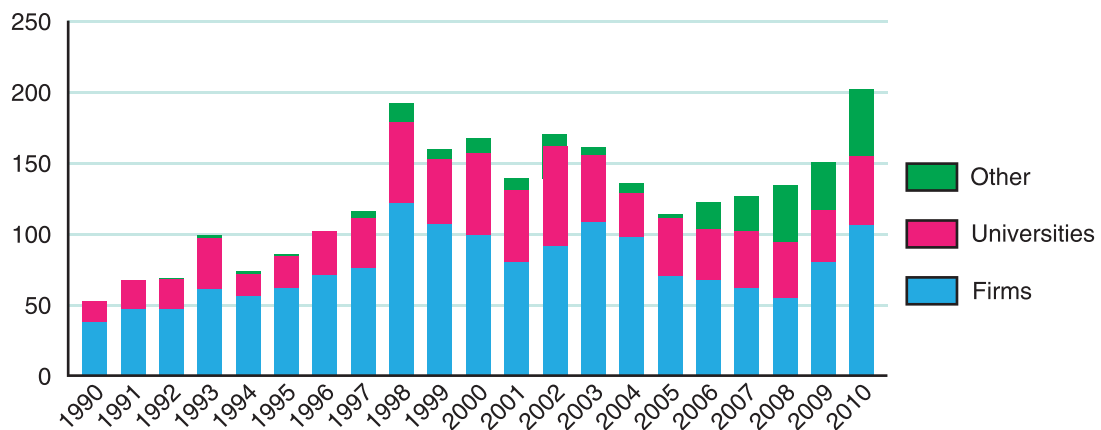
Table 12
Patents Granted in Life Sciences-Related Fields in Georgia, 2007-2011

Year	Number	Year-to-Year Change		Percent of All Patents	
		Georgia	U.S.	Georgia	U.S.
2007	177			13.5	14.9
2008	153	-13.6	-8.4	11.4	14.0
2009	154	0.7	9.9	10.9	14.5
2010	218	41.6	44.3	11.4	16.0
2011	265	21.6	4.4	13.7	16.6
Total	967	49.7*	51.5*	12.2**	15.4**

*2007-2011 percent change. **2007-2011 average.

Source: Based on The United States Patent and Trademark Office, General Patent Statistics Reports.

Number of Life Sciences Patents in Georgia, By Year Granted



Source: Based on Lynne G. Zuker and Michael R. Darby, COMETS Data Description, release 1.0, UCLA Center for International Science, Technology, and Cultural Policy, Los Angeles, CA, July 1, 2011.

R&D Activity

Georgia is ninth ranked among the states in population and labor force size, and the state's GDP ranks 11 in the nation. Historically, Georgia fared well, compared to the U.S. average, in terms of the number of high-tech businesses, high-tech business formations, and high-tech employment.

Compared to other states, Georgia underperforms in the portion of the state's GDP attributed to research and development, generating only about half of the U.S. average. Business R&D also falls at about the half of the U.S. average. Academic R&D does slightly better, however.

But this is only part of the story. In terms of absolute value, Georgia's R&D performance increased by 87.1 percent between 2000 and 2008 (most recent data available), compared to the 52.1 percent increase for the U.S. as a whole.

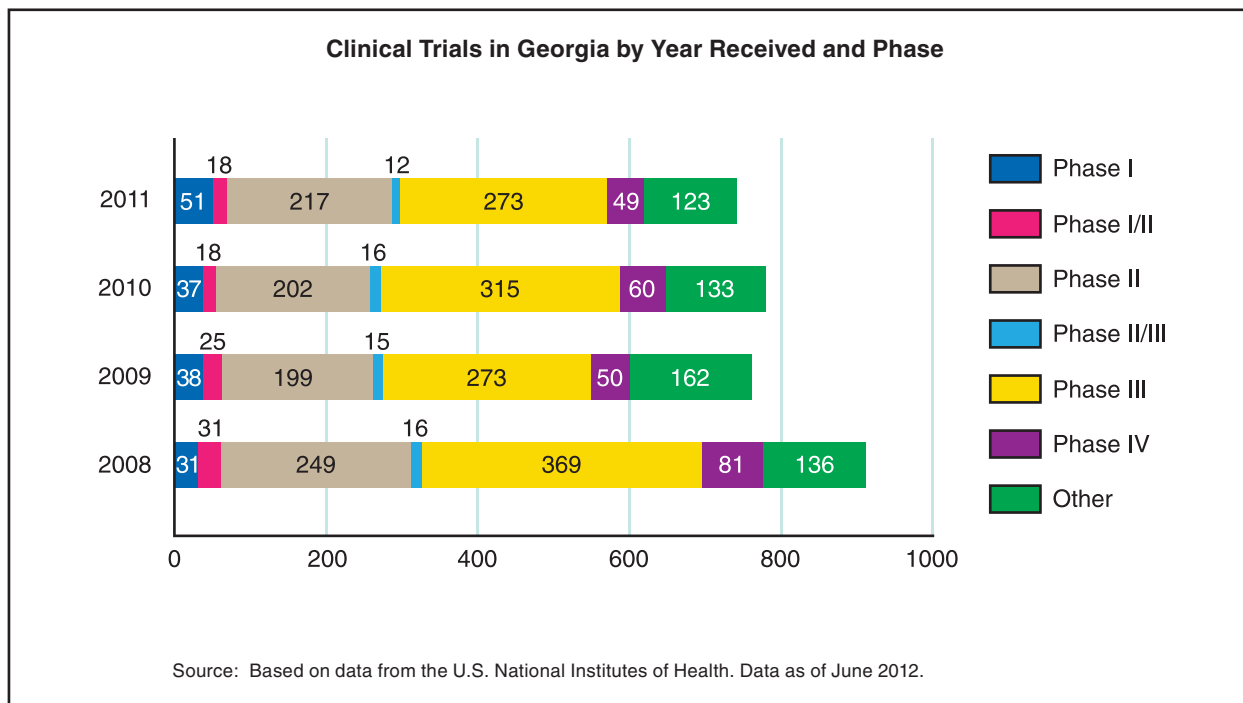
At 45 percent, R&D spending in life sciences constituted the largest portion of Georgia's academic R&D expenditures, but this was well under the 57 percent U.S. average. The 2010 expenditures in life sciences R&D ranked 16 among the states.

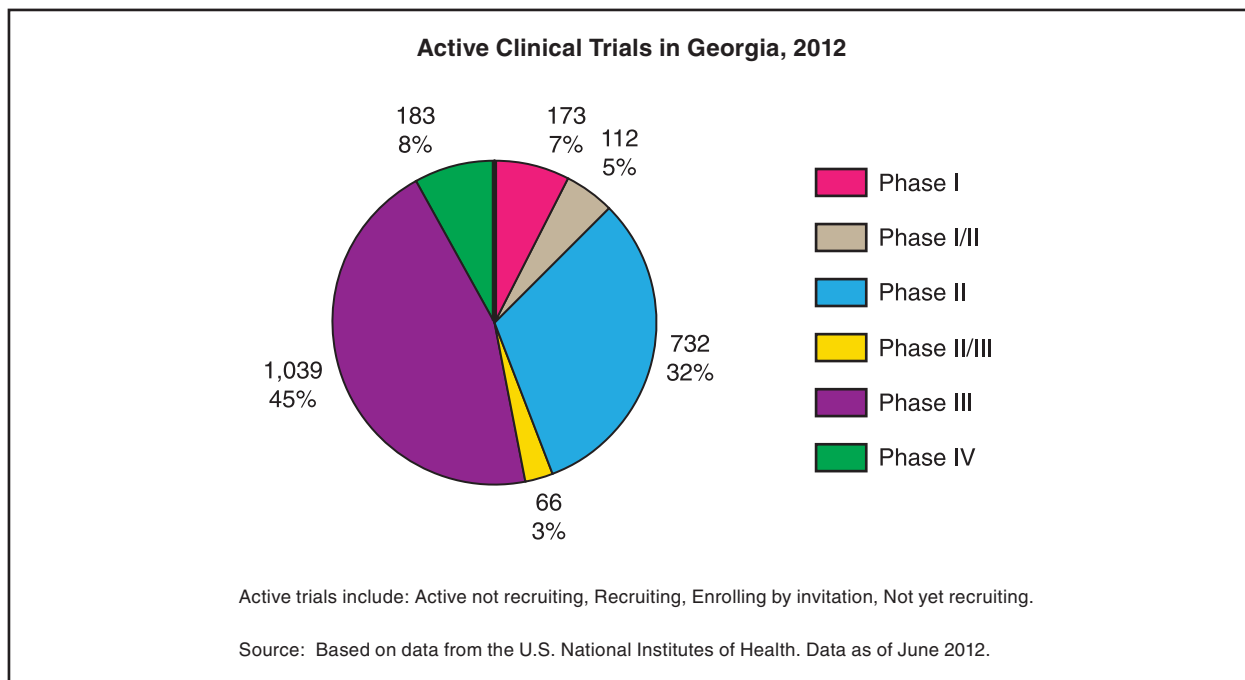
Academic research expenditures in bioengineering and biomedical engineering are fifth highest in the nation, however.

Clinical Trials

Clinical trials involve intensive R&D activity that utilizes a multifaceted array of skilled professionals and specialized infrastructure; therefore, the number of clinical trials performed in the state is an important indicator of the strength of life sciences industry. The number of clinical trial studies received for investigation in Georgia dropped from 913 in 2008 to 743 in 2011. The 18.6 percent drop was steeper than the 13.7 percent drop in the U.S. average, even though Georgia received more trials on a per-million residents basis.

In 2012, there are 2,886 clinical trial studies active in Georgia. Out of the 2,311 trials for which the trial phase data are available, Phase III trials comprised the largest group (45 percent), followed by Phase II trials, which made up 34 percent of the total.





Funding

Venture capital plays an important role in bringing young and promising companies' products to market. It also serves as an important indicator of the quality and strength of innovation-based industries. In 2010, Georgia ranked 13 in the nation with venture capital investment and then jumped two spots to rank 11 in 2011.

Funding has seesawed recently. Nearly a quarter of the 2010's \$80.8 million in VC was invested in life sciences firms (\$69.2 million in medical devices and \$11.6 million in biotechnology). A year later, the amount of capital invested in Georgia's life sciences companies dropped to \$36.2 million. In the first quarter of 2012, \$10.5 million was invested, far better than the estimated \$5.5 million invested in the first quarter of 2011.

According to the most recent report from the National Venture Capital Association, 15 percent of Georgia's total VC investment in 2010 came from VC firms headquartered here. In comparison, California, ranked first in VC investment, received 51 percent of VC investment from firms headquartered in that state. Second ranked Massachusetts drew 37 percent of its venture capital investment from VC firms headquartered

in-state. Georgia's neighbor North Carolina (rank 8) had 11 percent of its VC investment come from in state. On average, 20.5 percent of VC funding in the top-ranked states was raised in state.

Nationally, biotechnology firms typically receive more venture capital investment than devices firms do, but in Georgia the opposite is true. Since 2009, Georgia's medical devices firms attracted from 76 to 99 percent of the total life sciences VC investment. While venture capital investment in biotechnology plummeted from over \$40 million in 2008, to \$15 million in 2009 and \$11.5 million in 2010, medical devices investment rose from \$13.2 million in 2008 to \$47 million in 2009 and \$69 million in 2010. In 2011, however, funding for these two branches of the industry dropped, with only \$35.9 million raised, almost all of it by medical devices companies.

Life sciences firms reported an average of 10 deals per year between 2000 and 2012, with 81 deals reported by medical devices firms and 53 by biotechnology firms. Most capital invested in biotechnology since 2004 was for early stage development, while in medical devices, expansion and later stages garnered the most money. On the other hand, medical devices received more seed and startup funds between 2008 and 2011.

Table 13
Venture Capital Investments in Georgia, 2000-2011

Year	Biotechnology		Medical Devices		Life Sciences Total	
	Deals	Amount (\$)	Deals	Amount (\$)	Deals	Amount (\$)
2000	2	16,000,000	4	7,305,000	6	23,305,000
2001	2	2,200,000	6	39,295,000	8	41,495,000
2002	3	52,841,000	5	36,700,000	8	89,541,000
2003	2	20,546,000	1	13,999,900	3	34,545,900
2004	3	13,860,000	8	19,697,900	11	33,557,900
2005	10	24,909,000	7	71,474,800	17	96,383,800
2006	6	33,985,200	8	31,631,900	14	65,617,100
2007	4	39,307,000	11	68,433,700	15	107,740,700
2008	13	40,662,200	10	13,215,600	23	53,877,800
2009	4	15,002,000	7	47,050,900	11	62,052,900
2010	2	11,552,000	5	69,246,000	7	80,798,000
2011	2	329,000	7	35,859,800	9	36,188,800
2012 Q1			2	10,500,000	2	10,500,000

Source: PricewaterhouseCoopers/National Venture Capital Association, Money Tree Report, Thomson Reuters, June 2012.

Venture Capital Investment in Georgia's Life Sciences Companies



Source: Based on PricewaterhouseCoopers/National Venture Capital Association, Money Tree Report, Thomson Reuters, June 2012.

(continued on page 30)



Industry Insight

Special Articles Contributed by University and Industry Leaders



Industry Insight

Baxter International: Preparing for Success in Georgia

Chris Cummiskey
Commissioner
Georgia Department of Economic Development



For almost two decades, growing its biosciences industry has been a priority for Georgia. Even before the Commission for a New Georgia targeted the biosciences as a growth industry in 2004, the state was actively recruiting biosciences companies and building the infrastructure that would support it, most notably through the Georgia Research Alliance (GRA). During the last few years, we've significantly raised our profile by aggressively marketing the biosciences resources embodied in our universities and in groups like Georgia Bio, the Global Center for Medical Innovation, the Georgia Center of Innovation for Life Sciences, the Bioscience Leadership Council, and the Georgia Bioscience Commercialization Center. Through years of planning and with the assistance of these organizations and institutions and others like them, the state was honored to host the BIO International Convention in 2009 and continues to be a premiere sponsor at the industry's annual gathering. It is a testament to this collaborative, closely connected community that some of the top names in the industry have called Georgia home over the years: Merial, Dendreon, Sanofi-Aventis, Kimberly-Clark, CIBA Vision, Monsanto, UCB, Quintiles, and many more.

Baxter International's announcement in the spring of 2012 that it will locate a major pharmaceutical plant in Georgia is a watershed event in the development of our biosciences industry. The fact that this industry leader and household name chose Georgia following a global search for the site that best suited its business goals provides the most compelling case possible for other life sciences companies seeking a competi-

tive edge. We believe, simply, that Baxter's decision to invest over \$1 billion in the state and create over 1,500 jobs heralds a new era in Georgia's biosciences industry, one characterized by an increased cluster of companies in this field that will match or exceed the richness of our university resources for it.

Becoming known as a hub for biosciences is a goal sought by many states but achieved by very few. North Carolina, Massachusetts, and California have done an excellent job in marketing their assets. With Baxter's recent location in the state, our world-class research universities, 300 biosciences companies, educated workforce, Quick Start training program, and a logistics infrastructure that is unsurpassed, Georgia is uniquely poised to join this group. Atlanta is third in research facility space among all U.S. biosciences clusters. Our universities—Georgia Tech, UGA, Georgia Health Sciences University, Georgia State, Emory, Morehouse, and Mercer—are second to none, and the research coming out of them is groundbreaking. Emtriva, the world's most promising HIV/AIDS drug, was created here, and advances in neuroscience, cardiovascular medicine, immunology, veterinary medicine, regenerative science, diabetes, and many more areas of specialization are being made every day. The GRA's 44 world-renowned Eminent Scholars attract millions in federal and private dollars.

We are very proud of the work that these universities and biosciences companies are doing to save lives and improve the health and quality of life for people around the world. And we are proud that Baxter is now among them.

Baxter's arrival in Georgia also signals progress in the development of our workforce pipeline. Georgia already ranks among the top 15 states for overall bio-related occupational employment, and is one of the fastest growing in this field. We expect this pace to accelerate with the state-of-the-art biotech training center that Georgia Quick Start will build and operate to assist Baxter with its workforce requirements. This center will also build capacity and curricula within the Technical College System of Georgia to maintain a long-term pipeline of highly skilled employees who are well trained in bio-manufacturing operations. Because the biosciences industry pays higher-than-average wages for its workers, their families benefit from an enhanced quality of life, and our economy from increased activity.

Baxter's location in Georgia is good news for its clients, the company, its future employees and the state. We welcome this global leader to Georgia's fertile biosciences community and stand ready to help them both thrive.

Industry Insight

Medical Innovations and Partnerships That Make A Difference

Greg Duncan
*Executive Vice President and
President - North American Operations
UCB, Inc.*



At UCB, everything we do starts with a simple question: “How will this make a difference to the lives of people living with severe diseases?” We have a passionate, long-term commitment to discovering and developing innovative medicines that transform the lives of people living with severe diseases of the immune system and the central nervous system.

With a team of more than 8,500 employees and operations in over 40 countries, we are a Belgium-based, global biopharmaceutical company investing nearly 25 percent of revenue in cutting-edge scientific research to meet unmet patient needs. For many customers, we are known as “The Epilepsy Company,” having firmly established our leadership with two key drugs to treat this complex disease. We continue to advance our leadership positions in the areas of rheumatoid arthritis, Crohn’s disease, Parkinson’s diseases, and Restless Legs Syndrome with recently introduced treatments.

UCB established our first operations in Atlanta in 1995 with just 40 employees, not unlike many biotechnology companies. Today, we have grown to more than 400 people on our nearly 50-acre, Smyrna, Georgia campus. The site is home to the headquarters for our North America operations, which accounts for approximately 40 percent of UCB’s \$4 billion global business. While other companies in the industry are downsizing, we are expanding and adding key operations jobs to support the launch of several drugs, including Cimzia®, Vimpat® and Neupro®. UCB’s economic footprint in Georgia—representing the impact of our presence on the state—has grown to more than \$75 million.

Initially, UCB chose Atlanta as the location for our North American headquarters because it would be close to the chemicals facility the company owned in Augusta. The company

was beginning its evolution into a biopharmaceutical company and the city offered the opportunity to flourish both in the highly competitive North American pharmaceutical market as well as allowing us to continue our growth globally. Today we value the international transportation hub that Atlanta has become with direct access to Brussels.

We also value the great strides BIO, and state and local government leaders have made to attract the biotech industry to the state. The bill recently signed by Governor Nathan Deal allowing the State Employees' Pension Fund to invest in varied investment vehicles and the establishment of the Georgia Biosciences Commercialization Center will serve to enhance the environment and fuel the success of many more biotech companies and the overall growth of the industry.

In addition to Georgia's world-class health institutions, like the Centers for Disease Control and Prevention, as a biopharmaceutical company we see Georgia's world-class institutes of higher education as one of the strongest advantages the state has to offer. These academic research centers are originating groundbreaking biologic and genetics-based research that is enabling biopharmaceutical companies to develop working therapies from existing science quickly and efficiently.

As a result, UCB has redefined the way we work with academic research centers. The days are long past when companies like UCB conducted virtually all of their R&D—from basic research to full-scale development—in house. Today, UCB's core R&D model embraces strategic collaborations for sharing resources and knowledge while managing the risk associated with drug development. And we have one of the most robust pipelines in the industry to show for it. A recent analysis from Credit Suisse ranked UCB's pipeline and current portfolio highly in terms of good value for R&D investment.

These new, smarter partnerships are accelerating promising early stage science and delivering further innovation and science for the benefit of people suffering from chronic illnesses. Georgia is poised with its cutting edge academic research institutions and its life sciences community to nurture innovation that will not only result in economic growth but also improve the lives of patients and their families.

UCB's vision is to become the next generation biopharmaceutical leader based on the unique blending of innovation, entrepreneurship and experience. Our goal is to continue to bring breakthrough innovation and new medicines that will improve the lives of 1.7 million people coping with severe immunologic and central nervous system diseases by 2015. We are proud to call Atlanta our North American home and to be part of the efforts to further develop the state as a leader in the life sciences and biotech industry.

Industry Insight

Piedmont Heart Institute Exemplifies Breadth of Clinical Research in Georgia

*Charles Wilmer, M.D.
Board Chairman, Innovation Center
Piedmont Heart Institute*



The Piedmont Heart Institute (PHI) was formed in July 2008 and has grown into a multifaceted cardiovascular institute. There are 100 physicians, including cardiologists, thoracic, and cardiovascular surgeons, who all have a dream of improving patient care through innovation. Why is this important?

The number one reason for admission to a hospital for patients over 65 is congestive heart failure. In order to combat this, we devised a system of treatment to standardize care. Some patients fail medical therapy and will not live long enough to have a cardiac transplant. PHI innovated with mechanical supports, including a ventricular assist device (VAD), to help the heart pump blood as a way of improving its function. Dr. David Dean has placed 59 VAD pumps in offering this life saving therapy.

More than 50 million people have uncontrolled high blood pressure (blood pressure greater than 140/90). Many of these patients will require three or more medications for proper blood pressure control. PHI has joined an international research team to study the use of a catheter to ablate the nerves in the renal arteries. This will help reduce the blood pressure and allow medications to be reduced or stopped. This innovation may change the future of hypertension treatment for years to come. Patients from throughout the Southeast can enroll in this study.

There are other patients who have complex coronary disease. PHI has developed two innovations to help those patients with difficult heart blockages in their arteries. These patients are facing more and more medications or open heart surgery.

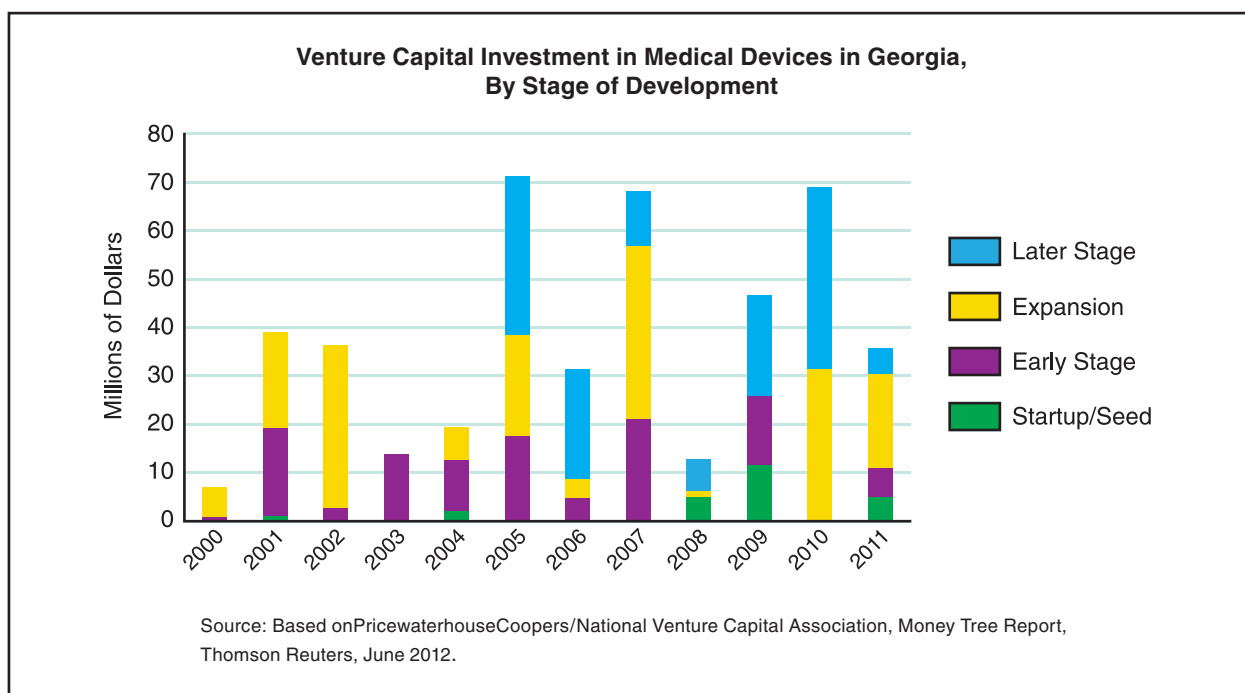
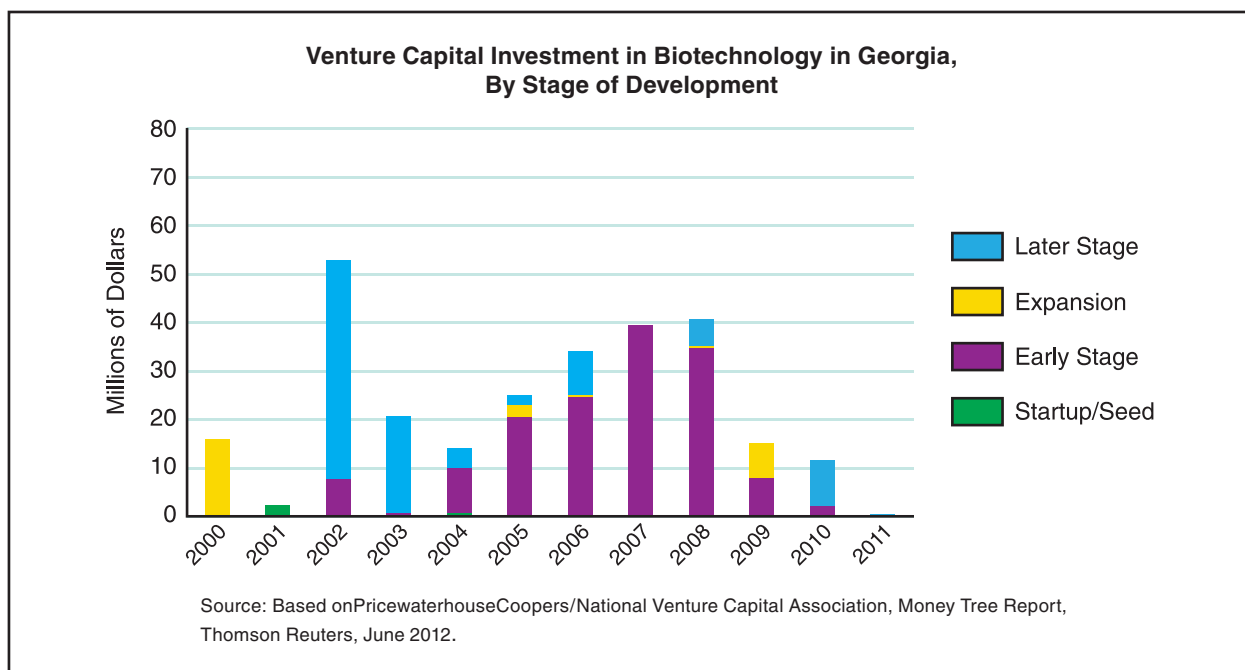
PHI is number one in the U.S. in an international clinical trial, under the direction of Dr. David Kandzari, to study placing drug-eluting stents in the left main artery versus open-heart surgery. We may be able to prove that it is safer to offer stents to some of these patients who otherwise are destined for surgery.

Some patients live with one blocked artery that doctors are unable to open. These patients continue to have chest pain despite medication. Traditionally, these chronic total occlusions (CTOs) are too difficult to open and are associated with a high failure rate. Through innovation, the doctors at PHI have developed a way to open these arteries to provide relief in a safe way. We are now the number one CTO center in the United States.

A new frontier in heart care revolves around the valves of the heart. PHI has received a \$20 million grant from the Bernie Marcus Foundation to build a National Valve Center. We are now repairing heart valves rather than replacing them. In the CoreValve trial, under the direction of Dr. Vivek Rajagopal, we are part of an international study to place a new aortic valve through the artery in the leg or upper extremity into the heart, to treat severe aortic stenosis (blockage of the aortic valve). These are patients who are felt to be at high risk for surgical repair. We are finding this less invasive approach to aortic valve replacement has been well tolerated so far.

These innovations, in addition to the research we are performing in patients with arrhythmias, such as atrial fibrillation, have catapulted the Piedmont Heart Institute to the level of a national heart center. We are proud to be part of Georgia's leaders in innovation. Stay tuned for the results of these exciting trials.

(continued from page 21)



2012 Life Sciences Questionnaire

The Selig Center identified 363 of the life sciences companies currently active in Georgia. For logistical reasons, only a small portion of the medical and diagnostic laboratories was included in the survey. The 2012 questionnaire was answered by 110 (30.6 percent) of the 363 companies. The information about 29 companies that answered last year’s survey, but failed to respond this year, was also tabulated. Counted together, survey responses were gathered from 139 (38.6 percent) life sciences firms included on the 2012 list. Data for the remaining 224 firms was gathered, when available, from publicly accessible sources.

The greater Atlanta metro area houses over half of the life sciences firms included in the 2012 list, and is the center of the life sciences industry in Georgia. Medical devices and pharmaceutical firms are the largest groups among life sciences firms in the Atlanta area, with concentrations—in equal proportions—in Atlanta and Alpharetta. Norcross and Kennesaw house large numbers of medical devices firms.

Outside of Atlanta, Athens and Augusta report sizable life sciences industry concentrations. While biotechnology

and pharmaceutical firms concentrate in Athens, Augusta is a center for diagnostics and medical device firms. Smaller concentrations of life sciences firms are located in Gainesville (pharmaceutical products) and Camilla (agricultural, biofuel, and environmental products).

Over half (56.9 percent) of the 295 life sciences companies—diagnostic, agricultural, devices, and biotechnology companies, in particular—for which data are available have been in business for over ten years. Only 10.9 percent of companies have been active in Georgia for less than three years.

Over 50 percent of the 328 companies for which employment data are available had between one to ten employees. Many biotechnology, biologics, and R&D firms fall within this range. Diagnostics and health IT companies tend to be larger, with most of them reporting a staff size of between 21 to 50 workers. Medical devices, pharmaceutical, and ag/chemical/environmental companies typically were small, but about 20 percent of these firms had 21 to 50 employees, and a few had staffs of 100 or more. ❖

Table 14
Georgia’s Life Sciences Industry Concentrations

Location	Number of Firms	Main Product Concentrations
Atlanta	85	Pharm, Dev
Alpharetta	26	Dev, Pharm
Athens	26	Pharm, Biotech
Norcross	24	Dev
Marietta	16	Pharm, Dev
Kennesaw	15	Dev
Augusta	14	Dev, Diag, Ag

Source: Selig Center for Economic Growth, University of Georgia, 2012.

Table 15
Life Sciences Companies in Georgia, by Primary Focus, 2012

Focus	Number of Companies
Medical devices (manufacturing, development, sales)	105
Pharmaceuticals (manufacturing, development, sales)	87
Diagnostics/Testing/Blood and Organ Banks	37
Biotechnology	23
Agricultural (manufacturing, development, sales)	15
Biologics (manufacturing, development, sales)	15
Health IT	14
Research and development/Platform technology	12
Medical and lab equipment	12
Biofuels	10
Chemical (manufacturing, development, sales)	9
Services/Marketing/Sales	8
Industrial	7
Environmental	5
Nanotechnology	2
Total	361

Source: Selig Center for Economic Growth, University of Georgia, 2012.

Table 16
Life Sciences Companies by Years of Business in Georgia, 2012

	Under 1	1-3	3-5	5-10	Over 10	Total
Devices/Medical and Lab Equipment	2	3	17	20	62	104
Pharmaceuticals	1	10	8	14	32	65
Agricultural/Chemical/Environmental/Industrial		2		7	23	32
Biotechnology		2	4	3	10	19
Biologics		2	1	2	7	12
Diagnostics/Testing/Other Labs		2		4	21	27
Research and Development		2	2	2	5	11
Health IT				6	3	9
Biofuel	1	3		2	2	8
Sales/Services		2	1	1	3	7
Nanotechnology				1		1
Total	4	28	33	62	168	295

Data tabulated for 295 companies for which employment data were collected.

Source: Selig Center for Economic Growth, University of Georgia, 2012.

Table 17
Life Sciences Companies by Employment Size in Georgia, 2012

	1-10	11-20	21-50	51-100	101-250	Over 250	Total Firms
Devices/Medical and Lab Equipment	52	10	19	9	10	8	108
Pharmaceuticals	39	12	16	5	6	0	78
Agricultural/Chemical/Environmental/Industrial	12	7	7	4	5	0	36
Biotechnology	20	1	1	0	0	0	22
Biologics	11	1	2	0	1	0	15
Diagnostics/Testing/Other Labs	9	2	14	1	7	0	33
Research and Development	7	2	1	0	0	0	10
Health IT	2	1	4	1	0	1	9
Biofuel	7	0	0	1	0	0	8
Sales/Services	6	2	0	0	0	0	7
Nanotechnology	2	0	0	0	0	0	2
Total	167	38	64	21	29	9	328

Data tabulated for 328 companies for which employment data were collected.

Source: Selig Center for Economic Growth, University of Georgia, 2012.

Appendix

LIST OF COMPANIES

Company	Location	Product/Focus
1st America Prescription Drugs	Valdosta	PHARM/DEV
1st American Infusion Services, LLC	Valdosta	PHARM/MEDEQ
3dmd, LLC	Atlanta	HI
A & L Shielding, Inc.	Rome	DEV
Abare Enterprises, Inc.	Forsyth	DEV
ABC Compounding Co., Inc.	Atlanta	AGR/CHEM
Abeome, Inc.	Athens	BIOTECH/R&D
Accellent, Inc.	Trenton	DEV/IND
Access Product Marketing, LLC/Can-Am Care	Alpharetta	PHARM/DEV
Accuitive Medical Ventures (AMV)	Duluth	V C
Acella Pharmaceuticals, LLC	Alpharetta	PHARM
Adaptive Mobility Systems, Inc.	Norcross	DEV
Adenopaint, LLC	Atlanta	DEV
Aderans Research Institute	Marietta	PHARM
Advanced Applications Inst./National Diagnostics	Atlanta	PAHRM/DIAG
Advanced Bio-Technologies	Suwanee	PHARM
Advanced Herbaceuticals, LLC	Atlanta	PHARM
Advanced Technology Pharmaceuticals Corporation	Dacula	AGR/CHEM
Agra-Med International, LLC	Cleveland	AGR/BIOL
Agri Biofuels, Inc.	Camilla	BIOFUEL
Agrinostics, Inc.	Watkinsville	PHARM
Ajay North America, LLC	Powder Springs	CHEM
AKESOgen	Norcross	RES/DIAG
Alaven Pharmaceutical, LLC/Meda Pharmaceuticals	Marietta	PHARM
Alcon (formerly CIBA Vision Corp.)	Duluth	DEV
Algae Bioenergy Solutions	Martinez	BIOFUEL
Alimera Sciences, Inc.	Alpharetta	PHARM
Allergan, Inc.	Atlanta	PHARM
Alliance Bio-Medical	Duluth	R&D/PHARM/RES
Alpha Omega Co. USA, Inc.	Alpharetta	DEV/MED EQ
Alternative Cellular	Marietta	BIOL
Altiris Therapeutics	Atlanta	PHARM
Ambit Corporation	Gainesville	DEV
Amendia, Inc.	Marietta	DEV/BIOL/HI
American Biosurgical, LLC	Norcross	DEV
Analytical Development, Inc.	Lawrenceville	LABEQ/DEV
Angiodynamics	Manchester	DEV

Company	Location	Product/Focus
Angionics	Athens	PHARM
Any Test, Inc.	Kennesaw	DIAG
Apeliotus Technologies, Inc.	Atlanta	DEV
APICA Cardiovascular, Inc.	Atlanta	DEV
Applied PhytoGenetics, Inc. (APGEN)	Athens	IND/AGR
AptoTec	Athens	PHARM
Aqua Solutions, Inc.	Jasper	AGR
Arbor Pharmaceuticals, Inc.	Atlanta	PHARM
Archaea Solutions	Tyrone	DIAG
Argent Diagnostics, Inc.	Athens	R&D/BIOTECH/DIAG
Aruna Biomedical	Athens	R&D
Athens Research and Technology, Inc.	Athens	BIOL
Atlanta Biologicals, Inc.	Lawrenceville	BIOL
Atlanta Center for Medical Research	Atlanta	PHARM/R&D
Atlanta Health Care Services	Atlanta	DEV
Atlanta Pathology Professional Association	Atlanta	DIAG
Atlanta Research Laboratory Supplies, Inc.	Atlanta	DEV/IND/AGR/R&D
Attain Med, Inc.	Atlanta	PHARM/DEV
Augusta Laboratory, Inc.	Augusta	DIAG
AuraZyme Pharmaceuticals, Inc.	Kennesaw	R&D/DEV
Axion Biosystems	Atlanta	R&D
Axona/Axotect	Atlanta	BIOTECH
Bard Medical Division (C.R. Bard)	Covington	DEV
Bard Urological Division (C.R. Bard)	Covington	DEV
Bayer Cropscience, LP/Woodbine Formulation Plant	Woodbine	AGR
Becton, Dickinson - Lee Laboratories	Grayson	DEV/BIOTECH/BIOL
Best Vascular/Novoste Corporation	Norcross	DEV
Beximco Pharmaceuticals USA	Suwanee	PHARM
Bimeco Group	Peachtree City	DEV/SALES
Bioanue Laboratories, Inc.	Rochelle	AGR
BioAutomaton Systems, Inc. (BSI)	Atlanta	R&D
Biocide Labs, LLC	Cumming	SERV
Biofisica, Inc.	Duluth	DEV
BioMed Design, LLC	Dunwoody	DEV
Biomedical Consultant Group, Inc.	Albany	R&D
Bioniche Animal Health USA, Inc.	Athens	BIOL/AGR/BIOTECH
Bio-Plus, Inc.	Madison	AGR/BIOFUEL
Bioprogress Technology International	Atlanta	R&D/BIOTECH
Biosystems America, Inc.	Cumming	PHARM/DIAG/BIOL
Biotest Pharmaceuticals	Athens	PHARM
Black & Black Surgical, Inc.	Tucker	DEV
Body Surface Translations, Inc.	Athens	DEV

Company	Location	Product/Focus
Bracy Analytics, Inc.	Marietta	RES/SALES/HI
Braegen Pharmaceuticals Company	Atlanta	PHARM
Brasseler USA, Inc.	Savannah	DEV
Brettech Alternative Fuel, Inc.	Tifton	BIOFUEL
Bristol-Myers Squibb	Atlanta	PHARM
Bruder Healthcare Company	Alpharetta	DEV
Burdock, Inc.	Griffin	DEV
C A P S Pharmacy	Norcross	PHARM
C. H. Martin Company	Atlanta	DEV
C2 Biofuels, Inc.	Atlanta	BIOFUEL
Caire Inc./Chart Biomedical Group	Ball Ground	DEV
Cannopi Pharma, LLC	Alpharetta	PHARM
Cardiac Regeneration Technologies, LLC	Woodstock	R&D
Cardio Analysis	Savannah	DIAG/DEV
CardioMEMS, Inc.	Atlanta	DEV/IND
Carlyle Health Element	Decatur	IND/CHEM
Carticept Medical, Inc.	Alpharetta	DEV
Celgenomics, LLC	Martinez	BIOTECH/R&D
Cell Constructs	Atlanta	R&D/DEV
Celtaxsys, Inc.	Atlanta	R&D
Century Systems, Inc.	Atlanta	PHARM
Cerebral Vascular Applications, Inc.	Duluth	DEV
ChemoCore, Inc.	Atlanta	PHARM
Chemtronics, Inc.	Kennesaw	CHEM
CIS Biotech, Inc.	Decatur	R&D
Claro Chemical Corporation	Alpharetta	NANOTECH
Clinical Laboratory Services	Winder	DIAG
Clinisys Associates, LLC	Atlanta	BIOL
CorMatrix Cardiovascular	Alpharetta	DEV
Covidien/Kendall Healthcare	Augusta	DEV
CryoLife, Inc.	Kennesaw	DEV
CSI Laboratories	Alpharetta	DIAG
Cyan Bio, Inc.	Athens	BIOL
D S M Nutritional Products, LLC	Pendergrass	PHARM
Danimer Scientific, LLC	Bainbridge	IND
Datta ImmunoChem.Inc (DIC)	Evans	BIOTECH
Dendreon	Union City	PHARM
Deobiosciences, Inc.	Lilburn	BIOTECH/R&D
Digital Vision	Atlanta	HI
Dornier MedTech America	Kennesaw	DEV
Dynamic Adsorbents, Inc.	Norcross	CHEM
Eckert&Ziegler Analytics, Inc.	Atlanta	LABEQ/DEV

Company	Location	Product/Focus
ECO Solutions, LLC	Chatsworth	ENV
Effcon Laboratories, Inc.	Marietta	PHARM/R&D/DEV
Effigene Pharmaceuticals	Atlanta	PHARM
EKA Chemicals, Inc.	Augusta	CHEM
Elan Pharmaceuticals/Alkermes	Gainesville	PHARM
Elanco/Augusta Elanco Technology Center	Augusta	BIOL
Elekta Holdings, U. S., Inc.	Norcross	DEV
Encompass Pharmaceutical Services, Inc.	Norcross	SERV
EnerGaia, Inc.	Atlanta	AGR/IND
Enterpriseone Pharmaceutical	Marietta	BIOL
Envisionier Medical Technologies	Woodstock	DIAG/DEV/R&D
Enzymatic Deinking Technologies, LLC (EDT)	Norcross	IND/CHEM
EPD Pharma Solutions	Alpharetta	PHARM/R&D
Equinox Chemicals, LLC	Albany	CHEM/SALES
ERBE USA, Inc.	Marietta	DEV
Ethicon	Cornelia	DEV
Evirx, LLC	Athens	HI
Exelan Pharmaceuticals, Inc.	Peachtree City	PHARM
Expression Therapeutics, LLC	Tucker	PHARM/BIOTECH
ExtRx Corporation	Roswell	SERV/PHARM
Facet Technologies, LLC (Div. of Matria Healthcare)	Kennesaw	DEV
Femasys	Suwanee	DEV/MEDEQ
First United Ethanol	Camilla	BIOFUEL
FOB Synthesis, Inc.	Kennesaw	PHARM/R&D
Fortec Medical	Norcross	DEV
Freedom Pines Biorefinery/LanzaTech	Soperton	BIOFUEL/R&D
Gallegos Bio-Pharma Consultants, LLC	Kennesaw	BIOTECH/PHARM
GE Healthcare	Atlanta	PHARM
Gene Probe, Inc.	Atlanta	BIOINF
GeneCure Biotechnologies	Norcross	BIOTECH
Genentech	Atlanta	PHARM
Genesis Biosciences	Lawrenceville	BIOL
Georgia Alternative Fuels, LLC	Dublin	BIOFUEL
Georgia Biomass/RWE Innology	Savannah	BIOFUEL
GeoVax, Inc.	Smyrna	PHARM/BIOTECH/R&D
GF Health Products, Inc.	Atlanta	MEDEQ
Given Imaging, Inc.	Duluth	DEV
GLASS HORSE PROJECT, LLC	Athens	HI
Glaxosmithkline, LLC	Columbus	PHARM
Global Plasma Solutions	Savannah	BIOL
Global Resources International	Flowery Branch	DEV
Glycoscientific	Athens	R&D/SERV

Company	Location	Product/Focus
Glycosensors and Diagnostics, LLC	Athens	R&D/BIOTECH/PHARM
Grace Labs, LLC	Atlanta	DIAG
Guided Therapeutics	Norcross	DEV
Gulmay Medical, Inc.	Suwanee	DEV/IND
Halscion, Inc.	Suwanee	DEV
Health Discovery Corporation	Savannah	DIAG/R&D
HealthByConnect	Kennesaw	HI
Healthtronics Laboratory Solutions	Augusta	DIAG
Histology Services Company	Stone Mountain	DIAG
Howmedica/Gasperini & Associates	Macon	DEV
ICON Interventional Systems®	Atlanta	DEV/DIAG
Iconic Therapeutics, Inc.	Atlanta	BIOL
Imiren Pharmaceuticals, Inc.	Forest Park	PHARM/BIOL
Immucor, Inc.	Norcross	DIAG/BIOL
Inhibikase Therapeutics, Inc.	Atlanta	PHARM/R&D
Inhibitex, Inc./BristolMyerSquibb	Alpharetta	PHARM
Innogenetics, Inc.	Alpharetta	BIOTECH/DEV
Innovation Factory	Duluth	DEV
Innovative Medical Robotics	Atlanta	DEV
Insectigen	Athens	AGR
Integrated Science Systems	Augusta	DEV/MEDEQ
International Plant Nutrition	Norcross	AGR
InVasc Therapeutics, Inc.	Tucker	PHARM
Ketal Biomedical, Inc.	Atlanta	PHARM
Kiel Laboratories, Inc.	Gainesville	PHARM
KPS Technologies	Atlanta	CHEM/R&D
Laboratory Corporation of America	Columbus	DIAG
Lazarus Enterprises, Inc.	Cartersville	PHARM
Lee Laboratories/BD	Grayson	DIAG/DEV
Level Four Orthotics	Austell	DEV
Libertas Pharma, Inc.	Lawrenceville	PHARM
Life Alarm Services, Inc.	Augusta	MEDEQ
Life Science Partner	Atlanta	SERV
Logos Nutritionals/Preventive Therapeutics, Inc.	Snellville	PHARM
Lucky Seven Botanica Corporation	Lithonia	PHARM
LumaMed	Johns Creek	DEV
Luminomics, Inc.	Augusta	RES/PHARM/SALES
Lynrose Labs, LLC	Suwanee	PHARM
Mab Technologies	Stone Mountain	BIOTECH
Magnesium Direct, Inc.	Alpharetta	PHARM
Matrix Surgical Holdings, LLC	Atlanta	DEV
McKesson Information Solutions, LLC	Alpharetta	HI/SERV

Company	Location	Product/Focus
MD Innovate, Inc.	Decatur	DEV/DIAG/MEDEQ
Mddatacor, Inc.	Alpharetta	DEV
Medical Device Development Group, LLC	Gainesville	DEV
Medical Edge Technologies, Inc.	Atlanta	SERV
Medical Neurogenetics, LLC	Atlanta	DIAG
Medical Specialty Innovations	Alpharetta	LABEQ
Meditech	Atlanta	HI
MedQuest Associates	Alpharetta	DIAG
Medshape Solutions, Inc.	Atlanta	DEV/R&D
Medtronic, Inc.	Atlanta	DEV
Meredian, Inc.	Bainbridge	IND
Merial Limited	Duluth	BIOL/AGR
Merial Select	Gainesville	PHARM/BIOL/AGR
Metabolic Testing Services, Inc.	Atlanta	DIAG/RES
Metaclipse	Atlanta	PHARM/BIOTECH
Metamatrix, Inc.	Duluth	CLINICAL LAB
Metro Vascular, PC	Decatur	DIAG
Micro-Macro International, Inc.	Athens	R&D
Microtek Medical Holdings, Inc.	Alpharetta	DEV
Middle Georgia Biofuels, Inc.	Dublin	BIOFUEL
Mikart, Inc.	Atlanta	PHARM
Millennium Cryogenics, Inc.	Athens	BIOTECH/BOB
MiMedx Group, Inc.	Kennesaw	DEV/BIOMATERIALS
Molecular Therapeutics, LLC	Athens	PHARM
Mölnlycke Health Care U.S.	Norcross	DEV
Monsanto Company	Tifton	CHEM
Myelotec	Roswell	DEV
Nanli Laser Supply, LLC	Atlanta	DEV
Nanomist Systems, LLC	Macon	DEV
National Diagnostics, Inc.	Atlanta	DIAG
NDC Health Corporation/McKesson	Atlanta	HI
NEBA Health (formerly Lexicor Medical Technologies)	Augusta	DEV/DIAG
Neural Signals, Inc.	Duluth	R&D
NeuroMatrix Group/Southern Neurophysiology, LLC	Alpharetta	DIAG
NeurOP	Atlanta	PHARM
NeuroTrials Research, Inc.	Atlanta	PHARM/DEV/R&D
Newton Laboratories, Inc.	Conyers	PHARM
Noramco, Inc.	Athens	PHARM/DEV/CHEM
North American Bioproducts	Duluth	IND
Nuvision Pharmaceuticals, LLC	Atlanta	PHARM
Octogen Pharmacal Co Inc/Pharmacal	Cumming	PHARM
Omega Bio-Tek, Inc.	Norcross	LABEQ/R&D

Company	Location	Product/Focus
Omni International, Inc.	Kennesaw	LABEQ
Oncose, Inc.	Athens	PHARM
Oncovaxine, LLC	Atlanta	BIOTECH
OpenCell Technologies, Inc.	Atlanta	R&D
Opti Medical Systems	Roswell	DEV
Opti-Medical (formerly Roche Diagnostics)	Roswell	LABEQ
Osmotica Pharmaceutical Corporation	Marietta	PHARM
P3 Laboratories	Winder	R&D
Pajunk Medical Systems, LP	Tucker	DEV
Pathens, Inc.	Athens	BIOTECH
Pathogen Control Associates	Norcross	ENV/DIAG
Peat Fuel Company	Ludowici	BIOFUEL
Petnet Solutions, Inc.	Atlanta	DIAG
Petnet Solutions, Inc./Siemens	Atlanta	PHARM/NUCMED
Pfeiffer Pharmaceuticals	Atlanta	PHARM
Pfizer	Marietta	AGR
Planteco Environmental Consultants	Athens	ENV
Plasma Surgical, Inc.	Roswell	DEV
Porex Porous Products Group/Porex Technologies	Fairburn	DEV
Prayon, Inc.	Augusta	AGR
Prentiss/ENIVCIO, LLC	Sandersville	CHEM/IND/AGR
Prizm Medical, Inc.	Oakwood	MEDEQ
Pti Royston, LLC	Royston	DEV
Pyramid Plasmas, LLC	Lawrenceville	BIOL
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
RayBiotech, Inc.	Norcross	DIAG/R&D/BIOTECH
Reach Health, Inc.	Alpharetta	HI/DEV
Recombinant Peptide Technologies, LLC (rPeptide)	Bogart	BIOTECH
Reddy Chemtech, Inc.	Kennesaw	CHEM/R&D
Relax-A-Cizor Products, Inc.	Atlanta	DEV
Remel, Inc./Thermo Fisher	Norcross	DIAG/DEV
Renovo Research	Atlanta	R&D/PHARM
Research Think Tank, Inc.	Buford	DIAG
Respironics Inc (Philips)	Kennesaw	DEV
Retinalabs	Atlanta	DEV
Revogenex, Inc.	Winder	PHARM
RFD Technology	Atlanta	DEV
RFS Pharma	Tucker	R&D/PHARM

Company	Location	Product/Focus
Rhodia Inc/Solvay	Winder	IND
Ripple Management, Inc.	Atlanta	SERV
Rx Specialty Services, Inc.	Ellijay	PHARM
S S S Company	Atlanta	PHARM
Salutria Pharmaceuticals, LLC	Alpharetta	PHARM
Sanguine Corportion	Roswell	DEV
Sanofi-Aventis/Genzyme	Forest Park	PHARM
Sanuwave Services, LLC	Alpharetta	DEV
Schering-Plough/Merck	Suwanee	PHARM/SALES
Scientific Adsorbents (Div. of Apyron Technologies, Inc.)	Atlanta	IND
Sebacia, Inc.	Duluth	DEV
Sebia, Inc.	Norcross	DEV/LABEQ
Sector Electronics, LLC	Marietta	DEV
Sero-Immuno Diagnostics	Tucker	DIAG
Siemens Healthcare Diagnostics	Atlanta	DIAG/BIOL/DEV
Siemens Medical Solutions USA, Inc., Ultrasound Div.	Alpharetta	DEV
Sigvaris, Inc.	Peachtree City	DEV
Skalar	Buford	LABEQ/SALES
Sleepmed, Inc.	Jonesboro	DIAG
Sleepmed, Inc.	Kennesaw	DIAG
Smisson Cartledge Biomedical	Macon	DEV
Snowden Pencer, Inc.	Tucker	DEV
SoloHealth	Duluth	HI/DEV/R&D/SALES
Solstas Lab Partners (formerly Doctors Laboratory)	Valdosta	DIAG
Southeast Regional Research Group, Inc.	Columbus	RES/SALES/PHARM
Spectropath, Inc.	Atlanta	DEV/R&D
Spheringenics, Inc.	Atlanta	BIOTECH
Splash Medical Devices, LLC	Atlanta	DEV
Sterimed, Inc.	Cartersville	DEV/MEDEQ
Stradis Medical, LLC	Lawrenceville	DEV
Stryker CMF/Porex Surgical, Inc.	Newnan	DEV
Sub-Micro	Atlanta	BIOTECH
Summit Industries, Inc.	Marietta	PHARM/AGR
Sunbelt Medical Services, Inc.	Sardis	SALES
Super Nova Manufacturing	Camilla	ENV/MED EQ
Surgical Biologics, LLC	Kennesaw	DEV
Synageva Biopharma (formerly Avigenics)	Athens	BIOTECH/PHARM
Syntermed, Inc.	Atlanta	HI
TAP Pharmaceuticals (Takeda Pharmaceuticals Intl.)	Atlanta	PHARM
Technical Products, Inc. of Georgia, USA	Lawrenceville	DEV
Technical Services Group, Inc.	Lawrenceville	IND/DEV
Technology Resource International Corporation (TRI)	Alpharetta	DEV

Company	Location	Product/Focus
The Nutrasweet Company	Augusta	AGR
Theragenics Corporation	Buford	DEV/PHARM
Thione International, Inc.	Atlanta	PHARM
Throwleigh Technologies, LLC	Milton	DEV
Tiber Laboratories, LLC	Suwanee	PHARM
Tissue Regeneration Technologies, LLC	Woodstock	R&D/DEV
Titermax USA, Inc.	Norcross	BIOL
Transfusion & Transplantation Technologies, Inc.	Atlanta	DEV/DIAG
Triad Isotopes	Norcross	NUCMED
Trs Labs, Inc.	Athens	PHARM/DIAG
UCB, Inc.	Smyrna	PHARM
Unisplint Corporation	Norcross	MEDEQ
United Medical Enterprise, Inc.	Augusta	MEDEQ
Velocity Medical Solutions, LLC	Atlanta	HI
VersaPharm, Inc.	Marietta	PHARM
Viacyte/BresaGen, Inc./Novocell, Inc.	Athens	BIOTECH
Vigilant Biosciences, Inc.	Norcross	DEV/LABEQ
Visioneering Technologies, Inc.	Alpharetta	DEV
Vitalabs, Inc.	Jonesboro	PHARM
Vitamin Derivatives, Inc.	Winterville	AGR
Vivebio, LLC	Lawrenceville	BIOTECH/BIOL
Vivonetics, Inc.	Atlanta	NANOTECH
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
Xytex Cryo International, Ltd.	Augusta	BOB
Z Technologies, LLC	Atlanta	DEV
Zenda Technologies	Roswell	BIOTECH
Zirus, Inc.	Atlanta	BIOTECH/PHARM

The list of companies was compiled based on publicly available sources. Company status was verified against the Georgia Secretary of State's Corporations Division database; and addresses were verified by mailing the 2012 life sciences questionnaire to the address listed for each company. While every effort was made to identify most of the companies that comprise the life sciences industry, some important firms may have been omitted inadvertently.

AGR	Agricultural, food, nutrition (human and animal)
BIOFUEL	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
LABEQ	Laboratory equipment and supplies
MEDEQ	Medical equipment and supplies
NUC MED	Nuclear medicine
PHARM	Pharmaceutical, biopharmaceutical, therapeutics (including veterinary)
RES	Research
R&D	Research and development, platform technology, product discovery
SERV	Services
VC	Venture capital

