

**The Biotechnology and Life Sciences Industry in the
Southeast Florida Region:**

Meeting the Workforce Challenges

Final Report

Commissioned by:

**Workforce Alliance, Inc.
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Introduction

With the decision to locate Scripps Florida in Palm Beach County, the biotechnology and life sciences industry appears ready to grow dramatically both within Palm Beach County and throughout South Florida. The Workforce Alliance asked Regional Technology Strategies, Inc. (RTS) to analyze the emerging biotechnology and life sciences cluster in Palm Beach and surrounding counties and recommend what types of education and training resources—at all levels—should be in place in order to 1) prepare workers for jobs in this industry and 2) capitalize on its ability to be a high-wage, high-growth employer.

To gather the information contained in the report, RTS used a variety of methods and analytical techniques. RTS staff interviewed biotech and life sciences company executives, academics, industry support organizations, economic development officials, and education providers, as well as other informed parties, to gain a qualitative sense of the biotech industry in the Southeast Florida region, its growth potential, and its workforce issues. Appendix A shows a list of all individuals interviewed for this project. The project team emailed and faxed surveys to life science companies; however, information from the surveys is only presented qualitatively because of a low response rate. The large number of companies interviewed by the project team includes several companies that did not complete surveys.

Working in tandem with the Economic Development Research Group (EDRG) in Boston, RTS also performed a quantitative analysis of the industry and its occupational makeup, including projecting growth in the biotech and life sciences industry and in the occupations that make up the cluster. Each section of the report provides more detail on methodologies when necessary.

Because Palm Beach County does not operate in isolation, the study examines the industry in a seven county area RTS is calling the “Southeast Florida region.” Counties were chosen based on commuting patterns and after discussions with Workforce Alliance and other economic development agencies. The seven-county region includes Palm Beach, St. Lucie, Indian River, Martin, Okeechobee, Miami-Dade and Broward counties. When relevant, information limited to Palm Beach County is separated from the Southeast Florida region.

In putting together the report, decisions also had to be made about what actually constitutes the biotech industry. The national biotechnology trade association BIO defines biotechnology as “a collection of technologies that capitalize on the attributes of cells, such as their manufacturing capabilities, and put biological molecules, such as DNA and proteins, to work for us.” Biotechnology companies are found in a wide array of government industrial classifications, and there is no uniform practice regarding which classifications to include.

In many instances researchers look beyond “strict” biotechnology companies to related industries that either support or share significant commonalities with biotechnology, such as medical device manufacturing. This broader group of industries is referred to in this report as *life sciences*. Health care establishments are not included in either definition.

For the purposes of this study, the narrow definition of *biotechnology* encompasses pharmaceutical and medicine manufacturing, biotech-related research and development, diagnostics, and medical laboratories. Medical labs, most of which serve the health care field, are included because that is the industrial classification for Scripps Florida. This study’s broader “life sciences” definition adds an array of medical manufacturing and testing facilities. Because of similar skill sets, regulatory environments, and connections between these industries, much of the analysis in this study focuses on the life science cluster.

These definitions align with those used in other national and regional studies. A full list of industries included in the definitions can be found in Appendix B.

The report is structured as follows:

- 1) *Analysis of existing biotechnology and life sciences cluster*: A description of the existing biotechnology and life sciences industry in the Southeast Florida region is provided. The section includes a quantitative analysis of the industry in the region as it compares to the rest of the nation. In addition, RTS offers a qualitative assessment of the cluster’s strengths and weaknesses based on interviews with industry experts both in the region and nationally.
- 2) *Industry and occupational growth projections*: RTS offers long-term projections for the biotech and life sciences industry in the Southeast Florida region. The projections include national industry trends, but also take into account the expected influence of Scripps and recent growth in specific biotech industries in South Florida. RTS offers a picture of expected job growth over the next decade using three different scenarios that take into account potential growth paths for the industry in the Southeast Florida region. Projections are presented by industry sectors and for the top twenty biotech related occupations.
- 3) *Occupational profiles*: Based on the projections offered in Section 2, RTS profiles the skills and educational requirements needed for the 20 largest job classifications within biotechnology / life sciences. It should be pointed out that some of the occupations profiled in this section could feed into other industries as well, particularly health care.

- 4) *Description of biotechnology education programs:* In this section RTS presents a matrix of biotechnology educational programs in the Southeast Florida region. Listed programs include those in universities and community colleges as well as in the region's secondary schools.
- 5) *Benchmark / Model Programs:* One of the ways that the Southeast Florida region can best meet the needs of the biotechnology and life sciences industry is examining what other areas of the nation have done in response to similar demands. In this section, some of the most successful biotech-focused workforce development programs are discussed with special attention paid to their applicability to the Southeast Florida region.
- 6) *Recommendations:* RTS offers a series of recommendations to help the Workforce Alliance as well as other interested parties meet the growing workforce needs of the biotechnology and life sciences industry in the Southeast Florida region.

In many ways, the future of the biotech industry in the Southeast Florida region is in flux. Scripps has yet to break ground on its permanent facility and making assumptions based completely on the impact of that institution is problematic. Such factors as spin-off of new companies and recruitment of biotech firms to the region are almost impossible to forecast. It is clear, however, based on both current local and national trends, that there will be a significant need for biotech related workers in the coming years. This study offers a picture of what those jobs will look like and how the Workforce Alliance and other agencies and education providers can be prepared to fill those positions.

Section I: Analysis of Existing Biotechnology/ Life Sciences Cluster

Although the area is home to many innovative companies and institutions, the Southeast Florida region does not currently appear to be a large hub of biotechnology and life sciences industry activity. Industry experts and local companies express general agreement, however, that the location of Scripps Florida in Palm Beach County will spur the growth of a competitive biotech cluster. This section describes the current state of the industry in the region, using statistics as well as offering a qualitative description based on interviews with employers and other biotechnology stakeholders in the Southeast Florida region. Quantitative data sources include employment and establishment data collected by state and federal government sources.

One way to measure an industry's presence in a region is through the use of location quotients. Location quotients indicate the importance of an industry to a region's own economy, measuring the concentration of sector employment in the region relative to the national concentration. The location quotient is calculated by measuring the percentage of a region's total employment in the cluster, divided by the same ratio for the nation. The location quotient for a region would be 1.0 if the concentration of biotech activity there were identical to that of the nation. If the resulting ratio is greater than one, it can be inferred that the region is relatively specialized in biotechnology, or a particular sub-sector of biotech.

Table 1 shows both Palm Beach County and the entire seven-county region's location quotients for the various sectors of the biotechnology. It indicates that currently the region has an average concentration of biotech, while Palm Beach County has slightly less employment concentration than the national average in the biotech industry as a whole. The region and county do have a relatively high location quotient in the sub sector of Medical Laboratories and Diagnostic Imaging Centers. The region does not fare as well in terms of Research and Development, with both the county and the region having location quotients well below 1.0 in that important sector.

Table 1: 2005 Employment Location Quotients for Biotech Industry Sectors

Sector	Palm Beach County Employment	Palm Beach County Location Quotient	Southeast Florida Region Employment	Southeast Florida Region Location Quotient
Medicinal and Botanical Manufacturing	13	0.2	106	0.3
Pharmaceutical Prescription Manufacturing	160	0.1	5,395	1.0
In-Vitro Diagnostic Substance Manufacturing	37	0.4	303	0.8
Biological Product (except Diagnostic) Manufacturing	182	1.8	237	0.5
R&D in the Physical, Engineering and Life Sciences	309	0.6	1,051	0.5
Medical Laboratories & Diagnostic Imaging Centers	1,214	1.4	4,924	1.3
Total Biotech	1,915	0.7	12,016	1.0

Source: Calculations by the authors based on Dunn and Bradstreet Zapdata. Biotech employment data pulled May, 2005; total employment data pulled June, 2005.

The industry's employment growth patterns from 1998 to 2002 (Table 2) show that the Southeast Florida region did have substantial growth in life sciences. While nationally the life sciences industry increased employment by 14 percent, it grew by 41 percent in the seven-county region. These figures encompass the larger life science industry definition described in Appendix B. Palm Beach County had much lower growth, with jobs in the sector only increasing by 11 percent, barely higher than the average growth in all industrial sectors. Table 2 compares growth among the county, region and nation between 1998 and 2002.

Table 2: Employment Growth for Life Sciences, 1998-2002

Location	Life Sciences Employment Growth (1998-2002)	Total Employment Growth (1998-2002)
Palm Beach County	11%	10%
Southeast Florida Region	41%	8%
United States	14%	4%

Source: Calculated by the authors from County Business Patterns, 1998 and County Business Patterns, 2002 for NAICS sectors 32532, 3254, 334510, 334516, 334517, 339111, 339112, 339113, 54138, 54171, 541940, 621511, 621512.

The biotech and life sciences industry in the Southeast Florida region does appear to

have some competitive advantage nationally. Several companies and research groups interviewed for the study suggest that there are areas of biotechnology in which the region excels and that could be optimized, relating to marine science and agriculture. The potential for marine science-related biotech receives a boost in part because of the location of the Harbor Branch Oceanographic Institution located in Fort Pierce. Harbor Branch performs both basic and applied research, some of which could be taken to market by able companies. Nearby the U.S. Department of Agriculture has a large horticulture research lab, and also close at hand in Fort Pierce is the Smithsonian Marine Science Station, which performs sophisticated research in marine science. The Indian River Research and Education Center, run by the University of Florida and also located at Fort Pierce, conducts a range of research on agriculture-related topics.

The presence of research hubs like these is extremely critical to the development of a biotech cluster. Mature biotech clusters like those in San Diego and Research Triangle Park in North Carolina developed primarily around a strong research university that attracted large amounts of federal research dollars as well as developing a cadre of employable scientists. The Southeast Florida region does not appear, at least yet, to have research universities that are currently able to drive the industry, though the University of Miami is quite well respected.

In a promising development, Florida Atlantic University's (FAU) relatively new biotechnology program appears to be making great strides in becoming a research center. The director of the Center for Molecular Biology and Biotechnology at FAU came to the university looking to accomplish three goals: developing research programs in this cutting edge field; creating leading training programs; and making FAU a magnet to attract interest from community and industry to locate in the region.

The Center's director says major headway is being made to the first two goals, including the employment of 25 research scientists at the university. "As for the third part, I wasn't making much headway until Scripps," he said. "That announcement did in two to three days what I couldn't do in six years."

The establishment of a permanent medical school at FAU will also benefit the biotech industry in the Southeast Florida region. FAU currently operates a joint degree program with the University of Miami, but the location of a fully-accredited medical school in Boca Raton will attract more of the research dollars that tend to drive innovation in the biotech industry.

Most beneficial will be the completion and operation of Scripps Florida. Many of the companies and individuals interviewed for the study suggest that the location of Scripps could serve much the same role as large research universities do in other regions—motivating some of the best and brightest in the field to come to the Southeast Florida region and also attracting important research dollars.

One advantage the cluster has in the Southeast Florida region is a strong collection of industry focused associations and support agencies. The Life Sciences Cluster, organized through the Business Development Board of Palm Beach County, brings together leading firms and supporting entities in the area. The South Florida Bioscience Consortium also works with local biotech firms and the programs that support them. These entities provide opportunities for firms to get to know each other and for the public programs that could support them to find out the needs of industry. Both these initiatives are relatively young, however, and consistent participation by area firms has yet to be achieved. West Palm Beach is also home to BIO Florida, which is the largest biotech trade association in the state and an affiliate of the national trade association BIO. BIO Florida organizes the state's annual participation in the BIO Trade Show, which is an extremely important event for highlighting the area as an attractive place to do biotech business.

Section II: Industry and Occupational Growth Projections

Industry Growth Projections

The project team developed three scenarios to estimate the likely growth of biotechnology and life science employment in Palm Beach and the seven-county Southeast Florida region. A detailed description of the methodology is included in Appendix C. The first projection, *Baseline Growth*, is based on a *national projection* forecast by the U.S. Bureau of Labor Statistics (BLS), which develops 2002-2012 employment growth projections for each industry.

To compensate for an apparent underestimation of likely biotech employment growth in this national BLS model, the second scenario, *Growth Trajectory 1*, is based on a methodology that captures recent *national trends* by adjusting the ten-year national projections upward to reflect the rapid growth in national biotech employment that actually occurred between 1998-2002. This approach imposes the assumption that higher-than-expected recent national employment growth will continue in the next ten-year projection period.

The third scenario, *Growth Trajectory 2*, is based on the assumption that the arrival of Scripps will fundamentally change the biotech growth trajectory in Palm Beach and the entire Southeast Florida region. This projection is based on two premises: 1) with the arrival of Scripps, the Southeast Florida region will be able to maintain the high regional-national growth differential experienced in the past few years; and 2) with the arrival of Scripps, future employment growth in Palm Beach will track with the rest of the region (whereas currently the county is underperforming relative to other counties in the Southeast Florida region).

Under each scenario, 1,040 jobs were added to the baseline estimate to reflect the expected contribution of Scripps Florida to local employment in 2012. This number is based on the minimum number of jobs Scripps is required to create by 2010 under its incentive package, plus an extrapolation of published projections for Scripps employment for 2015. Economic models show exponential growth in employment for Scripps from 2010 to 2015, reaching as high as 2,800.

Tables 3 through 6, below, show the levels of growth projected in the Southeast Florida region's biotechnology cluster and broader life sciences cluster. Table 3 is an overview table that shows the projected growth under all three scenarios, broken down by industry sector. Tables 4 – 6 show the biotechnology-related occupations that are projected to grow the most under each of the growth scenarios. (Table 3's totals are thus slightly different from those shown in Tables 4 – 6, because Table 3 concerns industry growth while Tables 4 – 6 concern occupational growth.)

Table 3: Industry Growth Projections 2002-2012 for South Florida's Biotech/Life Sciences Cluster (7 county region)

Industry (NAICS Code)	2002 Employment	Projected 2012 Employment		
		Baseline Growth	Growth Trajectory 1	Growth Trajectory 2
Biotechnology (narrow definition)				
Pharmaceutical and Medicine Manufacturing (3254)*	2,616	3,223	3,563	5,329
Research and Development in the Physical, Engineering, and Life Sciences (54171)*	2,499	2,667	2,991	3,909
Medical Laboratories (621511)*	3,743	5,163	5,649	9,203
Diagnostic Imaging Centers (621512)*	1,876	2,588	2,831	4,613
Total without Scripps employment	10,734	13,640	15,035	23,054
Direct Scripps employment		1,040	1,040	1,040
Total with Scripps employment		14,680	16,075	24,094
Job Growth		3,946	5,341	13,360
Cumulative Growth Rate		37%	50%	124%
Life Sciences (broad definition)				
Pesticide and Other Agricultural Chemical Manufacturing (32532)	0	0	0	0
Electromedical and Electrotherapeutic Apparatus Manufacturing (334510)	1,250	1,098	1,260	1,279
Analytical Laboratory Instrument Manufacturing (334516)	423	371	426	433
Irradiation Apparatus Manufacturing (334517)	3	3	3	3
Laboratory Apparatus and Furniture Manufacturing (339111)	154	164	184	240
Surgical and Medical Instrument Manufacturing (339112)	3,619	3,853	4,324	5,637
Surgical Appliance and Supplies Manufacturing (339113)	564	601	674	879
Testing Laboratories (54138)	1,123	1,172	1,318	1,683
Veterinary Services (541940)	4,744	6,494	7,111	11,522
Total without Scripps employment	22,614	27,396	30,335	44,730
Direct Scripps employment		1,040	1,040	1,040
Total with Scripps employment		28,436	31,375	45,770
Job Growth		5,822	8,761	23,156
Cumulative Growth Rate		26%	39%	102%

* Industries included in the narrow biotech definition and also in the broad life sciences definition
Source: Bureau of Labor Statistics, Economic Development Research Group, and Regional Technology Strategies, Inc.

Table 3 summarizes 2002 employment and growth projections for both the narrow biotech and the broad life sciences definitions. The analysis shows that South Florida's strength is in the core biotech industries, which accounted for 47 percent of the total life sciences employment in 2002. Under all three scenarios, the core industries are expected to grow at a faster rate than the life sciences cluster as a whole and are projected to make up more than half of the total life sciences employment by 2012. Medical laboratories are the largest core industry and are also expected to add the largest share of employees, even without including direct Scripps employment. The projections also show diagnostic imaging centers and pharmaceutical and medicine manufacturing adding substantial numbers of employees, whereas growth in research and development is projected to lag behind the other core industries. Growth in the larger life sciences cluster is concentrated in two industries—surgical and medical instrument manufacturing and veterinary services.

Projected total job growth for the core biotech industries ranges from 3,946 or 37 percent (using the unadjusted BLS projection) to 13,360 or 124 percent (under growth trajectory 2). Scripps accounts for about 25 percent of the projected employment growth in the baseline scenario. The projections for the broader life sciences cluster foresee employment growth rates ranging from 26 percent to 102 percent, adding between 5,822 and 23,156 new employees by 2012. It is important to keep in mind that all three projections are based on the current industry employment mix and assume no major shifts in the existing composition of the cluster. This assumption may not be entirely realistic and does not take into account effects of potential relocation or recruitment of companies in the future.

The *baseline growth projection* assumes that Scripps Florida will operate in isolation with no spillover effects on the Southeast Florida region's economy and that regional growth will follow the basic national projections. In that case, only the direct Scripps employment of 1,040 is added to the region's life sciences cluster; any additional growth would have happened without Scripps as well. The scenario is also based on the unadjusted BLS projection and would actually produce a slowdown in biotech employment growth in the Southeast Florida region, compared to 1998-2002. This basic scenario would most likely be characterized by gradually expanding existing businesses and little or no startup and relocation activities. If a slowdown in business expansions and employment growth can be observed, the region is most likely following the baseline growth projection.

Growth Trajectory 1 is based on the adjusted BLS projection and takes recent national biotech growth into account. It assumes that in addition to the direct Scripps employment effect, the region will follow the national trends. Employment growth rates would therefore be lower than what the Southeast Florida region experienced between 1998 and 2002, but higher than under the baseline growth scenario. This scenario would most likely again be characterized by business expansions more than

new business startups. Additional employment would probably result from relocation and recruitment efforts.

Growth Trajectory 2 assumes that with the arrival of Scripps, Palm Beach County and the region will continue to grow at a faster rate than the rest of the nation. As a result, biotech and life sciences employment is projected to grow more than twice as much by 2012 as in the other scenarios. Experiences in Grand Rapids, Michigan (Van Andel Research Institute) and Kansas City, MO (Stowers Institute) where major research facilities have started around five years are useful examples to examine. In both metropolitan areas, growth in biotech employment was limited primarily to the growth of the research institute itself for the first 4-5 years. No dramatic spillover effects or increases in startup activities could be identified. However, other studies (see, for example, the Washington Economics Group, Inc: *The Economic Impact of Scripps Florida Biotech Research Institute*) project a rapid increase in biotech employment growth rates 5-10 years after the facility opens. Even under growth trajectory 2, the Southeast Florida region should not expect to see dramatic changes in the first years, but should be prepared to handle growth that might be the result of successful recruitment efforts.

Occupational Growth Projections

The occupational projections were developed combining the ten-year employment growth projections in each biotech industry and the BLS matrix of employment by occupation for each biotech sector in 2012. A detailed description of the methodology is included in Appendix C.

Tables 4-6 present the 20 occupations that are both projected to show the greatest demand in biotechnology in the Southeast Florida region, and that require some degree of biotechnology-specific preparation (e.g., occupations in IT or administrative support, or healthcare occupations that focus solely on direct patient care, are not part of this analysis). The tables show current employment, projected employment for the year 2012, and the growth rate for Palm Beach County as well as the greater Southeast Florida region for the same three scenarios used in the industry projection above.

Table 4: Occupational Projections: Top 20 Occupations (Baseline Growth)

Occupation	Palm Beach County			Seven County Region		
	Employment 2002	Projected Employment 2012	% Growth	Employment 2002	Projected Employment 2012	% Growth
Medical and clinical laboratory technologists	155	349	125.4%	674	1,092	62.1%
Medical and clinical laboratory technicians	140	295	110.4%	602	923	53.3%
Veterinary technologists and technicians	147	216	46.7%	477	700	46.7%
Radiologic technologists and technicians	92	211	129.2%	402	660	64.2%
General and operations managers	104	146	40.9%	417	526	26.1%
Chemists	85	111	31.5%	219	282	28.6%
Packaging and filling machine operators and tenders	88	111	25.1%	229	282	23.2%
Medical scientists, except epidemiologists	71	99	39.3%	204	272	33.4%
Biological technicians	62	88	42.2%	190	251	32.2%
First-line supervisors/managers of production and operating workers	49	62	26.1%	259	302	16.7%
Chemical technicians	44	54	22.9%	118	142	20.6%
Chemical equipment operators and tenders	39	49	25.5%	85	107	25.2%
Diagnostic medical sonographers	20	46	129.4%	88	145	65.4%
Natural sciences managers	34	44	28.8%	95	118	23.6%
Maintenance and repair workers, general	32	43	33.7%	124	154	23.9%
Microbiologists	23	38	61.8%	73	107	46.6%
Biochemists and biophysicists	26	35	33.8%	71	94	32.6%
Dental laboratory technicians	27	31	13.0%	483	508	5.1%
Cardiovascular technologists and technicians	7	17	142.9%	31	51	64.5%
Nuclear medicine technologists	5	11	141.4%	20	35	75.7%
Total (all occupations)	5,441	7,868	44.6%	22,614	28,445	25.8%

Source: Bureau of Labor Statistics, Economic Development Research Group, and Regional Technology Strategies, Inc.

Table 5: Occupational Projections: Top 20 Occupations (Growth Trajectory 1)

Occupation	Palm Beach County			Seven County Region		
	Employment 2002	Projected Employment 2012	% Growth	Employment 2002	Projected Employment 2012	% Growth
Medical and clinical laboratory technologists	155	370	139.0%	674	1,183	75.6%
Medical and clinical laboratory technicians	140	313	123.3%	602	1,001	66.2%
Veterinary technologists and technicians	147	237	60.6%	477	767	60.7%
Radiologic technologists and technicians	92	224	143.3%	402	715	77.9%
General and operations managers	104	159	53.5%	417	582	39.5%
Chemists	85	124	45.9%	219	314	42.9%
Packaging and filling machine operators and tenders	88	122	38.3%	229	313	36.6%
Medical scientists, except epidemiologists	71	109	53.4%	204	301	47.6%
Biological technicians	62	96	55.1%	190	278	46.4%
First-line supervisors/managers of production and operating workers	49	68	38.3%	259	338	30.8%
Chemical technicians	44	60	36.6%	118	157	33.3%
Chemical equipment operators and tenders	39	54	38.8%	85	118	38.5%
Natural sciences managers	34	53	53.7%	95	135	41.1%
Diagnostic medical sonographers	20	49	144.4%	88	157	79.1%
Maintenance and repair workers, general	32	47	46.1%	124	171	37.5%
Microbiologists	23	42	78.9%	73	117	60.3%
Biochemists and biophysicists	26	39	49.1%	71	105	48.1%
Dental laboratory technicians	27	34	23.9%	483	569	17.7%
Cardiovascular technologists and technicians	7	17	142.9%	31	51	64.5%
Nuclear medicine technologists	5	12	163.3%	20	38	90.7%
Total (all occupations)	5,441	8,576	57.6%	22,614	31,387	38.8%

Source: Bureau of Labor Statistics, Economic Development Research Group, and Regional Technology Strategies, Inc.

Table 6: Occupational Projections: Top 20 Occupations (Growth Trajectory 2)

Occupation	Palm Beach County			Seven County Region		
	Employment 2002	Projected Employment 2012	% Growth	Employment 2002	Projected Employment 2012	% Growth
Medical and clinical laboratory technologists	155	522	237.1%	674	1,843	173.5%
Medical and clinical laboratory technicians	140	442	215.3%	602	1,558	158.7%
Veterinary technologists and technicians	147	383	160.1%	477	1,242	160.2%
Radiologic technologists and technicians	92	315	242.2%	402	1,115	177.4%
General and operations managers	104	230	122.0%	417	843	102.1%
Packaging and filling machine operators and tenders	88	182	106.1%	229	456	98.8%
Chemists	85	179	111.3%	219	446	103.3%
Medical scientists, except epidemiologists	71	155	118.1%	204	430	110.9%
Biological technicians	62	136	119.8%	190	400	110.6%
First-line supervisors/managers of production and operating workers	49	99	101.4%	259	454	75.5%
Chemical technicians	44	86	95.8%	118	223	89.4%
Chemical equipment operators and tenders	39	80	107.4%	85	176	105.8%
Natural sciences managers	34	74	115.4%	95	192	101.5%
Maintenance and repair workers, general	32	70	117.6%	124	242	94.7%
Diagnostic medical sonographers	20	69	244.1%	88	245	179.4%
Microbiologists	23	60	155.5%	73	175	139.7%
Biochemists and biophysicists	26	56	114.0%	71	148	109.5%
Dental laboratory technicians	27	45	64.0%	483	746	54.3%
Cardiovascular technologists and technicians	7	24	242.9%	31	85	174.2%
Nuclear medicine technologists	5	17	273.1%	20	59	196.1%
Total (all occupations)	5,441	12,478	129.3%	22,614	45,784	102.5%

Source: Bureau of Labor Statistics, Economic Development Research Group, and Regional Technology Strategies, Inc.

Biotech Companies' Perspectives on Workforce Issues

The data presented are useful because they provide alternative growth scenarios for biotechnology and life sciences in the Southeast Florida region. A good deal of the information implicit in those analyses stems from new companies that will either locate or start up in the region at some point in the future—and therefore from whom no immediate insight may be garnered. As such, it is also important to ascertain from existing companies the immediate and future workforce needs they face.

Interviews with companies and survey results indicate that for the most part biotech/life science companies do not currently report problems finding qualified workers. Companies spoken with are mainly hiring employees with either four-year degrees or more for advanced positions, or high school graduates for production positions. This is not surprising given that there are few two-year biotech programs right now—and none in Palm Beach County, although Palm Beach Community College is offering its first biotechnology course in the fall of 2005. Several companies noted that they see a greater demand in the future for workers with less than a four-year degree as their firm and other similar companies grow, creating more technician-level positions. This finding confirms the quantitative occupation projections.

The project team also asked employers what types of job positions they predict having the greatest need for in the coming years. The responses ranged from low-skill positions such as glass washers and assembly workers to, of course, Ph.D. scientists. More specifically, Scripps estimated that within five years 40 percent of the organization's 500 + workers will have two or four year degrees. Non-scientific positions they expect to be filling include administrative assistants, buyers/procurement specialists, facility management technicians, and IT specialists. In addition to high-level scientists, technical personnel will include lab technicians (two- or four-year degrees), animal lab technicians, and research assistants (four year degrees). Low skill jobs at Scripps will include glass washers and security personnel.

Importantly, the state and local incentive package for Scripps Florida mandates that the organization hire locally if at all possible, with searches first in Palm Beach County, then Florida, and only then outside of Florida.

Another large biotech company in Palm Beach County cited its greatest workforce needs as manufacturing and process development technicians (who could have two-year degrees, though many currently have four-year degrees, according to the company), quality control techs, sales & marketing employees and project managers.

Other firms in the region cited a need for more employees with clinical backgrounds, including a particular need for more research nurses capable of coordinating clinical trials.

The project team asked companies about their training for employees and new hires. Everyone responded that they currently either carry out such training in-house or contract with third party vendors, many of whom come from outside the region. Scripps Florida will at least initially rely on the training department of their La Jolla, California facility to manage most in-house training in Florida, although as more biotech-related training resources become available in Florida they plan to access them if they represent a costs savings.

Similar to other industries, biotech companies rely on the ability to recruit high- level talent from across the country, or indeed other countries, to fill positions such as lead researchers and principal investigators. There was no consensus among company executives about the attractiveness of the Southeast Florida region to such talent. Many “quality of life” advantages such as weather and low taxes were touted as advantages. Others pointed out that high cost of living (particularly real estate prices) and a perception of poor public schools make recruitment difficult.

Most company executives interviewed are not very familiar with regional biotech educational programs, although Florida Atlantic University and University of Miami were both mentioned fairly frequently.

Section III: Occupational Skills Analysis for Top 20 Life Science Occupations

This section examines more closely the specific preparation required of the people who will fill the highest-demand positions in the Southeast Florida region’s biotechnology and life sciences companies. The information pertaining to skills, tasks, and educational requirements comes from various industry reports, government databases, and research studies synthesized by the project team and prepared for this report.

Table 7 presents cumulative employment projections for the 20 occupations that are both projected to show the greatest demand in biotechnology in the Southeast Florida region, and that require some degree of biotechnology-specific preparation (e.g., occupations in IT or administrative support, or healthcare occupations that focus solely on direct patient care, are not part of this analysis). These 20 occupations fall naturally into three distinct groups: (1) biotechnology scientists, occupations that initiate and direct scientific research; (2) biotechnology science technicians, occupations that perform discrete tasks in biotechnology research or testing under the direction of, or in conformity with the specifications of, a scientist; (3) biomanufacturing production, occupations that in themselves are not specific to biotechnology, but in this analysis are examined only in light of their relevance to Southeast Florida region’s life science industries. Of the three groups, the second—biotechnology science technicians—is by far the largest in terms of both numbers of occupations and projected increase in demand.

Table 7: Recent and Projected Employment for 20 Largest Occupations in the Life Science Industries (Seven-County Region)

Occupational Category	2002 Employment	2012 Employment (Baseline Scenario)	2012 Employment (GT1 Scenario)	2012 Employment (GT2 Scenario)
Biotechnology scientists	663	873	971	1,392
Biotechnology science technicians	3,085	4,507	4,916	7,516
Biomanufacturing production	1,115	1,371	1,523	2,171

Source: Bureau of Labor Statistics, Economic Development Research Group, and Regional Technology Strategies, Inc.

These biotechnology science technicians are also the group that will require the greatest attention and preparation from the public sector in terms of regional training and education readiness. The biotechnology scientist occupations almost uniformly require advanced degrees, and are hired from a much wider search area than technicians. The biomanufacturing production occupations require primarily biotechnology context in

which to situate their foundational manufacturing skills. The biotechnology science technicians, in contrast, require in-depth education and training that is, if not entirely specific to, at least entirely relevant to the biotechnology industries.

The following sections present some of the most common job titles, tasks, and educational requirements of each of the occupations in the three groups. As the tables and narrative show, there is a fair degree of consistency across the occupations within each group with regard to educational needs and skill requirements.

A. Occupational Group 1: *Biotechnology Scientists*

The ranges of educational requirements shown in Table 8 represent the lowest and highest degrees with which it is possible to hold the position. Although some of the occupational categories shown in Table 8 are listed as attainable with a master's degree or even a bachelor's degree, this is true only for the lower-responsibility versions of these positions. In most of the categories, in order to direct research, work independently, and/or determine one's own research agenda, a Ph.D. will be required. In some cases, this status can be attained with a master's degree and many years of experience; however, it is likely that at some point during those years of experience, the employee will elect to gain a Ph.D. to facilitate her or his advancement. Positions that can be attained with a master's degree or particularly a bachelor's degree are likely to be under the direction of a Ph.D. scientist or medical doctor; they are still skill-intensive and well-paying, but usually do not involve responsibility for an entire research program. The only occupations in this group that list Principal Investigator as a sample job title are those in which most positions require a Ph.D. or medical degree (medical scientist and natural science manager).

The most commonly required skills for the biotechnology scientist positions are:

- an awareness of the principles and procedures of the scientific method;
- how to select technology tools and techniques and adapt them to specific research and diagnostic uses;
- operations and systems analysis and monitoring, which refers to the ability to create multi-phase systems and operational procedures to accomplish a specific research goal, to monitor the systems and operations to ensure their functioning according to set standards or objectives, and to interpret the outcomes of these systems and operations;
- quality control analysis, which refers to the ability to create systems and collect data that demonstrate the degree of consistency in the system's functioning and output.

All of these skills are requirements to fill any of these positions at any level. In addition, the two positions mentioned, medical scientist and natural science manager, that are most likely to require Ph.D.s and involve high levels of responsibility and authority, call for instructional, communications, and coordination skills, and the

natural sciences manager also needs a variety of administrative and management skills. For the other positions, particularly those listed as potentially requiring only a B.S., skills such as selection and use of equipment and management of materials and tools are more important. These positions are also more likely to involve discrete elements of research, such as “culture and analyze bacteria” (microbiologist), rather than directing and managing research projects.

Table 8: Skills and Preparation Needed for Occupations in the Biotechnology Scientists Group

Occupational Category	Sample Job Titles	Relevant Tasks	Required Education/ Experience
Medical scientists, except epidemiologists	Research Director Principal Investigator Research Scientist III/IV	Conduct/direct research on human health and disease; direct clinical trials Evaluate effects of drugs and other interventions on humans Advise physicians & public health officials	Minimum master’s degree, often a medical degree or Ph.D. in a specialized field
Chemists	Research Chemist Formulary Chemist Analytical Chemist	Work w/ scientists and research directors on research projects, interpreting results Compile & analyze test data for diagnosis Analyze organic/inorganic compounds Develop and improve products, processes, and analytical methods	Many have B.S. in chemistry/related field; master’s makes more competitive but not always necessary; for few, Ph.D. required
Microbiologists	Clinical Biologist Bacteriologist	Culture and analyze bacteria Perform contaminant tests on environmental media Identify and classify microorganisms Conduct/supervise lab services for hospitals	Opportunities for B.S. alone are improving; some have master’s; Ph.D. required for independent research positions
Natural sciences managers	Research Director Research Manager Principal Investigator	Plan & direct research projects Supervise/confer w/ scientists Present results of research to public Budget, personnel, client relations, other administrative duties	Most begin career as scientists/ engineers w/ master’s or Ph.D.; ascend to management through 5+ yrs exp. or MBA/ other administrative degree
Biochemists and biophysicists	Research Scientist III/IV	Study/analyze chemistry/physical principles of living cells Research disease treatments Analyze chemical/physical elements of human/animal physiology	Some have B.S. alone; more have at least master’s; Ph.D. required for independent research positions

Source: Bureau of Labor Statistics Occupational Outlook Handbook, Occupational Information Network, and Regional Technology Strategies, Inc.

B. Occupational Group 2: *Biotechnology science technicians*

In this group, most occupations require something more than a high school diploma and less than a bachelor's degree. Only two of the nine occupational categories require a bachelor's degree in most instances, and only two others show a strong representation among those with only a high school diploma. The most common credential is the two-year technical degree, or Associate's of Applied Science (A.A.S.). In general, where the term *technologist* is contrasted with the term *technician*, the former tends to denote a higher level of education, skill, and responsibility (e.g., the first two occupations listed in the table: medical and clinical laboratory technologists and medical and clinical laboratory technicians). Where the category is described only by the word *technician* alone, however, it appears to allow for a wider range of meanings; most biological technicians, for example, appear to have bachelor's degrees.

As in group one, there is some consistency in the skill sets required for the positions in group two. Awareness of scientific methods and the use of scientific equipment appear in the required skills lists for nearly all of these positions, as do operations monitoring and analysis and quality control analysis. Reading and mathematics comprehension rank highly among the needed skills as well. The positions that require less education are also apt to call for equipment handling and maintenance skills, while those that require more education are more likely to call for communications, management, and instruction skills. For some occupations, it is difficult to pin down the difference because the technologist and technician version of the same occupation are lumped into the same category; however, these categories are often the ones that show a wide range in the educational requirements, suggesting that one end of the educational spectrum pertains to the technician version and the other end to the technologist version.

What is revealed by the information on these occupational categories is that nearly all the biotechnology science technician positions—which constitute the bulk of projected job growth in the Southeast Florida region's biotechnology industries—can be at least approached on the entry level with preparation from a community or technical college. Even those that show most entering with a B.S. suggest that it is possible to work one's way up, with an A.A.S. and experience, to the position that a four-year graduate would hold (albeit more slowly). This finding suggests the need for well-integrated, career pathway-oriented set of training and education options, with multiple, easily navigated entry and exit points, that can prepare a potential biotech employee to start at an entry level position and continue working while gaining the education and/or training needed to move up to the next level.

Table 9: Skills and Preparation Needed for Occupations in the Biotechnology Science Technicians Group

Occupational Category	Sample Job Titles	Relevant Tasks	Required Education/ Experience
Medical and clinical laboratory technologists	Clinical Laboratory Manager, Histologist	Compile, interpret, present lab results Conduct chemical analysis of body fluids Operate, calibrate, and maintain equipment Ensure accuracy & consistency of lab results Supervise and train lab assistants Develop/monitor lab techniques	Most have B.S.; sizable minority has A.A.S. Majority receives 3-6 months of OTJ training. Work experience usually not required.
Medical and clinical laboratory technicians	Medical Lab Technician, Cyto-technician, Lab Associate	Conduct chemical analyses of body fluids Set up, maintain, clean lab equipment Analyze test results Analyze and record test data	Most have HS or post-secondary certificate and 1-6 months of OTJ training.
Cardio-vascular technologists and technicians	Same as category title	Assists with intensive cardiac procedures Administer noninvasive tests (EKG, stress) Assist with cardiac diagnosis Record and interpret test data	Most have 2-year degree, some have 4-year degree; 1 year certifications for subspecialties
Radiologic technologists and technicians	MRI Technologist, X-Ray or CT Technician/ Technologist, Staff Radiographer	Review and evaluate developed X-rays Take X-ray images Determine X-ray needs from physician's instructions Interact w/ patients Perform diagnostic procedures under physician supervision	Usually post-secondary certificate or A.A.S.; few have B.S.; short course of OTJ training is the norm; most have 6-12 months experience.
Veterinary technologists & technicians	Same as category title	Perform lab tests on animals, help w/ care Maintain lab records and documentation Maintain and use diagnostic lab equipment	Usually A.A.S.; some only HS/some college; 1-6 months OTJ training.
Diagnostic medical sonographers	Sonographer, Ultrasound Technician, ECG Tech	Analyze images, interpret to physician Operate, maintain, and assess ultrasound equipment Patient contact and relations	Usually post-secondary certificate or A.A.S.; between 1-3 months OTJ; experience not required.
Biological technicians	Lab Tech, Biological Science Lab Tech, Research Assistant/ Associate	Log of laboratory activities, test samples Monitor lab compliance w/ standards Tech support to scientists and researchers Clean, maintain, prepare lab & equipment	Most have B.S. and 3-6 months OTJ training; experience not usually required.
Dental laboratory technicians	Dental Device Technician	Fabricate/repair dental devices in response to specs from dentist, create dental models Test appliances for conformity to specifications	Usually have A.A.S.; few have B.S. Some have certificate and OTJ / apprenticeship.
Chemical technicians	Lab Technician, Research Technician, Lab Tester, R&D Technician	Monitor product quality, compliance with standards Set up and conduct chemical and physical laboratory tests and experiments in support of and in consultation with scientists Maintain and sterilize laboratory equipment	Most have B.S. or some college; sizable minority w/ HS. Usually requires 1-12 months OTJ training and 6+ months' experience.
Nuclear medicine technologists	Certified Nuclear Medicine Technologist, Radiation Safety Officer	Calculate, measure, and record radiation dosage or radio-pharmaceuticals Test for radiopharmaceuticals in patients Process images for use by physicians Handle and dispose of radioactive materials	Usually A.A.S.; sizable minority w/ B.S.; none has only HS. Some OTJ training is norm and 6-12 months of experience.

Source: Bureau of Labor Statistics Occupational Outlook Handbook, Occupational Information Network, and Regional Technology Strategies, Inc.

C. Occupational Group 3: Biomanufacturing production

The occupations in this group show a wide range in the levels of education required. The first occupation in Table 10, general and operations managers, requires a bachelor's degree for most positions, though sometimes only a post-secondary certificate is necessary. Though it seems a rather high-level position to require only a certificate (one of the sample titles is Chief Operations Officer), there may be lower-level positions that fall into this category. These positions may require little education and involve little responsibility, but do offer the potential to rise through the ranks to the higher-level management positions. The very next occupational category, packing and filling machine operators and tenders, requires only a high school diploma for most positions and no experience.

Table 10: Skills and Preparation Needed for Occupations in the Biomanufacturing Production Group

Occupational Category	Sample Job Titles	Relevant Tasks	Required Education/ Experience
General and operations managers	General Manager, Director of Operations, COO	Direct/ coordinate production/ distribution Manage personnel, schedules, finances Monitor productivity and performance Establish/implement department policies, goals, procedures	Most require either B.S. or post-secondary certificate; 6+ months OTJ training is the norm and 2+ years experience
Packaging & filling machine operators & tenders	Fabrication Technician, Chemical Operator, Pressman	Monitor and adjust machine operations Sort and process finished items Stock and sort product Routine machine maintenance	Most HS only; few w/A.A.S. or less than HS. Norm is 1-6 months OTJ training, no experience required.
Maintenance and repair workers	Maintenance Technician, Mechanic/ Supervisor/ Electrician/ Engineer; Process Technician	Repair/replace defective equipment parts Routine preventive maintenance Inspect machinery components Assemble/install components Diagnose mechanical problems Plan and lay out repair work using diagrams, blueprints, schematics, etc.	Usually HS or post-secondary certificate, few have some college, none w/ B.S.; usually 1-6 months of OTJ training; apprenticeships are fairly common
First-line supervisors/managers of production & operating workers	No alternative titles available	Calculate labor/equipment requirements and production specifications Help manage/train personnel Inspect products, materials, equipment Enforce standards and regulations Determine/manage production flow	Usually A.A.S. or other technical training; few require B.S.; 1-2 years of OTJ training/related experience is the norm
Chemical equipment operators and tenders	No alternative titles available	Adjust controls, valves, pumps, etc. on chemical equipment Maintenance, inspection, and monitoring of machinery, equipment, recording instruments Gather and test samples for quality control	At least HS, usually some vocational education required; some jobs require A.A.S. Often train w/apprenticeship.

Source: Bureau of Labor Statistics Occupational Outlook Handbook, Occupational Information Network, and Regional Technology Strategies, Inc.

The skills required for each occupational category show somewhat more, but not complete consistency. All the occupations require reading and mathematics comprehension and oral communication, but only the first (general and operations managers) and the fourth (maintenance and repair workers) call for higher-level skills such as personnel and resources management, instruction, negotiation, and written communication. The other occupations show a greater focus on manual skills: equipment handling, tool selection, and repairing or installation of component parts.

More important than these occupations' differences from each other, however, is their differences as a group from the first two occupational groups, particularly the biotechnology science technicians. Other than reading and mathematical comprehension and some communications-oriented skills, there is virtually no overlap among the tasks and skills required for the occupations in the two groups. Rather, the tasks and skills that pertain to the production group tend to be much more in line with those of other manufacturing occupations in non-biotechnology-related industries. This suggests that preparing for growth in demand in these occupations will not require fundamental changes in how these occupations are trained and educated; rather, it will mean providing opportunities for people in these manufacturing positions to learn the biotechnology context for their position, how it differs in a biotechnology industry from other production industries, and to gain some hands-on experience that will help them make the transition from other manufacturing to biomanufacturing.

Section IV: Description of Biotech-Related Education Programs

Table 11 presents the key biotech and life science educational assets identified by the project team in the seven county Southeast Florida region. Not every science program in the region is included, only life science programs. Appendix D gives more detailed descriptions of these programs.

The programs are organized by level of education, starting with high schools. It is important to note, however, that many experts consider middle school a critical time to “capture” students’ interests in science and indeed there are outreach efforts being carried out for those students. In fact, Scripps Florida seems to be focusing a good deal of its educational outreach on piquing young students’ interests in biotech through hands-on demonstrations and classroom activities.

Palm Beach County high school and community college biotechnology programs are just getting up and running, while regional university programs are more established. This is not surprising given both the relative youth of the cluster in the region (and even more so in Palm Beach County) and the fact that biotech career paths at levels below the four-year degree are in the process of being clarified throughout the biotechnology industry.

Experience from other biotech and life science clusters has shown that biotechnology companies, at least aside from manufacturing facilities, have a tendency to hire four-year biology- and chemistry-related graduates for most of their technical positions, probably more so than needed when a strict review of skill requirements is carried out. This is partly because, aside from traditional lab technician programs at community colleges which are oriented toward medical fields, there have not been many technical two-year biotech programs from which to hire (most two-year biology graduates go on to a four-year college). However, in places around the country where biotechnology is becoming a larger presence, more two-year colleges and companies are working together to develop programs that train skilled technicians to perform routine lab functions that do not require a four-year degree. This has benefited companies who find such graduates have high levels of hands on technical skills and have higher job retention and satisfaction rates. The occupational data projections regarding where the industry is headed reinforce this finding that technicians are becoming more important. With this in mind, the development of the new programs at Palm Beach Community College (PBCC) and Indian River Community Colleges (IRCC) are positive developments.

Table 11: South Florida Institutions Offering Biotechnology-Related Programs

Educational Provider	Location	Program	Credential / Description	Enrollments (most recent semester available)
Martin County High School	Martin County	Genetics course; offers biotechnology content	Class is open to grades 10, 11 and 12. Students need some biology and at least a co-requisite with chemistry	40-50
Palm Beach County School System	Palm Beach County	Two new High School Biotechnology Academies (Seminole Ridge begins Fall '05; Lakeside at a later date)	Two courses and a required internship	60 – 80 (starting Fall '05)
Florida Atlantic University & Indian River Community College	Palm Beach and St. Lucie Counties	One year Biotechnology Certificate for individuals who already have a B.S.	Credit bearing "Certificate"; Advanced Biotechnology Certificate is also in development.	Spring '05: 20 (at least 25 more Fall '06)
Florida Atlantic University	Palm Beach County	Center of Excellence in Biomedical and Marine Biotechnology	B.A. /B.S. in biological science; M.S. in Biomedical Science; and Ph.D. in Integrative Biology. Certificate in Biotechnology.	620 (all biological sciences)
Palm Beach Community College	Palm Beach County	New biotechnology program to start in Fall 2005	A.S.	48
Indian River Community College	St. Lucie County	New Biotechnology Degree Program begins Fall '05	A.S.; A.A.S.	15
Miami-Dade College	Miami-Dade County	Dismantled A.S. in Biomedical Engineering Technology in 2004	Currently developing common curricula for pharmaceutical manufacturers.	Not applicable
Broward Community College	Fort Lauderdale	Community College	A.A.S.: Biomedical Engineering Technology Program; Certificate in Biomedical Equipment Engineering	Approx. 50-100 students
Nova Southeastern University	Broward County	College of Medical Sciences (they also have an oceanographic center)	MBS in Biomedical Sciences. Most enrolled students do not graduate with an MBS, but pursue an MD or D.O. degree.	25
Florida International University	Miami-Dade County	Biomedical Engineering Program	B.S., M.S. and Ph.D. in Biomedical Engineering; Biomedical Engineering certificates in medical device engineering and medical instrumentation	Not available
Barry University	Miami-Dade County	School of Natural and Health Sciences	B.S., Biology with a Biotechnology specialization	Not available

Source: RTS Interviews and research

Another encouraging sign for Palm Beach County is the number of educational partnerships that are forming to respond to biotech. For example, Florida Atlantic University is partnering with Indian River Community College to offer its biotech certificate training to both Palm Beach County and Treasure Coast residents who already have a bachelor's degree. Additionally, Palm Beach County's high school biotechnology academies will have dual enrollment agreements with Palm Beach Community College, allowing students to begin their associate's degree while still in high school.

Palm Beach and Indian River Community Colleges partnered in late 2003 to conduct a curriculum development (called DACUM) process with industry in order to identify skills and content for biotech programs. Representatives from seven biotech companies, Harbor Beach Oceanographic Institute, and the USDA Agricultural Research Service participated in the three-day facilitated workshop. The colleges used the course outlines created in the DACUM to develop their new biotech programs.

At the high school level, the teacher and student summer internships at Scripps are a model program. In the summer of 2005 two teachers and several students from Palm Beach County have traveled to Scripps in La Jolla, California to work alongside scientists there. As Scripps Florida expands, the internship program will move to the Florida location, and the Education Commission of Palm Beach County hopes to expand this internship program to other biotech companies so that more teachers and students have these internship opportunities.

Regional Life Science Graduates

Table 12 shows that both Florida Atlantic University and Florida International University, the Southeast Florida region's primary public universities, have experienced an upswing in the number of life science degrees awarded in the last ten years. Whether the increase is due to an influx of students or the rising popularity of biotechnology, the result is a workforce ready to work.

FAU, located in Palm Beach County, awarded more than 1,500 life science degrees over the last ten years, and granted 250 percent more degrees in 2004 compared to 1994. In 2004, they awarded 189 B.S. degrees and 25 M.S. degrees.

FIU, located in Miami-Dade County, awarded close to 1,300 life science degrees over the last ten years. The 126 degrees awarded in 2004 was 63.6 percent higher than in 1994. 2004 life science graduates included 104 B.S. recipients, 15 M.S. recipients and 7 Ph.D. recipients.

Of note is the high percentage of Florida residents who receive degrees. At FAU, 95 percent of B.S. recipients and 84 percent of M.S. recipients are Florida residents. FIU

boasts a 94 percent Florida resident average for B.S. graduates, 93 percent for M.S. graduates, and 85 percent of doctoral graduates. Because these graduates are Florida residents, they may be more apt to stay in the region, giving the area a well-qualified workforce with local ties. These local ties may also benefit the region as they develop spin-off companies.

Table 12: Life Science Degrees Awarded by South Florida’s Public Universities 2003-2004

Institution	B.S.	Percentage of Florida Residents	Masters	Percentage of Florida Residents	Doctorate	Percentage of Florida Residents	Percent Change in Degrees Awarded, 1993-2004	Total Life Sciences Degrees (B.S., M.S., Ph.D.) from 1993 to 2004
<i>Florida Atlantic University</i>	189	95%	25	84%	0	N/A	250.8%	1,549
<i>Florida International University</i>	104	94%	15	93%	7	85%	63.6%	1,272

Source: Florida Department of Education

In contrast, regional community college enrollment growth in biological sciences, or indeed in all Associate’s of Science (A.S.) programs, is not as high. In order to receive guaranteed placement at a public Florida college or university, a community college student must graduate with an A.A. degree. As a result, transfer students, some of whom study science, do not receive A.S. degrees. Though some A.S. degrees are specifically articulated with four-year programs, they are designed for students wanting to go directly into the workforce.

Table 13: Enrollment in Comm. College Biological Science and A.S. Programs

Institution	2003-04 Biological Science Programs FTEs	2003-04 Headcount in all A.S. Degree Programs	Change in Headcount Enrollment: 1994—2004
<i>Broward CC</i>	963	5,184	2%
<i>Indian River CC</i>	484	2,063	13%
<i>Miami-Dade College</i>	2,330	6,699	19%
<i>Palm Beach CC</i>	892	2,954	27%

Source: Florida Community College System "The Fact Book" February 2005

Section V: Benchmark Programs in Biotechnology Education

Nearly every state and large city in the nation has a strategic plan for developing its biotechnology workforce, with the ultimate goal of expanding and growing the region's biotechnology base. To date, there is no agreed-upon way of determining what makes these plans work or even what distinguishes a good plan from a poor one. The outcomes, of course, will eventually determine what is truly effective, but there has not been sufficient time to fully evaluate the economic impact of cities' and states' efforts to nurture their biotechnology workforce and industries—at least not in a way that would defensibly state that the cause of economic change came from the strategic plans.

What is possible at this stage is to pull out those elements of the biotechnology workforce programs that are appearing, so far, to produce good interim and internal results, that are receiving attention as models to follow, that fit what is known about effective workforce development in other sectors, and that correspond with the regions' larger economic goals. Regions have different objectives in mind when launching a biotechnology workforce initiative; some are attempting to increase the workforce pipeline to meet a demand for biotechnology workers that is already outstripping supply, and some are attempting to develop the workforce's biotechnology skills in an effort to foster the growth of the region's still-burgeoning biotech industry base. In the Southeast Florida region, the goals incorporate both of these in some form. With this in mind, RTS has identified several elements of programs that have achieved success in some critical areas of their biotechnology workforce plan, and that offer lessons regarding valuable elements to be incorporated into the Southeast Florida region's eventual workforce development plan for the biotechnology and life science industries.

Career pathways. Many education and training initiatives focus on one way of breaking into the biotechnology field—through a certificate, a two-year degree, continuing education, or another type of program. Another approach is one that allows for incremental delivery of education and training, interspersed with opportunities to work in the biotech industry and work one's way up until the next level of education is required to move any farther (or at least to do it quickly). This allows those who are trying to break into the technology field to do so at an entry level that does not require a huge investment of time and funds in order to become qualified, and to move ahead at his or her own pace—and it also encourages lifelong learning by making it easier for program participants to build upon their previous levels of education.

Lakeland Community College in Northeast Ohio, in partnership with the region's school systems, four-year schools, and workforce entities, has created a four-tier biotechnology training system that facilitates a student/employee in eventually participating in all four levels, but also allows for a student to enter or leave the program at any of the levels, with an intact degree. The program begins with a biotechnician program at the high school level, and articulates through an Associate's of Science research assistant

degree, a Bachelor's of Science degree in biotechnology, and a research scientist's Master's degree. It also offers a biotechnology career management model through a "Biotechnology Career Coach" website.

The career pathway approach is also an effective way to incorporate an equity focus into a biotechnology workforce initiative. The *OnRamp* and *Bridge to Biotechnology* programs in San Francisco target the city's disadvantaged and underserved populations with programs that first provide, through the OnRamp, a basic level of readiness in reading, writing, and mathematics to study biotech-specific material. The Bridge to Biotechnology program then offers opportunities first for a two-year and then for a bachelor's degree in biotechnology. The programs are accompanied by career coaching and social services, and so far the program has had a high retention and completion rate. When part of a community's goal is to make sure that the new jobs created in biotechnology will not be offered only to those in the community who already have opportunities, but extended also to those who need it most, an equity-oriented career ladder program can be a highly effective tool.

One element of the career pathway approach that makes it particularly appropriate for a region such as Palm Beach is its incremental nature. In a region where the demand for biotechnology workers is projected to grow, but is not yet outstripping supply, the risk in creating new education and training programs is that the workforce will suddenly be flooded with newly minted biotechnology workers—for whom there are no jobs. A career pathway approach allows a region to lay the foundations of a large-scale workforce education and training plan that can eventually produce hundreds or thousands of biotechnology workers at every level of education—but that, at the beginning, may do no more than educate the K-12 population about biotechnology opportunities and lay the groundwork for the additional tiers to come. Most relocating companies look first at the quality of a prospective site's K-12 system, so initiatives that focus on high school graduates' readiness for biotechnology jobs are likely to have positive effects on relocation.

Another biotechnology education model that is starting to gain attention is that of the "baccalaureate retread"—programs developed and delivered by community colleges that are aimed at four-year college graduates who do not have sufficient industry-oriented expertise to start work in the biotechnology industry. This approach is proving popular with some employers who have an automatic preference for job candidates with bachelor's degrees, but are finding their preparation insufficiently applied even for an entry-level position. These programs, because they target four-year graduates, are higher-level than most community college courses, but are often offered by community colleges as well as by four-year colleges, or by a partnership between the two (as with FAU's Biotechnology Certificate program).

Partnerships with industry. A close and open relationship with local biotechnology

companies is absolutely critical to the success of any biotechnology workforce initiative. However, the task of gaining the attention and ear—not to mention the time and effort—of the biotechnology industry can be one of the most time-consuming, and at times frustrating, elements of any biotechnology workforce development initiative. If the goal is to meet industry demand (in which case it is likely to be easier to get the companies involved), the workforce responses must be very closely keyed into the industry's immediate needs. If the goal is to grow the industry, the workforce initiative will have to work all the harder to be relevant to industry's future, perhaps as-yet unanticipated, needs, perhaps even playing a convening or facilitating role in the industry-wide conversation about where the workforce demands are headed.

In *San Diego*, the workforce organization accomplished this by not heading into the fray alone. The San Diego Association of Governments (SANDAG), the San Diego Regional Economic Development Corporation, and the San Diego Workforce Partnership proved to be a strong enough coalition that they were able to forge an alliance with BIOCUM, the region's biotechnology trade association. The city's community college system and four-year university were brought in as well, creating a powerful force that was able to engage industry in an ongoing workforce planning process. Not all of these entities focus on workforce—SANDAG, for instance, is primarily concerned with infrastructure capacity issues—but because the coalition as a whole is able to address many issues of importance to the industry, each member has much more clout than it would have independently. In addition, the collaborative nature of the approach to supporting the biotechnology industry means that each entity is spilling over into others' "territory" more than it usually might—but with positive results. The community college system is moving beyond training into an R&D and production role, and the workforce partnership is creating an education and training plan that is much more closely linked to the region's cluster-based economic development plan than it previously was.

"Divide and cluster." Particularly in places where the community college systems have been central to the biotechnology workforce strategies, many areas have encountered a conflict: all the areas of the state or region want to share in the biotechnology training and opportunities, but the programs are expensive already without replicating them in every institution. North Carolina's community college system is using a model that has been quite successful, and is now being used by the national Department of Labor: specialized centers of excellence. *North Carolina's BioNetwork* program created six regions in the state, and invited all the community colleges to submit proposals for niche-oriented biotechnology centers that would be housed at one college, but that would share their resources and products with the entire community college system. The six centers are:

- the BioNetwork Capstone Center, with a focus on short courses for incumbent workers in biomanufacturing
- the BioNetwork Bioprocessing Center, with a focus on bioprocessing preparation

- the BioNetwork BioEd Center, with a focus on distance education
- the BioNetwork Pharmaceutical Center, with a focus on pharmaceutical manufacturing
- the BioNetwork BioAg Center, with a focus on agricultural biotechnology
- the BioNetwork BioBusiness Center, with a focus on the business models and entrepreneurship in biotechnology.

The centers' niches are based both on the colleges' core competencies and on the makeup of the biotechnology industry in their region (and a lack of industry concentration is not a deterrent, as the center focusing on distance education shows). The system builds stronger ties among the institutions, as well as making it easier for industry to know where to turn with specific needs.

Section VI: Recommendations for Education and Training Responses to Meet the Needs of Palm Beach County's Emerging Biotech / Life Science Cluster.

The occupational projections presented earlier indicate that there will be a significant increase in demand in the Southeast Florida region across many categories of scientists, technicians, and production workers. The greatest growth in demand is anticipated to be for technicians—perhaps growing in the seven county region by more than 140 percent to 7,516 employees by 2012, if the region falls on Growth Trajectory 2, described earlier. This represents a shift in the workforce profile from its current composition.

Recommendations in this section are based on the fruition of the Scripps Florida research facility as announced and on the competitive advantages of the cluster as it stands in mid-2005. Despite the project team's use of state-of-the-art statistical analysis and access to the best available data (including non-suppressed Florida employment figures), clearly the composition of the cluster will change in the coming years in ways that cannot be predicted. Changes will come from factors such as which new companies choose to locate in the area and whether they move the cluster toward certain niches; what types of new companies are started; advances in technology and "convergence" with other industries such as medical devices and nanotechnology; the development paths of other regions' biotechnology clusters; and even regulations and political decisions (e.g., the continuation or lifting of restrictions on stem cell research).

The following recommendations focus primarily on the workforce needs below the graduate degree level because Ph.D. positions are often filled through national or even international searches, whereas other positions are most likely to be filled by residents of the region. Therefore the region's ability to produce such workers is very important.

RECOMMENDATIONS

1. Further engage biotechnology companies.

Experience from other U.S. regions with more mature biotechnology and life science clusters has shown that biotechnology companies are often somewhat difficult to engage. Due to intense competition among members, the small size of companies and the relative youth of the industry, biotech firms are often unwilling or, due to time constraints, unable to share much information with one another, much less with public agencies. However, if the Workforce Alliance and other agencies hope to meet the needs of the industry as it grows, this barrier to information sharing must be broken down. Perhaps the most important thing that Palm Beach County can do now is to build on existing workforce efforts to create a coherent and responsive system to monitor demand for and coordinate biotech-related education and training resources

available among the many different providers, both in the County and in surrounding counties.

Fortunately, the region does possess a good infrastructure of industry support agencies that may be able to facilitate this form of associational behavior. The Life Sciences Cluster sponsored by the Business Development Board of Palm Beach County and the South Florida Bioscience Consortium bring together biotech-related firms to talk about specific workforce issues. Encouraging both groups to develop active workforce committees that could meet on a periodic basis with Workforce Alliance staff would be extremely helpful as the Alliance initiates new programs or improves existing ones to meet the needs of industry. Representatives from local educational institutions who provide the programs should also be closely involved.

In addition to these two local cluster groups, Workforce Alliance staff should also engage two larger industry associations. BioFlorida, the state chapter of the largest biotech trade association in the United States, BIO, recently relocated its headquarters to West Palm Beach and already has an education working group. In addition, the South Florida Manufacturers' Association may be a good source of engaging more industry. Several biotech companies suggested this general association was actually used more than the specific biotech-focused groups.

The Workforce Alliance should make sure in particular that it remains closely engaged with Scripps Florida. If, as expected, Scripps Florida drives the industry in the Southeast Florida region, it will be important to monitor its needs and future direction.

A successful model for engaging industry that goes beyond workforce issues can be found in San Diego, as described in the previous section. By using a coordinated approach to support biotechnology needs in multiple arenas, the region has created a supportive environment for the industry that contributes to the region's biotech success. Palm Beach County should consider emulating this multi-faceted initiative.

2. Support and expand biotechnology educational programs, especially at the technician level.

The occupational analyses for this study indicate that demand for biotech-related technicians will increase even more than scientists or production workers in the coming years, in some cases doubling or more. In particular, the greatest needs will likely be for:

- Medical and clinical laboratory technologists
- Radiologic technicians
- Chemical technicians

Because the core skills and competencies of these and other technician positions are similar, the findings of this report do not indicate the creation of multiple types of biotechnology programs at this time (this finding also applies to four year programs). The new community college programs at Palm Beach and Indian River Community Colleges are, appropriately, general biotech technician preparation programs, and they are being backed by significant investments in high-quality laboratories.

Some technicians may be “imported” from other counties or even regions. Therefore other local programs, at places like nearby Broward and Miami-Dade Community Colleges, are also important potential pipelines for new technicians. Careful attention should be paid to providing additional capacity for these programs as demand for workers increases, especially after Scripps becomes fully operational.

The core curricular content of these biotechnology programs should be kept fairly general in order to prepare technicians for a variety of types of biotech / life science companies. It is useful, however, to incorporate to some degree the competitive advantages the region offers in marine and agriculture-related aspects of biotech. For example, Palm Beach County’s new biotech academy is a general preparation program yet it includes a hands-on horticulture lab. Future high school academies could include marine, agricultural, or, as Scripps’ impact is felt, pharmaceutical emphases.

3. Create biotechnology modules or elective courses for non-biotech education programs.

Many employees in biotech companies do not carry out biotech-specific functions, but rather perform other duties such as business, administrative or facilities management. Yet it is valuable for these workers to understand the operating context of biotech companies, particularly the strict regulatory environment they face. Workforce Alliance should consider supporting the development of discrete modules or elective courses for these students—both at the two-year and the four-year college level that teach, at a general level, for example:

- Overview of biotechnology
- Overview of Standard Operating Procedures (SOPs), Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP)
- Quality assurance / quality control
- Regulatory issues
- Bioethics

While some modules could be used across disciplines, some should be tailored for different programs—for example, industrial and facilities maintenance students would learn the fundamentals of common biotechnology equipment and systems, while

marketing students would learn the about regulations related to disclosures and labeling. Modules or courses should be created by faculty teams from different educational institutions with input from industry. This is important because the modules become more cost effective and the process more efficient as both the development costs and use of the modules are spread across many colleges and courses. The modules or courses should be “packaged” in a consistent and flexible format that allows them to be used by faculty at different colleges. Developing the content in an online format so that modules could be taught in distance or hybrid (in class + online) courses should be considered.

The Florida Consortium for Biotechnology Workforce has already developed some online biotechnology content through a state-funded initiative. The Workforce Alliance should review these materials, as they likely contain content suitable for the modules described in this recommendation as well as for the short courses for industry workers described in Recommendation 5. The curricula include building soft skills, such as communications, in the context of the biotech industry, safety, regulations and compliance, and equipment and facilities. More advanced modules cover laboratory methods and procedures.

These modules could become a workforce competitive advantage for the region—a resource the Southeast Florida region has that most other locations do not and something that can be promoted to prospective companies. That being said, it would be wise to start developing these modules on a fairly modest scale in order not to outpace demand. The best strategy would be developing a few core modules, while simultaneously establishing an infrastructure that will allow for the quick development of new ones in response to industry demand.

4. Seek additional funding to expand Workforce Alliance-funded one-year Biotechnology Certificate to earlier educational levels as the cluster grows.

Because most life science companies in Palm Beach and nearby counties currently hire primarily employees with four-year degrees (with the exception of some assembly workers), it is reasonable that FAU’s Biotechnology Certificate for dislocated workers targets those who already have a B.S. degree. Interviews and research for this study do not indicate sufficient demand right now for a dislocated workers’ initiative for those with less educational background, because it is not clear what jobs they would fill in area life science companies.

As the industry evolves and the number of technician and entry-level workers increases, however, there are likely to be opportunities to create dislocated worker programs for biotechnology jobs that do not require higher degrees. The Alliance should engage Scripps and other large employers in discussions about lab preparation

and maintenance functions that might require some short-term training, and which could represent the first rung on career pathways, as discussed later.

In addition, if one or more pharmaceutical manufacturing facilities move to Palm Beach County, there could be room to create a bioprocessing-oriented training program for entry-level workers, especially those with manufacturing experience. Another avenue to explore is the cross-over skills shared between life science companies and the health field. It is possible that health-related training programs could be altered to incorporate some of the foundational lab skills required in biotech companies, increasing trainees' marketability for positions in life science companies.

5. Develop short courses for incumbent workers.

Interviews and survey results indicate that most biotech firms do a considerable amount of in-house training and/or use third party vendors for this training. The Workforce Alliance could explore offering the recommended modules to companies on a fee-for-service basis to help up-skill their non-biotech specific workers. Additional "short courses" for technical workers could also be developed and offered to incumbent workers, probably at less expense than what companies currently are paying. Making the modules and courses credit-bearing by working through colleges would increase the value to employees and would encourage non-degreed workers to matriculate into programs.

Topics for short courses could include:

- advanced regulatory affairs
- project management
- data gathering and documentation
- handling of hazardous materials (with crossover applicability to other fields such as first responders and emergency response)
- monitoring compliance with laboratory standards
- lab equipment maintenance.

6. Develop career pathways.

Career pathways are initiatives that help disadvantaged workers gain access to jobs and advance to higher-paying positions within an industry through training and support programs. Career pathways in biotechnology are just emerging (a San Francisco model is profiled in the Benchmark Programs section). It is too early right now to develop career pathways for biotech in Palm Beach County, because the cluster has not yet reached sufficient scale. However, as Scripps and other large companies grow, there will be relatively low-skilled biotechnology jobs that could represent the first rung of a career pathway. For example, Scripps will employ glass washers who could pursue

additional training to become lab assistants or technicians. In the counties north of Palm Beach served by Indian River Community College, the research labs such as Harbor Branch Oceanographic Institution and the Smithsonian Marine Station might be open to taking part in such an effort.

Biotech career pathways should also go beyond entry-level positions. As mentioned in the Benchmark Programs section, Lakeland Community College in Ohio has developed easy entrance/exit career pathways for biotech starting with high school and moving up through the four-year level. Palm Beach County has all the pieces in place to develop a similar effort and should consider implementing this approach.

7. Coordinate biotech-related education and training resources across South Florida.

RTS has worked with other states to develop plans for coordinated efforts to steer specialization among educational providers with respect to education and training for particular industry clusters. North Carolina (as described in the Benchmark section) has adopted this model for biotechnology. Specialization reduces duplication and competition among providers. Other benefits of a coordinated effort in Southeast Florida region would be developing and implementing recommendations in this report—such as modules and short courses—on a regional basis, making the scale and impact greater.

Creating a “virtual” organization to engage industry and to create appropriate, flexible education and training resources on a regional basis would build the area’s biotech capacity for existing companies and increase its attractiveness to prospective employers. The initiative could be “branded” and marketed under a single name, such as South Florida BioConnect.

The important first step, of course, is to find a regional entity that has the legitimacy and ability to manage such an endeavor and to include all the appropriate partners. Typically industry organizations are important leaders and can even “house” staff persons to manage an effort of this type. The ability of the lead entity to secure and distribute funding to partners to carry out initiative activities increases its effectiveness.

Potential functions would be:

- Monitoring industry trends and workforce needs
- Interfacing with industry organizations
- Coordinating specialization among providers, including specialties within biotechnology programs if they become necessary, and the development and use of biotech modules and short courses at the two- and four-year level.
- Plugging into national biotech networks and identifying benchmark practices

- Implementing ways to improve access and outcomes for disadvantaged populations
- Sponsoring faculty development opportunities

The ultimate goals are to facilitate close interaction with companies and establish short feedback loops to quickly translate employers' needs into appropriate curricula delivered in flexible formats. Another goal is to make it clear to companies that the education community is speaking with one voice—there is only one phone number they need to know when they have a workforce issue. This type of workforce system would put the Southeast Florida region ahead of the many other areas aspiring to develop their biotechnology clusters, and it could become an important regional asset.

Appendix A: List of Individuals Interviewed

Biotech Companies

Name	Title	Affiliation
Marcia Cage	Oncology Research Coordinator	Jupiter Health Care
Patrick Cusick	Director of Finance	Altor Bioscience Corporation
Michael Della Silva	Director, Human Resources	NBTY, Inc.
John DiPrima	Director, Talent Management	Nabi BioPharmaceuticals
Stephanie Finnegan	Chief Executive Officer	Goodwin Biotechnology
Brenda Gordon	Administrative Director of Oncology and Women's Services	Jupiter Health Care
Ken Kirby	President	TransDermal Technologies
Jose Lopez	Assistant Scientist	Division of Biomedical Marine Research, Harbor Branch Oceanographic Institution
Kristen Noppinger	President	DNA Labs International
Harry Orf	Vice President of Scientific Operations	Scripps Florida
Ervin Owens	Human Resources Director	Scripps Florida
Mel Rothberg	Industry representative,	South Florida Bioscience Consortium
Melody Sanger	Director of Clinical Research	Drug Study Institute
David Scott	Vice President	Palm Beach Research Center
Claire Thuning-Roberson	Vice President, Product Development and Compliance	Sunol Molecular Corporation
Rhys Williams	Chief Executive Officer	Tequesta Marine Biosciences

Economic Development and Workforce Development Support Agencies or Organizations

Name	Title	Affiliation
Vernon Bailey	Bioscience Business Liaison	Workforce One
Gary Hines	Senior Vice President-Development	Business Development Board of Palm Beach County
Debora Kerr	Private Consultant	Formerly with Workforce Alliance
Larry Pelton	Board Member	Workforce Alliance, Inc.
Jane Teague	Executive Director	Enterprise Development Corporation
June Wolfe	President	South Florida Manufacturers Association

Educational Institutions

Name	Title	Affiliation
Blair Atherton	Executive Director of Institutional Research	Nova Southeastern University
Fred Barch	Science Program Planner	Palm Beach County Public Schools
David Binninger	Associate Professor	Center for Molecular Biology and Biotechnology, Florida Atlantic University
Sherry Bowen	Project Coordinator, Title III & Living Science	Indian River Community College
Jody Gleason	Executive Director	Palm Beach County Education Commission
Casey Lunceford	Academic Director, Mathematics & Science	Indian River Community College
Herbert Weissbach	Distinguished Research Professor and Director,	Center for Molecular Biology and Biotechnology, Florida Atlantic University
Ed Willey	Dean of Academic Affairs	Palm Beach Community College

Appendix B: Definition of Biotechnology and Life Science Cluster

Biotechnology—narrow cluster

Pharmaceutical and Medicine Manufacturing (3254)
Research and Development in the Physical, Engineering, and Life Sciences (54171)
Medical Laboratories (621511)
Diagnostic Imaging Centers (621512)

Life Sciences—broad: all of the above plus the following:

Pesticide and Other Agricultural Chemical Manufacturing (32532)
Electromedical and Electrotherapeutic Apparatus Manufacturing (334510)
Analytical Laboratory Instrument Manufacturing (334516)
Irradiation Apparatus Manufacturing (334517)
Laboratory Apparatus and Furniture Manufacturing (339111)
Surgical and Medical Instrument Manufacturing (339112)
Surgical Appliance and Supplies Manufacturing (339113)
Testing Laboratories (54138)
Veterinary Services (541940)

Definition adopted from A Blueprint for Life Sciences Industry Growth in the Research Triangle Region, Research Triangle Regional Partnership (NC Biosciences Organization, NC Biotechnology Center, and Price Waterhouse Coopers LLP). 2003.

Appendix C: Detailed Description of Industry and Occupational Projections

Industry Projections

Three biotech sector scenarios were developed to estimate the likely growth in employment Palm Beach and the South Florida region. The first is based on a *national projection* incorporated in BLS's 2002-2012 employment growth projections for each industry. For this scenario, we multiplied the industry-specific specific employment growth projections from BLS by the 2002 employment by industry data from ES-202 to estimate likely job growth if Scripps had not located in Palm Beach. In order to capture the effect of Scripps on the growth trajectory, 1,040 jobs were added to the baseline estimate to reflect the contribution of Scripps to local employment.

The *national projection* methodology, however, has at least one potential shortcoming: it appears to underestimate likely growth in employment in biotech nationally. When these industry growth rates are applied to the U.S. biotech industry mix for 2002, projected ten-year (2002-2012) employment growth would be 16.7 percent for the broadly-defined biotech sector and 19.1 percent for the narrowly-defined one. These projections are quite low compared to recent experience in the industry: between just 1998 and 2002, U.S. employment grew by 13.8 percent in the broadly defined biotech sector and 19.4 percent in the narrowly defined sector.

To compensate for this shortcoming, the second employment growth scenario is based on a methodology that captures recent *national trends* by adjusting the ten-year national growth rates upward to reflect rapid growth in national biotech employment in 1998-2002. This approach imposes the assumption that higher-than-expected recent national employment growth will continue in the next ten-year projection period. In addition, 1,040 jobs were added to reflect the contribution of Scripps to local employment.

The third scenario is based on the premise that the arrival of Scripps will fundamentally change the biotech growth trajectory in Palm Beach and South Florida. To estimate this effect, it was assumed that with the arrival of Scripps, employment growth in Palm Beach County, which greatly lagged behind the rest of the South Florida in the 1998-2002 period, would match the rest of the region in the next ten years. (Holding industry mix constant, biotech employment grew 102% faster in the seven-county region in South Florida than in the nation as a whole during the 1998-2002 period.¹ When the same calculations are performed for Palm Beach County, they show that biotech employment grew slower than in the nation as a whole.) These projections are based on two premises: 1) with the arrival of Scripps, South Florida will be able to maintain the high regional-national growth differential experienced in the past few years; and 2) with the arrival of Scripps, future employment growth in Palm Beach will track the rest of the South Florida region. In addition, 1,040 jobs were added to reflect the direct contribution of Scripps to local employment.

¹ Authors' estimate based on County Business Patterns data and internal calculations.

Occupational Projections

The occupational projections are developed using projections of ten-year employment growth in each biotech industry and a matrix of employment by six-digit occupational code for each biotech sector in 2012. The industry employment projections developed by the project team are described in detail below; the occupational matrix was developed by the U.S. Bureau of Labor Statistics (BLS). Applying the occupational matrix to the projected employment growth by 2012 yields estimates of employment by occupation for biotech industry for 2012. The sum of occupational projections across industries yields estimates of employment by occupation in the biotech sector for 2012.

Projections of biotech employment by occupation in 2012 are used in two ways: they are reported “as is” to provide an estimate of demand by occupation for that year; and they are compared to estimates of demand by occupation in 2002 to provide an estimate of the increase in demand by occupation that will accompany growth in the biotech sector in South Florida over the next ten years. (Estimates of demand by occupation in 2002 were calculated using 2002 employment data from ES-202 and BLS’s occupational matrix for 2002.²) Projected growth in demand by occupation for the 2002-2012 period is assumed to provide a good proxy of likely growth in occupational demand over the next ten years (2005-2015) in Palm Beach and South Florida.

² “2002-12 National Employment Matrix, detailed industry by occupation,” available at <http://www.bls.gov/emp/empiols.htm>.

Appendix D

Biotech-Related Program Descriptions

Florida Atlantic University offers two types of training: a Certificate in Biotechnology and Bioinformatics for un- or underemployed workers with a B.S. in math or the sciences (funded by the Workforce Alliance), and a B.S., M.S. or Ph.D. in a biotechnology-relevant field.

The certificate training program is part-time and lasts for one year. Prospective students must apply through the Workforce Alliance. They must have a B.S. in math or the sciences, and reside in Palm Beach, Martin, St. Lucie, Indian River or Okeechobee Counties. Classes are held at either FAU or Indian River Community College. The program is funded by a High Growth Job Training Initiative grant from the Department of Labor.

FAU also offers a Certificate in Biotechnology and one in graduate bioengineering; a variety of related B.S. programs; a M.S. in biomedical science and a Ph.D. in integrative biology. The undergraduate certificate program heavily emphasizes lab skills. The Biomedical Sciences Department is also developing a series of training courses to ensure regulatory compliance, and is also working with industry and academic partners to discover, develop and commercialize new medicines from Florida's natural resources.

FAU operates a research and development park, which offers space to faculty and graduate student projects, FAU's technology transfer program, and the Technology Business Incubator.

Palm Beach Community College will offer an A.S. biotechnology program beginning fall 2005. Students may also take core courses as part of an A.A. degree so that they may transfer to a four-year university. PBCC will have a dual enrollment program with the Palm Beach County School System's biotechnology academies, and hopes to articulate its A.S. program with FAU.

Indian River Community College begins this fall to offer an A.S. and an A.A.S. in biotechnology. The A.A.S. offers specialized lab work compared to the A.S. program. In addition, IRCC is a partner in the FAU grant-funded certificate program described earlier. FAU Certificate classes are offered through distance learning and at an Indian River Community College campus.

Miami-Dade College recently dismantled its A.S. in biomedical engineering technology, but is currently developing a common curriculum for pharmaceutical manufacturers with Broward Community College. In addition, MDC was recently awarded a \$1 million grant from the U.S. Department of Labor for biotechnology

training and retention programs at the new MediVector Biopharmaceutical Center. Miami-Dade College plans to train 800 technicians and workers to fill the estimated 1,500 jobs that will be created when the Poinciana Industrial Park is completed. Miami Dade College's partners in this project include MediVector, Inc., Onco-Vector, Inc., IVAX Corporation, South Florida Workforce, Inc., Miami-Dade County Public Schools, Florida A & M University, Miami-Dade County and the Greater Miami Chamber of Commerce.

Broward Community College offers both an A.A.S. in biomedical engineering technology and a certificate in biomedical equipment engineering. This program is the only one in the area, and is equipment-based. BCC has very strong relationships with Phillips Medical Systems, GE Health Care, local hospitals and health facilities; these institutions also helped guide the curriculum. Students are required to complete internships, and BCC offers Job placement assistance for students who want to enter the workforce during school or immediately after graduation. Currently the community college is developing a curriculum for pharmaceutical manufacturers with Miami-Dade College.

Nova Southeastern University offers a Master's of Biomedical Science degree.

Barry University offers a B.S. in biology, with a biotechnology specialization. Program strengths are hands on laboratory experience with cutting edge technology and faculty who are directly involved in biomedical research. Another program highlight is a biotechnology internship for students.

Florida International University has the only public Biomedical Engineering (BME) program in South Florida, with the following credentials:

- a B.S., M.S. and Ph.D. in biomedical engineering (the M.S. program has 2 tracks —professional and research)
- an undergraduate minor in BME;
- a combined B.S. (engineering)/M.S. (BME) 5-year program (designed by and for the biomedical industry);

- BME certificates in medical device engineering and medical instrumentation; and
- Ph.D. programs in chemistry and biology

Through the university's partnership with Baptist Health Systems of South Florida, Inc. and the Miami Cardiac and Vascular Institute, students are introduced to applications and real life situations associated with the use of medical devices and instruments in clinical medicine. It also requires one semester of clinical rotations and a senior project for the B.S. degree. The department assists students in finding relevant internships for all students.

Palm Beach County Biotechnology High School Academies

The School District of Palm Beach County will operate two Biotechnology Academies at the high school level. The first will open in the fall of 2005 at Seminole Ridge High School, a new school close to Mecca Farms, which is the location where the expanded Scripps Florida campus will be located. The County has invested more than \$800,000 in biotech classroom and lab facilities at Seminole Ridge, and has based this program on similar academies in California and Massachusetts.

The "magnet" Academy (it can draw students from across the county) will comprise three courses taken from 9th through 11th grades and a capstone internship experience. Each grade cohort will be 60 to 80 students. The program has a career focus, meaning its graduates will be suitable for some entry-level positions in the industry; however, it will also offer dual enrollment with Palm Beach Community College and expects to attract some college-bound students. A second biotech academy at another high school is also being pursued.

Florida Consortium for Biotechnology Workforce Development

This web-based program is sponsored by WFI and developed by the Florida Consortium for Biotechnology Workforce Development (Florida Community College at Jacksonville, Santa Fe Community College in Gainesville, and Hillsborough Community College in Tampa). The web-based curriculum includes more than 40 hours of instruction on such topics as biotech communication; safety; problem solving; technical mathematics; sterilization; quality control; quality assurance; regulatory; biotech facilities; and lab skills. Curriculum planning, development and evaluation, as well as industry coordination was supported by BIO Florida, Florida Atlantic University, the University of Florida, and the University of South Florida.