

At the Heart of Bioscience

- business
- community
- diversity
- knowledge
- location

**4,700 people are employed by the
Bioscience industry in RI...and growing!**



REPORT OF THE RHODE ISLAND BIOSCIENCE INDUSTRY
SKILLS GAP TASK FORCE

Report of the Rhode Island Bioscience Industry Skills Gap Task Force



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November 2009

Dear Bioscience Community Member:

Rhode Island's Bioscience industry is a vastly diverse and growing sector of our workforce and community. It is a very exciting time to be in Rhode Island! However, although we have established a strong foundation for the biosciences, we must continue to foster their development and success through addressing key needs. One such need is an adequate workforce talent pool.

Seeing this, and in its commitment to building a world class, high-wage economy in the state, the Governor's Workforce Board of Rhode Island awarded Tech Collective an Industry Partnership grant to identify skills gap shortages within the industry and offer strategic solutions to enhance career and employment opportunities.

For the past 18 months, the Bioscience Skills Gap Task Force conducted research and compiled data across the industry, academic and government sectors through a series of interviews, surveys, public forums, publications and other data sources in order to identify the skills that Rhode Island employers require from bioscience professionals. The result of this undertaking is the **"Report of the Rhode Island Bioscience Industry Skills Gap Task Force."** The report defines the state's Bioscience industry, investigates the level and root causes of the talent shortage in Rhode Island and offers strategic recommendations for future growth and direction.

Our work in developing a world class Bioscience industry has a strong start, but we still have a long way to go. The "Report of the Rhode Island Bioscience Industry Skills Gap Task Force" is a stepping stone. I urge you to read the report to better understand the workforce challenges faced by the industry, and how we can work together to meet those challenges for both a more prosperous Bioscience industry and Rhode Island.

Please do not hesitate to contact me with any questions or comments.

Sincerely,

A handwritten signature in black ink, appearing to read "K Shields", written in a cursive style.

Kathie Shields
Executive Director
Tech Collective

REPORT OF THE RHODE ISLAND BIOSCIENCE INDUSTRY SKILLS GAP TASK FORCE

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REPORT OF THE RHODE ISLAND BIOSCIENCE INDUSTRY SKILLS GAP TASK FORCE

INTRODUCTION

The Bioscience industry is one of the most earnestly growing sectors in both the Rhode Island and national economies. According to the Biotechnology Industry Organization (BIO), the Rhode Island Bioscience industry currently employs nearly 5,000 people and generates an estimated revenue of \$526M (direct and “multiplier effect.”) As such, the Bioscience industry and our ability to provide a high-quality workforce are vital to the prosperity of Rhode Island’s people, industries, economy and future.

During the spring of 2008, the BioGroup/Tech Collective began a year-long process to conduct a skills gap analysis of Rhode Island’s Bioscience industry. The study was part of an Industry Partnership Grant that was awarded to Tech Collective by the Governor’s Workforce Board of Rhode Island. BioGroup/Tech Collective partnered with the Biotechnology Center at the University of Rhode Island (URI) to conduct the study. A Bioscience Skills Gap Task Force comprised of industry, academia and government was then appointed with the charge of guiding the study process, reviewing data and making recommendations in the overall success of the report.

*Rhode Island’s
Bioscience industry
employs nearly 5,000
people and generates
an estimated revenue
of \$526M*

*Biotechnology Industry Organization
(BIO), 2009*

The following is the Report of the Rhode Island Bioscience Industry Skills Gap Task Force, a resource intended to continue to foster, promote and support the potential and prosperity of Rhode Island’s burgeoning Bioscience industry and its vital youth, transitioning and incumbent workforce.

Industry Overview

For the purposes of this study, the Task Force’s first initiative was to provide a definition of the “Bioscience industry.” The following definition has been selected from the “State Bioscience Initiatives 2008: “Technology, Talent and Capital” report published by BIO, the world’s largest biotechnology organization:

The biosciences are a diverse group of industries and activities with a common link—they apply knowledge of the way in which plants, animals and humans function. The sector spans different markets and includes manufacturing, services and research activities. By definition, the biosciences are a unique industry cluster and are constantly changing to incorporate the latest research and scientific discoveries. The bioscience industry sector is defined as including the following four subsectors:

- *Agricultural Feedstock & Chemicals*
- *Drugs & Pharmaceuticals*
- *Medical Devices & Equipment*

- *Research, Testing & Medical Laboratories.*

The largest bioscience subsectors in Rhode Island include Drugs & Pharmaceuticals (1,884), Medical Devices & Equipment (1,505) and Research, Testing and Medical Laboratories (1,565). However, all of Rhode Island’s bioscience sectors play a prominent role in the state economy:

- **The Bioscience industry is a major employer in Rhode Island.** It employs nearly 5,000 people. The biomanufacturing sector is the largest sector in the state and is as large as its shipbuilding industry. In Rhode Island, bioscience workers are well compensated at an average salary of \$64,785 annually, earning 67% more than the average state Private Sector salary of \$38,732 (BIO/Battelle Bioscience ’08.) When the Bioscience and Healthcare industries are combined, Rhode Island is home to 1,400 life sciences businesses employing more than 35,000 people (www.riedc.com.) Nationwide, “professional and related occupations [in the Biotechnology industry] account for 59% of all jobs,” according to the US Department of Labor (USDOL).

- **The Bioscience industry is a significant driver of Rhode Island’s economy.** The sector is responsible for direct wages of at least \$270M and potential “multiplier effect wages” of an additional \$256M. In total, this amounts to an annual impact of \$526M. Studies suggest that each job in the Bioscience industry is linked to the creation of three additional jobs in the state economy. The similar is true for academic research funding. For each \$167,000 in research funding, one academic research position is generated.

On average, RI bioscience employees earn \$64,785 annually. That is 67% more than the average RI Private Sector salary of \$38,732

BIO / Battelle, 2008

In conjunction with creating jobs, the Bioscience industry brings in tens of millions of dollars to Rhode Island in commercial sales and public research funds. Rhode Island institutions have won over \$60M from major infrastructure grants including COBRE, INBRE and EPSCoR over the past five years. And the number of awards granted to Rhode Island from the National Institutes for Health (NIH) grew 40% faster for the period 2000-2004 than awards made to other states. NIH funding reached an all time high of \$130M in 2007.

Although Rhode Island has been increasing its share of the funding pool, it has yet to join other states in providing support for basic and transitional Life Sciences research. Rhode Island can continue to propel its research funding opportunities through this avenue.

- **Rhode Island’s Bioscience industry is diverse.** It includes sectors such as: biopharmaceutical manufacturing, biotextiles, bioprocess design and assembly, medical device design and manufacturing, diagnostics, basic biomedical research and design and bioinformatics.
- **The Bioscience industry is a significant contributor to the state budget.** Employees of the sector generate at least \$16M in income and sales taxes.

- **Rhode Island’s Bioscience industry is among the fastest growing nationwide.** According to the Milken Institute, Rhode Island’s Health and Life Sciences industries are projected to triple from 2004-2014. From 2001-2006, employment in Rhode Island’s Drugs and Pharmaceuticals industry sector grew an astounding 258.9%, whereas it grew 4% nationwide. Rhode Island’s Research, Testing and Medical Laboratories industry sector grew 21.3% versus 17.8% national growth. Total Private Sector growth for both Rhode Island and the United States dwindle to just 3.1% for the same period (BIO/Battelle Bioscience ’08).

Rhode Island’s Bioscience Industry is Diverse:

*Biopharma-
ceutical
Manufacturing*

Biotextiles

*Bioprocess
Design and
Assembly*

*Medical Device
Design and
Manufacturing*

Diagnostics

*Biomedical
Research and
Design*

This report details the existing state of Rhode Island’s Bioscience industry and workforce as well as the tremendous potential they possess. It also suggests future directions for the vital structures, initiatives and training programs needed to realize them.

APPROACH

BioGroup/Tech Collective and the University of Rhode Island appointed a Biotechnology Skills Gap Task Force with representation of leaders from industry, academia and government. The Task Force worked to develop a plan to conduct an analysis of the bioscience workforce gap as well as a comprehensive strategy to ensure that bioscience employers have the talent required to succeed and grow in Rhode Island. The specific goals of the Task Force were to:

- Identify the most critical industry workforce shortages
- Identify critical skill needs of all levels of workers to obtain and maintain employment in the industry
- Identify top barriers to hiring entry level workers in the industry
- Map existing training and education programs and services
- Recommend strategies to ensure that the biotechnology industry has the workforce that it needs to prosper and grow in Rhode Island.

The Biotechnology Skills Gap Task Force conducted research and analysis in both qualitative and quantitative capacities, which include:

- Identifying the bioscience companies that are located in Rhode Island. This was done through research and information gathered from Tech Collective, the Rhode Island Economic Development Corporation, industry representatives and internet searches.

** It was decided for the purpose of this study, the analysis would focus on the Drugs and Pharmaceuticals, Medical Devices and Equipment and the Research and Development sectors of the Bioscience industry, as they are the key benefactors of this Skills Gap Report and recommendations. Therefore, this report does not reflect information attained from or about college, university or medical –related research institutions or groups.*

- Conducting one-on-one interviews with the CEOs of Rhode Island’s largest, fastest growing and most influential bioscience companies representing the various sectors of the industry.
- Conducting an online survey of identified bioscience companies in Rhode Island. This survey was targeted to CEOs and senior-mid level managers from a comprehensive group of companies representing all major Bioscience industry sectors.
- Conducting three public forums involving the leaders and stakeholders from Industry, Academia, and Government. This was called the “Bio-Ed” event series. Held during the months of October – December 2008, each event showcased a specific sector and was comprised of 3-5 panelists who were asked a series of questions regarding successes, challenges and needs for future growth of the industry in Rhode Island. Over 100 people who attended the series, representing local bioscience companies, academic institutions, government agencies and the general public.
- Analysis of US and Rhode Island Labor Market Information (LMI)
- Researching and mapping of bioscience educational and training programs In Rhode Island
- Examining industry research, reports, trends, analysis and workforce strategies on national, regional and state levels from institutions and resources such as: Battelle, BIO, BioWorld, Mass Biotech Council, Milken Institute, North Carolina, San Diego, Snohomish County Workforce Development Council, and the Tech Collective Bio Report - *Biotech Rhode Island: An Analysis of Opportunities for Growth*.

KEY FINDINGS

CHAPTER 1 – WORKFORCE CHALLENGES

Listed below are the six major workforce challenges faced by Rhode Island’s Bioscience industry, as identified through the aforementioned methods. It became clear as the study progressed that all of these challenges are closely tied to each other and to the top five barriers employers face when hiring entry-level and higher talent. Recommendations on how to overcome these challenges can be found at the end of this report in *Recommendations and Strategies*.

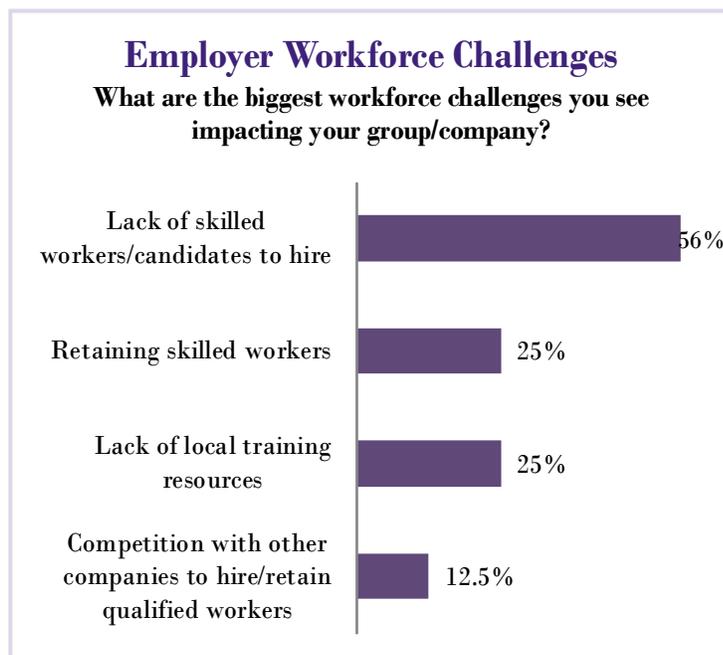
1. Lack of Skilled Workers/Candidates to Hire

Rhode Island bioscience companies and professionals consistently identified “lack of skilled workers/candidates to hire” as their top workforce challenge. 56% of the survey respondents noted this as one of the greatest workforce challenges impacting their company. This challenge was also voiced by leaders of Rhode Island bioscience companies present at the Bio-Ed events.

When addressing current staffing levels, over one-third of survey respondents reported their company’s current staffing level as “marginal.” Types of open positions identified were scientists, chemists, technicians and business development staff. Not only can the expenses of recruiting and training a new employee equal the cost of that position’s annual salary, it can also take companies months, even up to a year, to find a qualified candidate to hire. Respondents noted the following as average time frames in hiring personnel:

- 33% reported that it takes up to 6 months to hire entry-level workers
- 86% reported that it takes up to 6 months to hire mid level workers
- 85% reported that it takes up to a year to hire senior level workers

This is a significant problem for Rhode Island because it forces companies to draw from outside talent pools (i.e. Massachusetts, Connecticut) or begin a competitive recruitment process vying for each other’s hired talent. Ultimately decreased talent and increased competition can cause a company to not locate into or relocated out of the state.



2. Skills Gap

All of the study related interviews, surveys and research found that there is a skills gap between the needs of Rhode Island’s bioscience employers and the local pool of workforce talent. Panelists and participants of the Bio-Ed series identified and discussed this topic at each of the three events that were held and results of the survey show that 84% of respondents reported that there is a skills gap in the Rhode Island Bioscience industry. Other important data related to this include:

- 88% of respondents reported that applicants for open positions **do** have the “basic knowledge” skills that are required. The most critical basic knowledge skills identified were Biology, Math, Chemistry, Oral Communications, Computer Skills and Writing.
- 40% of respondents reported that applicants for open positions **do not** have the “professional/technical” skills that are required. The most critical professional/technical skills identified were Regulatory Compliance, Business, General Process Operations, Maintenance/Facilities/Engineering, Process Development, Pharmaceutical Manufacturing Technology, Instrumentation Control and Automation and Unit Operations.

- 25% of respondents reported that applicants for open positions **do not** have the “soft skills” that are required. The most critical soft skills identified were Teamwork, Critical Thinking/ Problem Solving,

What Skills Are Required to Work in Your Company?

84% of responding employers report a skills gap does exist in RI’s Bioscience industry.

Professional / Technical Skills	Soft Skills	Basic Knowledge
<p>40% of employers report applicants have inadequate professional skills, including:</p> <ul style="list-style-type: none"> ○ Regulatory Compliance ○ Business ○ Instrumentation Control ○ General Process Operations ○ Maintenance/Facilities/Engineering ○ Automation and Unit Operations ○ Process Development ○ Pharmaceutical Manufacturing Technology 	<p>25% of employers report applicants have inadequate soft skills, including:</p> <ul style="list-style-type: none"> ○ Teamwork ○ Critical Thinking / Problem Solving ○ Written & Verbal Communications ○ Self-Organization ○ Time Management ○ Cultural Awareness 	<p>12% of employers report applicants have inadequate basic knowledge skills, including:</p> <ul style="list-style-type: none"> ○ Biology ○ Mathematics ○ Chemistry ○ Oral Communications ○ Computer Skills ○ Writing

Communications (verbal and written), Self Organization, Time Management and Cultural Awareness.

While applicants for positions do have adequate basic skills, many lack the technical/professional and soft skills needed to succeed in this very technically specific and public-facing industry.

3. Lack of Local Education/Training Resources

Rhode Island does have a number of successful programs providing bioscience education and training resources to enhance the workforce pipeline. A great deal of work and effort has gone into establishing and growing these programs, particularly over the past 5-8 years. Most notable are:

- PK-12 – Rhode Island Department of Education’s Biosciences Academy Program, Amgen/Bruce Wallace Biotechnology Program, SMILE (Science and Math Investigative Learning Experiences), ARISE, GRRL Tech.
- Certificate Programs – University of Rhode Island’s Biotechnology Manufacturing Certificate Program and the Community College of Rhode Island’s Biotechnology Certificate Program
- Undergraduate Programs – University of Rhode Island, Brown University, Roger Williams University
- Graduate Programs – University of Rhode Island, Brown University
- Incumbent Worker Training – University of Rhode Island, Community College of Rhode Island, Roger Williams University

The major issues with training are the need for additional programs in some areas and the higher capacities of others. The programs that do exist are successful, however they need to be more coordinated and able to handle a higher capacity of students in order to meet the current and future high-skill industry workforce demands. This will require more communication and cooperation between programs and additional resources such as lab space, equipment and funding. Increased industry participation is also required to better align industry needs with course curriculums and to provide more opportunities for students to gain hands-on experience through internship placements and other career awareness activities.

Incumbent worker training is another pertinent issue revealed through the skills gap study. Many bioscience companies and professionals either 1.) are not aware of the local education/training programs that currently exist, 2.) feel those that do exist need improvement, or 3.) do not have the funds available to pay for training.

- 30% of survey respondents identified the “lack of availability of training and/or lack of effective training” as a major challenge related to training of their workers.
- 41% of survey respondents identified “ensuring learning content meets workforce requirements” as a major challenge related to training of their workers.
- 30% of survey respondents identified “lack of money” as a major challenge in training their workers.

In regards to the funding of training, the analysis found several state and local entities offering assistance to Rhode Island companies seeking to train new, transitioning and incumbent workers. They include:

- Governor’s Workforce Board of Rhode Island
- Rhode Island’s two local Workforce Investment Boards – Workforce Partnership of Greater Rhode Island and Workforce Solutions of Providence/Cranston
- Rhode Island Department of Labor and Training
- Rhode Island Economic Development Corporation

Along with this, the BioGroup/Tech Collective is also very active in workforce development and in securing and managing state and federal training grants that focus on its core technology industries. This includes the successful management of the biotechnology-focused USDOL H-1B Skills Training Initiative from 2004-2008. Tech Collective continues to work in collaboration with the above state agencies to secure additional training grant opportunities for the Bioscience industry.

4. Retaining Skilled Workers

After finding and hiring skilled workers, employers reported a challenge in retaining them. This concern came up consistently during the survey, interviews and employers/professionals who participated in the Bio-Ed event series. Also, survey results show 38% of respondents reported that one of their greatest workforce challenges is “retaining skilled workers” and/or “competing with other companies to hire/retain qualified workers.” The most critical reasons for this are identified as:

- Lack of Growth Opportunities – 54% of company respondents identified this as a major challenge in retaining skilled workers. Also, employees report a lack of “growth opportunities” within many Rhode Island biotech companies, compelling them to move on to other companies, within or outside of the state.
- Competition with other companies – Due to a shortage of workforce talent in Rhode Island, there is competition between companies (local and from surrounding states) for skilled workers. 23% of survey respondents identified competition as a major challenge in retaining skilled workers.
- The Knowledge Retention effect – The Knowledge Retention effect has seen many of Rhode Island’s college graduates (in Biotech and all industries) leave the state for stronger career opportunities, higher pay scales and lower costs of living in other states. (Refer to *Chapter 2 – Employer Challenges in Hiring at the Entry Level.*)

5. Lack of Industry/Career Awareness

Over the past 5-8 years there has been significant publicity about a number of the state’s successful bioscience companies and training and education investments, the most recent of which being the new Center for Biotechnology & Life Sciences building at the University of Rhode Island. However, there remains an overall lack of general awareness about the industry by the public.

Awareness and understanding of the Bioscience industry and what it has to offer Rhode Island’s workforce, employers and economy is key to state and industry growth. It is also key to attracting the involvement of the youth and transitioning worker populations into the industry. This is a growing initiative among many industry stakeholders, who have held awareness activities and outreach over the years. We need to continue and increase this outreach to educate the public about the industry, its role in Rhode Island, career paths, employment opportunities and education/training resources.

A significant portion of Rhode Island’s Biotech industry is comprised of small, start-up Research and Development (R&D) companies. Although deeply passionate about their industry, these R&D’s have traditionally struggled to find the time, finances and avenues they need to promote their achievements while continuing to perform the research and secure the funding that is so critical to their operations.

6. Rhode Island’s Economic and Business Climate

When companies recruit skilled workers – especially mid-senior level – to come to the state, they often have difficulty attracting them due to its lack of affordable housing, real/perceived poor educational system and tax structure. However, as many bioscience companies have begun to feel overcrowded and over-expensed in Cambridge and New York over recent years, Rhode Island’s location along the 1-95 Corridor is able to offer a local New England alternative.

It is important to note that during the course of this study, there were a number of issues raised regarding Rhode Island's economic and business climate also being a contributing factor to their workforce challenges. Outside the megacities but still within comfortable reach, Rhode Island can become prime and prosperous bioscience real estate if its workforce challenges, in addition to some of its economic, funding and resources challenges, are addressed.

CHAPTER 2 –EMPLOYER CHALLENGES IN HIRING AT THE ENTRY LEVEL

Each of the industry workforce challenges cited above closely correlate to the top five barriers that bioscience employers face when looking to hire entry-level workers. Additional barriers employers face include:

1. A limited youth workforce pipeline.

Inadequate STEM-based testing and a low number of bioscience-related degrees being earned are evidence of a lack of youth engagement in bioscience and general STEM studies. *The Governor's Blue Ribbon Panel on Mathematics and Science Education: An Action Plan for Rhode Island* reports from the NAEP only 28% of fourth-grade Rhode Island students reached at or above "proficient standards" for mathematics in 2003. Similarly, only 24% of eighth-graders reached the same level.

Another possible reason for limited youth interest in the industry is a lack of up-to-date knowledge of the industry on behalf of education administrators, teachers, guidance counselors and even the general public. The Bioscience industry is rapidly growing and there are limited teacher training or experiential learning programs available to educators. Because of this in part, it can be difficult for teachers and counselors to remain current on the industry news, growth and career pathways they might otherwise share and explore with their students.

Programs and measures, however, have been implemented within the last five years to aid in youth STEM and Biotechnology industry awareness. They include:

- RIDE Biotechnology Academies (RIDE – Dept. Career & Technical Education)
- Amgen/Bruce Wallace Biotechnology Lab Program (URI and CCRI)
- SMILE – Science and Math Investigative Learning Experiences (URI)
- Project Arise (Brown University)
- GRRRL Tech (Tech Collective)
- PK-8 Science Enrichment Program (URI)
- PK-12 Science Improvement Program (URI and RIC)
- GEMS-NET (Guiding Education in Math and Science Network)

During the fall of 2008, a \$12.5M National Science Foundation grant was awarded to the University of Rhode Island and Rhode Island College for the "Rhode Island Technology Enhanced Science (RITES) Program." This

The Knowledge Retention Effect

What:

The mass exodus of talented, college-educated young adults from Rhode Island and into other states.

Causes:

- Perceived lack of career opportunities
- Substantially lower wage levels
- High costs of living
- Robust competition with nearby, well-established states

Effects:



3. Knowledge Retention Effect

Although Rhode Island's size, location, concentration of education institutions and bioscience diversity converge for prosperous bioscience growth in the state, many of the necessary measures to ensure this

promising and well-received initiative is a five year statewide initiative to improve the quality of science teaching and learning at middle and high schools. The project is based at Rhode Island College's STEM Center and its other core partners are the Rhode Island Department of Education and the Johnston Public Schools.

2. A disparity between the number of male and minority and/or female bioscience professionals.

This race and gender gap has been seen widely across several industries, and it is no different in the Bioscience industry. A 2008 report by the National Action Council for Minorities in Engineering found that African Americans, Latinos and Native Americans represented 30% of college attendees, but comprised of only 12% of undergraduate STEM (science, technology, engineering and mathematics) degrees. Science Magazine has reported that minorities make up 27.7% of biotechnology professionals.

For women, the education pipeline is more promising. According to the National Academy of Sciences (NAS), over half of the STEM bachelor's degrees awarded since 2000 have been earned by women. Additionally, women comprise 45% of biomedical postdoctoral fellows and 46.3% of awarded Biological Science PhD's. Despite these strong beginnings however, there is a significant disparity between mid and senior level female and male STEM professionals.

growth have yet to be taken. This includes for employees and employers.

For students and employees, factors including a perceived lack of career opportunities, substantially lower wage levels and high costs of living have pushed many of Rhode Island's talented college graduates to seek careers outside of the state. This is known as the "Brain-Drain" effect, and it is compounded by the fact that Rhode Island has robust competition in nearby, well-established and higher-paying Biotech Hubs such as Massachusetts, Connecticut and New York.

Bioscience Industry Salaries



For example, the average salary of a Rhode Island Biotechnology worker is \$64,785 annually, according to the BIO and Battelle *Bioscience '08* report. While that is substantially (67%) higher than the average Rhode Island Private Sector salary of \$38,732, it is still pointedly less than the national bioscience salary average of \$71,371. (The average national Private Sector wage is \$42,272 annually). The same report cites the average salary of a Massachusetts bioscience worker as an attractive \$84,090 annually, and Connecticut as a skyrocketing \$88,119. In a state with some of the highest taxation and cost of living, such a discrepancy in salary only makes our bioscience neighbors look even more alluring. See Appendixes B, C and D for Rhode Island, Massachusetts and Connecticut industry wage breakdowns.

CHAPTER 3 – OCCUPATIONAL CLASSIFICATIONS AND OPENINGS

The BIO organization along with Battelle and the Biotechnology Institute recently released the *Technology, Talent and Capital: State Bioscience Initiatives 2008*. The report shows that in 2006 the Bioscience industry was home to 42,000 businesses and employed 1.3 million people nationally. The industry was directly and indirectly responsible for the employment of 7.5 million workers.

Despite these facts, the Federal Labor Market Information (LMI) data does not distinguish the Biotech industry as a Standard Occupational Classification (SOC). In fact, it is intermingled in several categories, including: 17-0000 – Architecture and Engineering Occupations; 19-0000 – Life, Physical and Social Sciences Occupations; 29-0000 – Healthcare Practitioners and Technical Occupations; 31-0000 – Healthcare Support Occupations; and 51-0000 – Production Occupations.

For example, in the Rhode Island LMI *Occupational Wage Report*:

Occupation	Classification Number	Classification Description
Chemical Engineer	17-2041	Architecture and Engineering
Chemical Equipment Operators and Tenders	51-9011	Production Occupations
Chemical Technicians	19-4031	Life, Physical and Social Science Occupations

Each of these three occupations is a viable and common position in the Biotechnology industry, but they are dispersed throughout several SOC categories. This makes it extremely difficult to not only identify industry-specific occupations, but also their wages and employment numbers.

A similar problem occurred during the Skills Gap Study that InfoGroup/Tech Collective conducted for the Information Technology Industry in 2006. The United States Department of Labor (USDOL) and Rhode Island state LMI data did not align well with the industry occupations, titles and class descriptions. Because of this factor and the variable nature of the Bioscience industry, the Task Force was unable to identify a reliable and universal list of the top 25 occupational openings within the industry.

However, with data from the USDOL and Rhode Island LMI data, the Task Force was able to identify four major *Occupational Categories* within the industry. They are:

Occupational Category	Technical	Manufacturing	Administrative	Management
Occupation Examples	<ul style="list-style-type: none"> • Clinical Safety Scientist • Principle Scientist • Lab Analyst • Research Technician • Chief Scientific Officer 	<ul style="list-style-type: none"> • Chemical Equipment Operator • Chemical Equipment Technician • Level I Manufacturing Technician • Quality Assurance Technician • Instrument Calibration Technician 	<ul style="list-style-type: none"> • Administrative Assistant • Finance Manager • Purchasing Manager • Facilities Manager • Quality Assurance Documentation Coordinator 	<ul style="list-style-type: none"> • Shift Supervisor • Department Manager • Director • General Manager • COO/CIO/CFO/CEO

Rhode Island employers who responded to the survey reported they are currently hiring:

- Entry-level workers in the Technical and Manufacturing occupations
- Mid-level workers in all four of the Occupational Categories
- Senior-level workers for the Technical, Manufacturing and Management occupations

Seventy percent (70%) of the employers who responded to the survey stated they see the Bioscience industry in Rhode Island expanding over the next 3-5 years. They also expect their talent demands to grow. The total of all projected openings over the next 2-3 years is between 129 to 550 positions. These projected openings include:

- Entry-level – Projected openings for a total of 58-215 positions
 - 20-75 technical
 - 30-100 manufacturing

70% of responding employers see the Bioscience industry expanding in RI in the next 3-5 years.

- 5-25 administrative
- 3-15 management

- Mid-level – Projected openings for 47-215 positions
 - 25-105 technical
 - 10-50 manufacturing
 - 8-40 administrative
 - 4-20 management

- Senior-level – Projected openings for 24 to 120 positions
 - 7-35 technical
 - 4-20 manufacturing
 - 3-15 administrative
 - 10-50 management

**It is important to note that these are projections and the numbers only reflect those companies who responded to the survey. The projections may also be effected by the national and state economic situations during that time frame.*

Career Tree:

The “Biotechnology, Biomedical and Nanotechnology Career Tree” on the follow page illustrates the various career paths available through the Bioscience industry as well as the education needed to attain them. (Workforce Development Council Snohomish County. *Career Trees: Planting Seeds in Growth Industries*. 2007. www.wdcsc.org.) The Career Tree correlates to the *Where Are You Going?* guide, published by the Workforce Training and Education Coordinating Board of Washington State. The report and more information can be found at www.wtb.wa.gov.

Biotechnology, Biomedical & Nanotechnology Career Tree

June 2007

<p>Advanced Degree (6-8 years) \$35,000 – 240,000 per year</p>	<p>Agricultural Scientists Animal Scientists Biochemists Bioinformatics Analysts/Programmers Bioinformatics Scientists/Engineers Biologists Biostatisticians Business Development Research Analysts Chemical Engineers Chemists</p>	<p>Clinical Data Managers Clinical Research Managers Directors of Project Management Directors of Quality Directors of Regulatory Affairs Environmental Scientists Food Scientists Hematologists Marine Biologists Medical Directors Medical Scientists Microbiologists</p>	<p>Pharmacologists Physicists Quality Control/Assurance Managers Senior Regulation Specialists Toxicologists Validation Managers Veterinarians Vice Presidents of Business Development Vice Presidents of Marketing Zoologists</p>
<p>Bachelor's Degrees (4 years) \$25,000 – 150,000 per year</p>	<p>Administrators Biological Technologists Biomedical Engineers Clinical Research Associates Computer Scientists Documentation Senior Associate Assistants Electrical Engineers Environmental Engineers Facility Managers Geneticists</p>	<p>Managers of Regulatory Affairs Marketing Researchers Medical/Technical Writers Molecular Biologists Natural Sciences Managers Purchasing Agents/Buyers Product Marketing Managers Project Managers Quality Assurance Documentation Specialists</p>	<p>Quality Control Analysts Quality Control/Assurance Supervisors Regulatory Affairs Analysts and Specialists Research Associates Safety Engineers Software Engineers Validation Specialists</p>
<p>Associate's Degree (2 years) \$21,000 – 64,000 per year</p>	<p>Agricultural Food and Science Technicians Animal Technologists/ Technicians Aseptic Fill Technicians Biotechnology Laboratory Specialists/Science Technicians Chemical Technicians Clinical Data Associates</p>	<p>Documentation Associate Assistants Environmental Engineering Technicians Facilities Technicians Laboratory Assistants Manufacturing Instrumentation/ Calibration Technicians Manufacturing Technicians</p>	<p>Medical Device/Biomedical Repairers Process Technicians Quality Assurance Documentation Coordinators/Associates Quality Control Technicians Veterinary Technologists & Technicians</p>
<p>Short-Term or On-the-Job Training (2-12 months) \$18,000 - \$40,000 per year</p>	<p>Glasswashers/Technicians Material Handlers Medical Equipment Preparers Shippers/Receivers</p>		

Foundations for Success

Math

English

Science

*This information attained from *Career Trees: Planting Seeds in Growth Industries*, a publication by the Workforce Development Council Snohomish County, 2007. (www.wdesc.org).

Job titles and salary information obtained from the following sources: America's Career InfoNet (www.acinet.org/acinet); Massachusetts Biotechnology (www.massbio.org/directory/careers); North Seattle Community College, Nanotechnology Program (www.northseattle.edu/nanotech); Snohomish County Workforce Development Council (www.worksourceonline.com); Washington State Workforce Training and Education Coordinating Board (www.wtb.wa.gov); and Workforce Development Council of Seattle-King County (www.seakingwdc.org).

CHAPTER 4 – ENTRY LEVEL WAGES

The Bioscience industry as a whole offers its workers a highly competitive salary compensation. As reported previously, the average wage of a Rhode Island bioscience worker is \$64,785 annually versus the average wage of \$38,732 for a Private Sector worker.

Determining hourly wages for entry-level bioscience workers was again difficult for the Task Force due to there being numerous occupational codes that these would be categorized with. Below are examples of the average entry-level wages of several occupations from RI LMI data related to 2007. The range is \$13.39 hourly to \$58.62 hourly.

Occupational Sector	Occupational Title	Entry Level Hourly Wage	Entry Level Annual Salary
Technical	Biological Scientist	\$ 26.87	\$ 55,890
	Chemical Engineer	\$ 28.75	\$ 59,800
	Life Scientists	\$ 20.55	\$ 42,744
Manufacturing	Chemists	\$ 22.50	\$ 46,800
	Chemical Equipment Operator	\$ 16.87	\$ 35,090
	Chemical Technician	\$ 13.39	\$ 27,850
	Level I Manufacturing Technician	\$ 15.47	\$ 32,178
	Quality Assurance Technician	\$ 17.26	\$ 35,901
Administrative	Financial Analyst	\$ 23.23	\$ 48,318
	Database Administrator	\$ 26.92	\$ 55,994
	Purchasing Agent	\$ 21.99	\$ 45,739
Management	Training and Development Manager	\$ 31.72	\$ 65,978
	General and Operations Manager	\$ 35.30	\$ 73,424
	Chief Executives	\$ 58.62	\$ 121,930

CHAPTER 5 – TRANSFERRABLE SKILLS

Prior to the last 5-10 years, the Bioscience industry experienced relatively few workers transitioning in from other industries. This was largely due a lack of training and certificate programs, which can now prepare a worker to enter into the field in as a little as 12 -24 months. From there workers can benefit from hands-on

work experience as they continue their education in additional certifications or bachelors and masters degrees.

For this study, the Task Force reviewed the state LMI listing of *Rhode Island Declining Occupations 2006-2016* (www.dlt.ri.gov/lmi) to identify occupations requiring hard and soft skills which can be related to a successful transition into Bioscience industry employment. Referring back to the four Occupational Categories established in *Chapter 3 – Occupational Classifications and Openings*, declining occupations with hard and soft skills that can be related to the Bioscience industry include: “First-Line Supervisors/Managers of Production and Operating Workers” (estimated decline of 4.8%) and “General and Operations Managers” (estimated decline of 0.6%). Workers in both of these occupations can transition into Managerial positions within the Bioscience industry. Similarly, workers currently employed in the declining occupation of “Inspectors, Testers, Sorters, Samplers and Weighers” (estimated decline of 7.3%) could transition their skills to become Quality Assurance professionals within the industry.

Another natural transition into biosciences fields comes from workers in the declining occupations of machine setters, operators and tenders – particularly within the textile industry. As these occupations continue to decline an estimated 9.0% - 32.5% by 2016, workers in these fields can receive industry training to transition into Biotechnology Manufacturing positions with pharmaceutical and medical device companies.

An inspiring and large-scale example of such a transition can be made with several Rhode Island companies, one of which was able to transform its failing traditional textile manufacturing business into a successful medical textile device manufacturing division. The Company attained industry-specific standards such as FDA regulation compliance, auditing and an ISO Certification for medical devices; it also invested in its workers. Instead of laying off untrained employees, the Company provided both necessary technical cross-skills training as well as soft skills training such as business planning, English as a Second Language and adult education. Not only was the Company able to transform its operations, it also transformed its existing staff, as both move forward into the growing prosperity of the medical device industry field.

CHAPTER 6 – INDUSTRY SKILL SHORTAGES AND CAUSES

To better align with the dynamic and individualized nature of the Biosciences industry, rather than identifying particular occupations within the industry sectors, the Task Force focused on skill shortages and causes in relevance to the four Occupational Categories established in *Chapter 3 – Occupational Classifications and Openings* and in relevance to the Basic Knowledge, Professional/Technical and Soft skills discussed in *Chapter 1 – Workforce Challenges*.

Of the four established Occupational Categories within the Bioscience industry, Technical-based operations are of the highest employer demand, followed by Manufacturing and Management occupations and then by Administrative roles. The Task Force findings also employer concern over various hard and soft skills shortages across all occupational sectors. As was identified in *Chapter 1 – Workforce Challenges*, of this report a significant percentage of employers that responded to the survey reported skills gaps in the following areas:

- Professional/Technical Skills – 40% of employers report a gap in this area. Skills such as Regulatory Compliance, General Process Development and Operation, Maintenance/Facilities/Engineering, Pharmaceutical Manufacturing Technology, Instrumentation Control and Automation, Unit Operations, and Business.
- Soft Skills – 25% of employers report a gap in this area. Skills such as Teamwork, Critical Thinking/Problem Solving, Time Management, Project Management, Leadership and Written and Verbal Communication (verbal and written), Self Organization, and Cultural Awareness.

If this gap continues to grow, it would pose detrimental barriers for the industry, as many employers expect to hire new employees within the next 2-3 years.

The Task Force has concluded root causes of these shortages include, but are not limited to:

- The Knowledge Retention effect – which sees college-educated students and professionals migrating to outside states in search of more career opportunities, higher wages and lower cost of living rates.
- Lack of Industry Awareness – where students and workers are simply unaware of the dynamic bioscience opportunities which exist within the state. Students may be persuaded to choose fields perceived as more popular, abundant and even “recession proof” because of this. Graduates and workers might be inclined to seek out-of-state work, adding to the talent shortage in Rhode Island.
- Education Funding – while Rhode Island does have several established and successful bioscience training, certificate and degree programs available, funding for them, as with many other courses of study, still remains a problem for many people. More bioscience training scholarships and program funding need to be allotted to individuals pursuing bioscience careers.
- Industry Diversity – Rhode Island has a uniquely diverse Bioscience industry comprised of research and development start ups to medical device companies to large pharmaceutical corporations. Because of this – and similar to our occupational reorganization stated in *Chapter 3 – Occupational Classifications and Openings* – it can be difficult for academic institutions and training providers to align curricula directly with any one company’s technical requirements. Curricula can provide basic knowledge skills, but students must depend on internships, apprenticeships and company-specific training to supplement their skill sets.

CHAPTER 7 – BIOSCIENCE INDUSTRY EDUCATION AND TRAINING RESOURCES

Rhode Island boasts several comprehensive industry training programs for entry-level, incumbent and transitioning workers, and on levels ranging from one course to certificate programs to bachelors and masters degrees. There are no apprenticeship programs currently available for the biosciences fields. On an internship level, while some bioscience companies actively advocate for and host student interns, there is no established or unified state or industry internship program for employers or students to draw from. Below, available training offerings are broken out by education levels beginning from PK-12 and working up to graduate programs and incumbent worker training.

1. PK-12 Programs

Amgen-Bruce Wallace Biotechnology Lab Program – Introduces the fundamentals of biotechnology and molecular biology to middle and high school students. Two sets of biotechnology laboratory equipment are distributed on a monthly rotating basis to middle and high school teachers who have completed training sessions.

Rhode Island boasts many comprehensive industry training programs ranging across the education spectrum:

- PreK – 12
- Certificate Programs
- Undergraduate Degrees
- Graduate Programs
- Incumbent Worker Training

Lead Institution: University of Rhode Island

Partners: Community College of Rhode Island, SMILE Program

GRRL Tech (Girls Reaching Remarkable Levels) – GRRL Tech is an interactive technology expo offering female high school students in Rhode Island an up-close and engaging look into dynamic and rewarding technology career opportunities. Through industry mentoring and hands-on workshops, GRRL Tech aims to encourage STEM learning, break down gender myths and offer career insight into STEM industries. In 2009 there were eight bioscience-related workshops which focused on areas including: biology, biotechnology, biostatistics, forensics, DNA and marine biology.

Lead Organization: Tech Collective

Partners: Roger Williams University, Amgen, EpiVax, Atrion Networking, Junior Achievement, Governor’s Workforce Board of Rhode Island

Project ARISE (Advancing Rhode Island Science Education) – A professional development program for Rhode Island High School biology teachers. The program is designed to engage teachers and students in inquiry-based approaches to learning about science and improve the understanding of the relevance of science to everyday life. The goal of the program is to develop the tools and perspective that will enable high school teachers to integrate high-level concepts in molecular and genomic biology, bioinformatics, neuroscience and physiology into the high school classroom.

Lead Institution: Brown University

RIDE Biosciences Academies – Bioscience academy programs are established in six Rhode Island high schools and career and technical centers. The goal is to provide students in grades 10 through 12 with the knowledge and skills needed to pursue advanced education and employment opportunities in the Bioscience industry. The program also provides intensive curriculum and laboratory training for high school teachers.

Lead Institution: Rhode Island Department of Education – Career & Technical Education

Partners: University of Rhode Island, Community College of Rhode Island, Tech Collective, Burrillville High School, Exeter-West Greenwich High School, Mt. Hope High School, William B. Cooley Health and Science Technical High School, William M. Davis Career and Technical High School, Woonsocket High School

RITES Program (Rhode Island Technology Enhanced Science) – Comprehensive statewide effort to improve the quality of science teaching and learning at all of Rhode Island’s middle and high schools, with the goal of increasing the number and diversity of students who are proficient in science and pursue STEM careers. Funded by the National Science Foundation.

Lead Institutions: Rhode Island College, University of Rhode Island

Partners: Rhode Island Department of Education, Johnston Public Schools, Brown University, Community College of Rhode Island, Rhode Island Economic Development Corporation, Concord Consortium

SMILE Program (Science and Math Investigative Learning Experiences) – A science and math academic after school enrichment program for elementary, middle and high school youth to encourage interest in learning science and math, and to attain the motivation to remain in school, graduate and go onto college. The program goal is to increase the number of underrepresented minority and educationally disadvantaged students attaining higher education and careers in science, math and engineering.

Lead Institution: University of Rhode Island

Partners: Rhode Island School Districts – Central Falls, East Providence, Providence, South Kingstown, West Warwick, Woonsocket

Funding: American Power Conversion, Amgen, Stanley Bostitch, Toray Plastics, National Oceanic and Atmospheric Administration, Environmental Protection Agency, Rhode Island Foundation, the Nellie May Education Foundation

2. Certificate Programs

Community College of Rhode Island – Biotechnology Certificate – The Biotechnology Certificate Program at CCRI offers hands on, competency-based instruction designed for entry-level students and transitioning workers. This 18 credit certificate program provides an overview of the field of biotechnology explores related scientific concepts and skills and emphasizes hands-on training in industry techniques. The multidisciplinary program includes coursework in chemistry, biology and engineering and technology departments and will enable a highly motivated individual to acquire the knowledge and skills needed for a smooth transition into the biotechnology workforce.

University of Rhode Island – Biotechnology Manufacturing Certificate – The Biotechnology Manufacturing Certificate Program at URI is offered as the first year of a 1+ 3 year curriculum format. This first year involves two semesters of full time academic training including: biology, chemistry, microbiology, issues in biotechnology, biotechnology manufacturing methods, technical writing and a summer internship in the biotechnology industry. Following their internship, students are encouraged to secure employment in the biopharmaceutical manufacturing industry and continue an additional 3 years of academics to complete a BS in Clinical Laboratory Sciences.

3. Undergraduate Degree Programs

Brown University – The Department of Molecular Pharmacology, Physiology and Biotechnology is a basic science department within Brown Medical School, and is a full participant in the undergraduate-based Program in Biology within the Division of Biology and Medicine at Brown University. The department supports graduate and postdoctoral education by providing a highly interdisciplinary framework for individual and thematic training programs within both classical and newly emerging areas in the biomedical sciences.

Bryant University – Offers a Minor in Biotechnology.

Roger Williams University – Offers a Bachelors of Science Degree in Biology with a Certificate in Biotechnology. The multidisciplinary scope of the program is designed to combine a 40year Bachelors Degree with a practical certificate in Biotechnology that graduates with critical/analytical skills in biotechnology.

University of Rhode Island – Offers Bachelor of Science Degrees in Clinical Laboratory Sciences, Biotechnology, Microbiology and Plant Science (Agricultural Biotechnology).

4. Graduate Programs

Brown University – Department of Molecular Pharmacology, Physiology and Biotechnology offers Masters of Science and Ph.D. Programs in Molecular Pharmacology and Physiology, Artificial Organs, Biomedical Engineering and Biomaterials and Cellular Technology.

University of Rhode Island – Professional Science Masters (PSM) Degree Program in Biotechnology; Masters Degree in Clinical Laboratory Science with specializations in either Biotechnology or Cytopathology.

5. Incumbent Worker Training

Community College of Rhode Island – Courses from CCRI’s Biotechnology Certificate Program are available to be taken by incumbent workers (technical and non-technical) from area companies. Examples include Orientation to Biotechnology, Intro to Biotechnology Laboratory Skills, Chemical Technology, Cell Biology for Technology and Intro to Instrumentation.

Roger Williams University – Offers intensive short-term “boot camps” in biotechnology intended for industry top officials, financial managers, executives, marketing professionals and patent attorneys associated with the Biotechnology industry. The program is offered in four modules that range from 1 – 5 days. An online program to earn a Certificate in Biotechnology is pending.

Tech Collective – Rhode Island’s industry association for the Bioscience and Information Technology industries. Provides workforce development and training activities and funding resources for the Bioscience industry through a variety of state and federal grant initiatives.

University of Rhode Island/Providence Biotechnology Center – Through its Biotechnology Training Initiative, the Center offers short course lectures and hands-on workshops on the entire spectrum of critical unit operations used in upstream and downstream processing. Programs are taught by experts from industry, research, private practice and regulatory groups. These training programs are held in the Center’s new biomanufacturing laboratory with the latest commercial equipment at the Feinstein Providence Campus. They can also be customized and conducted for industry on-site at their own facilities.

RECOMMENDATIONS AND STRATEGIES

Based on the research and findings of this study, there are three areas that BioGroup/Tech Collective believes are critical to creating a strong and highly qualified workforce for Rhode Island’s Bioscience industry: 1.) foster unity and collaboration among all industry stakeholders, 2.) development of a strong workforce pipeline and 3.) raise industry awareness. To ensure these areas are adequately addressed, BioGroup/Tech Collective recommends the following:

1. Unity – Improve coordination and collaboration between industry, academia and government

Rhode Island is unique in that its small size allows for strong collaboration opportunities amongst many stakeholders across the state. To take advantage of these opportunities, all of the stakeholders in the Bioscience industry must work together to create clear lines of communication, share resources and reduce redundant efforts and spending between individual organizations. While there are a number of models of excellence in individual sectors and institutions, and there has been some success in increased collaboration among them over the past several years, there is still work to be done to foster better communication, coordination and collaboration between them – especially during these times of limited resources and funding availability. This can only benefit Rhode Island’s Bioscience community, as all groups work together to strengthen its voice, foster workforce development, leverage resources and increase the industry’s prominence and prosperity in the state and region.

Instead of creating another industry council, the BioGroup/Tech Collective recommends the growth and support of its Steering Committee. The Steering Committee would meet quarterly with Rhode Island’s

Recommendations & Strategies – *at a glance*

- 1. Unity:**
foster collaboration between Industry, Academia and Government
- 2. Workforce Pipeline Development:**
improve and expand upon Rhode Island’s K-16 and continuing education workforce pipeline
- 3. Increase Awareness:**
public awareness of the Bioscience industry and career opportunities & industry awareness of available training and business resources

Bioscience industry stakeholder groups in a forum focused specifically on coordination and collaboration between entities. Leaders of stakeholder groups such as the following would be invited to participate:

- Companies representing Rhode Island’s Bioscience industry
- Rhode Island Science and Technology Council/Rhode Island Research Alliance
- EPSCoR
- Academia – Institutions representing Rhode Island’s PK-20 education community, including the University of Rhode Island, the Community College of Rhode Island, Brown University and the Rhode Island Department of Education
- Rhode Island Department of Labor & Training
- Rhode Island Economic Development Corporation
- Slater Technology Fund

The main goals of these meetings would be to educate each other about existing groups, programs and services and to create and carryout a comprehensive statewide workforce development and strategic growth plan for the Bioscience industry in Rhode Island. Resources and efforts from all involved would be leveraged to fulfill the tasks of this and other statewide plans.

Also recommended is the creation of an Industry Liaison position at the BioGroup/Tech Collective that would focus specifically on the Bioscience industry. An integral staff position within the BioGroup/Tech Collective Biotechnology Industry Partnership, the Industry Liaison would work to establish relationships between industry employers, academia and government. To insure the success of this industry’s development the Industry Liaison would provide facilitation and implementation of the activities, tasks and collaboration that will need to occur between industry, government and academia to fulfill the outlined recommendations and strategies of this study. The Industry Liaison will be selected based on their knowledge of the Bioscience industry, people skills and workforce development. The Industry Liaison’s role will be to manage the activities of the Biotechnology Industry Partnership as well as working towards the alignment of Tech Collective’s workforce development plans and the Governor’s Workforce Board of Rhode Island’s Strategic Workforce Plan.

2. Workforce Pipeline Development – Improve/expand Rhode Island’s Bioscience workforce pipeline

Over the past 5 years, there has been a significant effort made by a variety of institutions, organizations and companies to develop and provide education and training programs in the creation of a pipeline of qualified workers for Rhode Island’s Bioscience industry. While there have been models of workforce development excellence, there needs to be the creation of new ones and the expansion of existing ones, along with better communication, coordination and collaboration across the educational and training systems, government and industry. This will require increased resources from both the public and private sectors.

- **Strengthen and Expand PK-12 Programs**

Exposing students to the biosciences and improving the preparation of PK-12 students in bioscience fields must be a high priority. There are a number of very successful PK-12 programs that already exist in Rhode Island to serve this purpose. They include: the Rhode Island Department of Education's Biotechnology Academy Program, Amgen/Bruce Wallace Biotechnology Program, SMILE, Project ARISE, URI PK-8 Science Enrichment Program, URI/RIC PK-12 Science Improvement Program and GRRL Tech. These programs should be expanded to service more students in more communities. A related goal is to increase the number of female, African-American, Latino and other under-represented populations in biosciences fields.

The above programs would be greatly enhanced with increased involvement of Bioscience industry employers, additional resources (lab equipment and materials) and additional funding sources.

- **Improve Community College and Technical Training**

Career opportunities for workers with less than a bachelor's degree and transitioning workers (particularly those from related industries) need to be explored. Programs should include opportunities for both transitioning and incumbent workers to strengthen both the technical and soft skills that would allow them to enter and advance in the industry. The Biotechnology Certificate program at the Community College of Rhode Island (CCRI) needs to be strengthened and expanded. The proposed associate's degree program at CCRI should be approved and supported. CCRI and the Biotechnology Training Initiative at the URI Biotechnology Center can also help incumbent workers maintain technical competency in this rapidly evolving industry.

At the secondary education level, industry-specific skills need to be identified and incorporated in entry-level certificate and other short-term programs created below the bachelor's degree level. This will produce a faster workforce pipeline, filling vital industry roles at less cost and in less time.

These programs need to be guided by industry to assure that the appropriate programs are developed and sustained. BioGroup/Tech Collective would be the appropriate agency to facilitate this process via the Industry Liaison and the stakeholder groups.

- **Strengthen and Expand Undergraduate Education through Interdisciplinary and Experiential Learning**

Because of the heterogeneous nature of the Bioscience industry, undergraduate education can be enhanced by integrating education in the life, physical and information sciences. Programs should place greater emphasis on lab skills, problem-solving and soft skills. For example, the Certificate in Biotechnology recently implemented at Roger Williams University is designed to train and test graduates in both critical thinking as well as practical skills. Additionally, internships, co-ops and other experiential learning opportunities should be developed and expanded.

Rhode Island also needs to increase the number of students who complete undergraduate programs in bioscience disciplines. This is essential for the entry-level pipeline for the industry. Strong advising, tutoring and mentoring programs should be developed, implemented and sustained. This will improve the retention and graduation rates for biosciences majors, particularly for female, African-American and Latino students.

- **Develop Graduate Programs with Interdisciplinary Training**

Rhode Island has several excellent graduate programs in Biotechnology and the Life Sciences. However, they are not interdisciplinary in nature. Graduate students need additional training in international business,

management, information technology, regulatory affairs and translational studies. This will better prepare them for the interdisciplinary and global nature of the industry. A model doctoral program has been developed by the University of Rhode Island (Colleges of Life Sciences, Pharmacy, and Engineering) Brown University and the University of Braunschweig (Germany) that is interdisciplinary, global and experiential in nature. The program should be approved, implemented and sustained. There also needs to be increased efforts to encourage domestic students to pursue graduate biosciences programs. New financial incentives, particularly for Rhode Island residents, should be considered to help with the high cost of graduate education.

The URI Biotechnology Center has a long-established Professional Science Masters (PSM) degree program in Biotechnology. It integrates graduate study in the biotechnology and the life sciences fields with professional training in business and regulatory affairs. New degrees or certificate programs should be explored in targeted areas such as legal and regulatory affairs, quality assurance and control and clinical research.

- **Improve and Expand Training Programs for Incumbent Workers**

The Bioscience industry is a rapidly evolving and fast changing industry. Therefore, incumbent workers are in constant need of maintaining and updating technical competencies and learning new skills.

Current incumbent worker training programs and courses, including URI's Biotechnology Training Initiative and course offerings at CCRI, need to be expanded, and new ones created. These training programs should be designed with input from industry to be better aligned with the needs of area companies. Program and training curricula should be developed so incumbents can acquire and strengthen both the technical and soft skills needed to maintain and advance in the industry.

Additionally, many of the state's bioscience companies are of a medium to small size, and most do not have a training department or budget resources to support incumbent worker training. For this reason, it is also recommended that state and federal training grants be secured to assist with training funding needs. BioGroup/Tech Collective has been successful at securing and operating these types of training programs in the past and will continue to do so (i.e. USDOL H-1B Biotech Grant – 2004-2008).

3. Awareness – Public awareness of the Bioscience industry; industry awareness of training and resources

- **Increase Public Awareness about the Bioscience Industry and Career Opportunities**

BioGroup/Tech Collective recommends the development and execution of a statewide marketing campaign involving all stakeholders to raise awareness of the Bioscience industry and related workforce development initiatives. The following are potential activities that could be part of this campaign:

- Informational events/forums held for the general public which would focus on the overall industry, Rhode Island's industry, state and local education and training programs that focus on Bioscience careers, etc...
- Career Fairs, Job Fairs, Job Shadows and Experiential Learning Opportunities

- Increased industry participation in BioGroup/Tech Collective and other Rhode Island Bioscience-related education and training initiatives
- The creation and distribution of Bioscience industry and career collateral such as brochures, fact sheets, newsletters, reports and resource information
- The creation of a brochure or guide to better align the local LMI data with industry occupations. Continue to participate in regional, national and international Bioscience industry associations to better define the industry and its jobs. These associations include:
 - BIO – (the Biotechnology Industry Organization). BioGroup/Tech Collective is the state affiliate for this bioscience organization, the largest in the world.
 - NEBA – (the New England Biotech Association). BioGroup/Tech Collective is the state affiliate for this regional bioscience collaborative
 - The Council of State Bioscience Associations – BioGroup/Tech Collective is the state affiliate for this national bioscience association.

BioGroup/Tech Collective will partner with all of Rhode Island’s stakeholders – industry, academia and government to develop and facilitate this campaign.

- **Increase Industry Awareness of Local Training Resources**

Although this study found that Rhode Island has a number of bioscience education/training programs that provide services to youth, transitioning and incumbent workers, it is also evident that industry professionals are not aware of many of them. BioGroup/Tech Collective recommends the development and execution of a statewide awareness campaign to inform and educate companies and industry professionals of existing education and training programs. Part of this campaign would also be to increase industry input in strengthening existing program curricula, providing support in the creation of new programs, promoting the hosting of experiential learning opportunities and donating lab supplies and equipment.

The following are potential activities that could be part of this campaign:

- BioGroup/Tech Collective’s Steering Committee – discussions/presentations at quarterly meetings
- BioGroup/Tech Collective event(s) that spotlight local education/training resources and potential funding sources
- The creation and distribution collateral of local bioscience education and training resources.
- Online community

CONCLUSION

The findings of the Rhode Island Bioscience Industry Task Force and this Report show the foundation and the backbone of the Biotechnology industry already exists here in the state. We just need to be able to harness it

into its full potential through actions including the creation of a stronger workforce pipeline across the PK-12 to incumbent levels, stronger industry/academic curriculum alignment, increased experiential learning and continuing education/training opportunities and increased industry awareness. The beginnings of those steps have been outlined in this report with insight from industry, academic and government representatives. Standing as a collective voice, we can work together to advance a flourishing and prosperous Bioscience industry, workforce and community to the benefit of our state, our economy and our citizens.

Rhode Island has a strong, dynamic Bioscience industry FOUNDATION.

We just need to HARNESS it.

REPORT OF THE RHODE ISLAND BIOSCIENCE INDUSTRY SKILLS GAP TASK FORCE

Appendixes

(A) Rhode Island Department of Labor and Training Outcome Requirements Map	30
(B) Rhode Island Industry Wage Map	31
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Appendix A – DLT Required Outcome Map

Outcome Requirement	Outcome Addressed/Key Findings
1. Identify the top five (5) industry workforce challenges for the partnership and how each might be overcome.	Chapter 1 Pgs 4-8 Recommendations and Strategies Pgs 21-26
2. Identify the top twenty-five (25) occupational openings in the partnership (data sources should be provided.)	Chapter 3 Pgs 10-14
3. Identify the hourly wage to be attained at entry level in the partnership (data sources to be provided.)	Chapter 4 Pg 15
4. Relate existing hard and soft skills of the entry level and the incumbent workforce in the top 20 declining industries and occupations to the skills needed to become employed and to work successfully within the industry partnership.	Chapter 5 Pg 15-16
5. Identify the occupations that have the greatest skill shortages within the partnership and determine the root causes for those shortages.	Chapter 6 Pg 16-17
6. Identify the top five (5) barriers that employers face when looking to hire entry level workers in the industry partnership and provide data validation. (*See hyperlinks below for additional data.)	Chapter 1 Pgs 4-8 Chapter 2 Pgs 8-10
7. Identify and map all existing training programs, including among others, apprenticeship programs; for both entry level workers to obtain jobs and to move incumbent workers to better paying positions within the industry partnership.	Chapter 1, Point 3 Pgs 6-7 Chapter 7 Pgs 17-21
8. Identify training programs that are based on skill standards that lead to industry recognized degrees or certifications.	Chapter 1, Point 3 Pgs 6-7 Chapter 7 Pgs 17-21
9. Identify gaps in available training and help align curriculum and programs to industry demands.	Chapter 1, Point 3 Pgs 6-7 Chapter 2, Point 1 Pgs 8-9 Chapter 7 Pgs 17-21

Appendix B – Rhode Island Industry Wage Map

From *Technology, Talent and Capital: State Bioscience Initiatives 2008*. Published by Biotechnology Industry Organization (BIO) and Battelle Technology Partnership.

Bioscience Industry Base, 2006

Industry Subsector	Rhode Island 2006	Island 2001-6 Change	United States 2006	States 2001-6 Change
Agricultural Feedstock & Chemicals				
Establishments	3	-24.1%	2,183	3.8%
Employment	40	49.7%	105,846	-6.1%
Location Quotient	0.10		n.a.	
Direct-Effect Employment Multiplier	3.72		11.22	
Total Employment Impact	149		1,214,709	
Average Annual Wage	\$64,115		\$67,870	
Drugs & Pharmaceuticals				
Establishments	16	23.1%	2,654	1.9%
Employment	1,884	258.9%	317,149	4.0%
Location Quotient	1.16		n.a.	
Direct-Effect Employment Multiplier	5.84		9.92	
Total Employment Impact	11,001		2,880,242	
Average Annual Wage	\$80,725		\$86,892	
Medical Devices & Equipment				
Establishments	74	-4.4%	15,215	0.3%
Employment	1,505	-6.4%	422,993	-0.9%
Location Quotient	0.97		n.a.	
Direct-Effect Employment Multiplier	2.47		4.85	
Total Employment Impact	3,719		1,980,128	
Average Annual Wage	\$46,037		\$59,441	
Research, Testing, & Medical Laboratories				
Establishments	137	58.6%	22,857	32.7%
Employment	1,565	21.3%	449,991	17.8%
Location Quotient	0.94		n.a.	
Direct-Effect Employment Multiplier	1.98		3.25	
Total Employment Impact	3,093		1,440,500	
Average Annual Wage	\$68,266		\$71,284	
Total Private Sector				
Establishments	35,278	7.0%	8,575,730	10.2%
Employment	417,704	3.1%	113,463,842	3.1%
Average Annual Wage	\$38,732		\$42,272	

Note: n.a. = metric is not applicable

Appendix C – References & Resources

Amgen, Inc. – www.amgen.com

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Tech Collective

Tech Collective is Rhode Island's Information Technology and Bioscience Industry Association. Our mission is to inspire, engage, educate and employ a high-skill, high-wage Knowledge Economy in Rhode Island through:

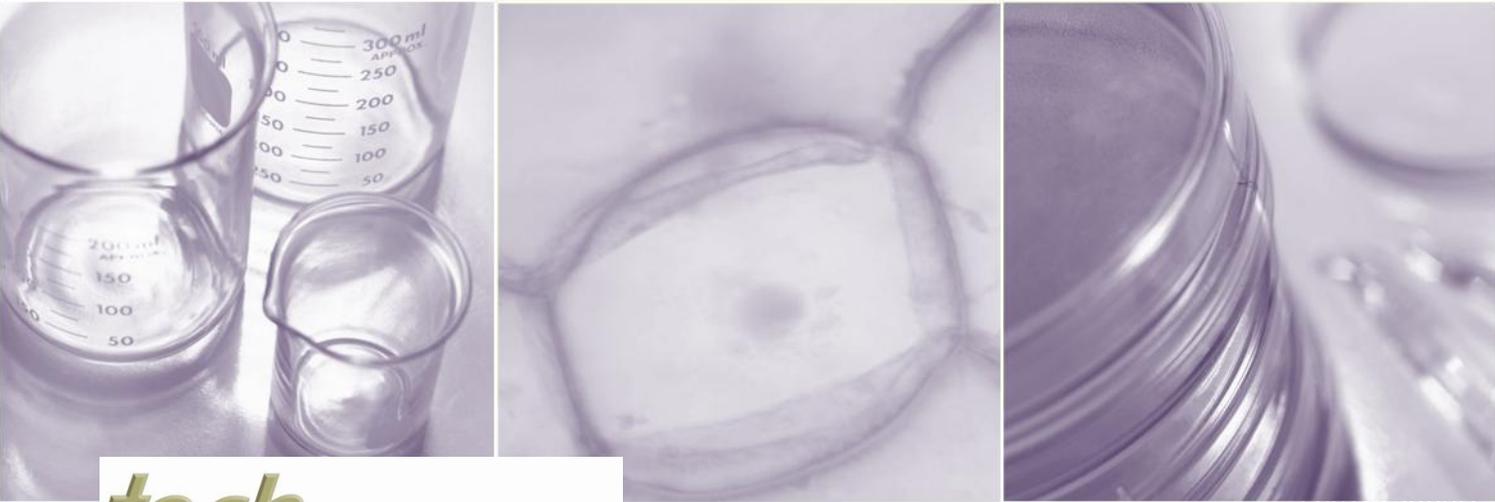
- Uniting industry, government and academic stakeholders
- Raising technology awareness and participation
- Cultivating existing and emerging IT and Bioscience sectors
- Growing the economy through a high-skill, high-wage workforce pipeline with ample employment opportunities
- Developing people personally and professionally
- Promoting strong, proactive, collaborative and leadership-driven technology industries

Since its transition from the Rhode Island Technology Council (RITEC) in 2004, Tech Collective has received more than \$6M in federal, state and private grant funding to foster industry collaboration, awareness and development through events and initiatives including: GRRL Tech, Women in Technology, Bio-Ed, Tech Laureates' Night and STEM-based education and training programs for K-16 students as well as incumbent and transitioning workers. For more information about Tech Collective, please visit www.tech-collective.org.





REPORT OF THE RHODE ISLAND BIOSCIENCE INDUSTRY SKILLS GAP TASK FORCE



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