



Biotechnology/Bioscience Training & Workforce Needs Assessment

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Central Coast Biotechnology Center,
Moorpark College & Ventura College
2007**

Prepared by The Resource Group



To Regional Education, Workforce, Industry and Economic Development Partners

Community College biotechnology graduates make excellent contributions to our regional industry and economic success each day. This survey was commissioned in conjunction with the Ventura County Workforce Investment Board, Moorpark College, Ventura College and the CCBC (updating The Resource Group surveys from 1995 and 1998) to allow an understanding of industry training trends. Program planning and articulation of High School, Community College and University programs will be assisted by this analysis. The analysis included Central Coast businesses from Ventura County to San Luis Obispo and Santa Clarita to Lancaster.

The Ventura region's biotechnology programs trace their roots to specific industry instructor teaching modules deployed in traditional science classes in the mid-1980s and a Ventura College biotechnician certificate program initiated in the early 1990s. Collaboration between San Francisco City College and Ventura College led to the establishment of the national Bio-Link.org community college biotechnology training program organization a decade ago. As the local biotechnology industry became global, Moorpark College graduated exceedingly successful manufacturing biotechnicians starting in early 2000. Community College faculty produced biotechnology texts at Moorpark for the laboratory (2001) and at Ventura College for a theory course (2003). Recently, College of the Canyons, in the midst of a dramatically expanding economic region, launched its biotech/biomed cleanroom and nanotechnology programs. Addressing the ongoing shortage of adequately trained entry-level biotechnicians documented by California's Economic Development Division (edd.ca.gov) and the national organization bio.org will take additional efforts. Biotechnology modules included in the science curriculum at regional Community Colleges (Oxnard, Santa Barbara, Allen Hancock, Cuesta and Antelope Valley) are vital to this strategy and deserve additional institutional support for supplemental grants.

Biotechnology is now framed within a set of converging technologies that include nanotechnology, information sciences and cognition. Students trained locally will increasingly need to be aware of newly emerging transformational technologies that will supplant those of the contemporary workplace. For example, alongside highly established national programs (National Science Foundation and National Institutes of Health), the National Nanotechnology Initiative (www.nano.gov) is now coordinating resources to dramatically change the nature of instrumentation, analysis, and manufacturing in biotechnology. Successful convergent technology training solutions will be capable of being utilized by non-scientists (as is the case with the Ventura College GIS/RT-PCR training project for genetically detecting and mapping bacterial contamination in coastal waters, hospitals and agricultural products in a half hour). Previously developed training pedagogy in fermentation bioreactor technology is being reapplied to ethanol and biodiesel production. A focus on marine sciences at Oxnard College can yield opportunities for engagement with pharma and energy sectors.

Others in education and economic development both nationally and globally view California's success in the Central Coast Region as a model to be emulated. Our response must be to strengthen collaborations with industry advisors, former students (employed locally), faculty and administration to further articulate an intersegmental education and training model. Collaborations that seamlessly transition students between local advanced placement level High School courses, Community College industry training programs and regional University higher degree programs are key to offering students multiple industry entry and re-entry opportunities. Within the Community College, allowing students of degree and certificate programs in nursing, medical laboratory technician, water quality and affiliate sciences access to biotechnology training is also of strategic importance. Increasingly, we must recognize that an advanced technology career in our community starts with early counseling that illuminates the interrelatedness of higher degrees and emerging skill sets.

A collaborative spirit drives our efforts in this new century.

Looking Forward,

James Harber, Director
Central Coast Biotechnology Center



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EXECUTIVE SUMMARY

BIOTECHNOLOGY/BIOSCIENCE TRAINING & WORKFORCE NEEDS ASSESSMENT

The Ventura County Workforce Investment Board, The Central Coast Biotechnology Center, Moorpark College and Ventura College contracted with The Resource Group—a Southern California-based market research firm—to assist with conducting an assessment of biotechnology and bioscience firms in San Luis Obispo County, Santa Barbara County, Ventura County and portions of both Kern and Los Angeles Counties. The 2006 Biotechnology/Bioscience Training and Workforce Needs Assessment project brought together these key providers to assess the needs of companies to ensure local training and workforce development programs continue to be relevant to the workplace and to the changing requirements of businesses in the biotechnology and bioscience industries.

A total of 33 biotechnology/bioscience businesses participated in the survey project by returning a completed survey. Responding companies provided a detailed look at their business, the characteristics of their workforce, the specific skills and training needed by current and future employees, preferred training delivery methods and their interest in career preparation activities. Following is a presentation of the key trends and issues expressed by these responding companies.

Major Findings

- 39% of responding firms self-identify as fitting within the environmental market segment
 - 27% of participating organizations operate in the market sub-sector of analytical services/testing
 - 24% of companies are involved with environmental bioremediation
 - 30% have been in business for more than 20 years, resulting in an overall median of 13 years in operation
 - 91% of businesses in the current study are fully operational
 - 73% of firms responding to the survey indicate that their business is growing to some degree
 - 88% believe the industry will improve at least slightly over the next 5 years
 - 73% of responding organizations employ 25 or fewer employees
 - 28% of those working for companies in the current study are involved in production
 - 20% of employees from responding firms have QA/QC jobs
 - 16% of those employed by responding businesses hold technical support positions
 - 14% is the average percentage rate of turnover among QA/QC employees
 - 27% (at least) of responding employers attribute turnover to the cost of living in the area
 - 59% (at least) of employers require entry-level technicians in analysis, QA/QC and R & D to have at least a bachelor's degree
 - 65% of responding employers indicate individuals do not need more than AA/AS degree for entry-level production jobs
 - 50% of surveyed area employers indicate there are industry-specific skills needed by their current workforce
Top skills needed by current employees: engineering, equipment calibration, field biology, phlebotomy
 - 63% of responding organizations currently offer training programs to staff
 - 71% of those that offer training programs to staff have in-house training resources
 - 14% of employers with staff training programs use outside consultants or vendors
 - 63% of businesses indicate some interest in low-cost, effective training for staff
 - 42% of responding firms prefer training at a college or other district training sites
 - 58% of those interested in training at a college or other district site prefer such training on weekday evenings
 - 33% would be interested in on-site training
 - 69% interested in on-site training prefer weekdays during the day
 - 78% of businesses responding to the survey indicate there are specific skills and abilities they would like to see in a pool of applicants for their industry
Top skills needed for future employees: computer, basic skills, chemistry, engineering, lab skills
 - 33% of responding organizations indicated an interest in serving as a guest speaker to a class or offering course instruction
 - 24% of firms have an interest in hosting worksite visits for students
 - 18% each would be willing to donate equipment and materials, offer worksite internships or provide entry-level jobs for screened program graduates
-

Major Findings *(continued)*

Top 10 Skills Considered "Essential" For Entry-Level Technicians

Skill	Topic Area
12th grade reading level	General Education
Oral skills	General Education
Use of personal protective equipment	Safety
Safety procedures	Safety
Recognize safety symbols	Safety
MSDS	Safety
Proper HazMat handling	Safety
Spreadsheets	Computer
Scientific notebook entry	General Lab
Word processing	Computer

Top Skills Needed By Entry-Level Technicians *(By Topic Area)*

Topic Area	Skill
<i>Animal/Plant Handling</i>	Plant propagation
<i>Chromatography</i>	Column Gas HPLC/FPLC
<i>Computer</i>	Spreadsheets Word processing Database
<i>Culture Techniques</i>	Bacterial culture Yeast Viral culture
<i>Fermentation Technology</i>	Large scale fermenter
<i>General Education</i>	12th grade reading level Oral skills
<i>General Lab</i>	Scientific notebook entry Work area organization Recognition of symbols
<i>Microscopy</i>	Brightfield Phase contrast
<i>Molecular Techniques</i>	PCR Agarose gel Recombinant DNA techniques PAGE
<i>Nanotechnology</i>	Nanotechnology
<i>Safety</i>	Use of personal protective equipment Safety procedures Recognize safety symbols
<i>Spectrophotometry</i>	Standard curves UV Visible (20/21)

INTRODUCTION

Background

In 1997, the California community colleges launched the Biotechnology Initiative to fulfill a California legislature requirement to contribute to economic growth through continuous training and workforce development in the fast growing biotechnology industry. As a result of this initiative, in 1998, the Central Coast Biotechnology Center (CCBC) undertook the Biotechnology Workforce Census, an assessment designed to begin dialogue with local biotechnology and biotechnology-related businesses in the Central Coast Region of California to understand their current standing and what they needed in terms of workforce to stay strong in the regionally and internationally competitive industry and economy.

The CCBC contracted with The Resource Group—a Southern California-based market research firm—to assist with conducting the 1998 assessment. The census was modeled after the Biotechnology Industry Training Needs survey conducted by The Resource Group in 1995 on behalf of the California Biotechnology Educational Consortium (CBEC) South, an association of educational institutions, businesses and organizations engaged in the field of bioscience and related fields in Southern California. The purpose of the 1995 CBEC study, funded by a grant from the Chancellor's Office of the California Community Colleges, was to determine the workforce and training needs of biotechnology, biomedical, agricultural, pharmaceutical and other related industries in Southern California.

In 2006, the Ventura County Workforce Investment Board (WIB), partnering with the CCBC, Moorpark College and Ventura College, funded an effort to repeat the 1998 CCBC assessment. The goal of the follow-up assessment was the same—to enable biotechnology and bioscience firms to identify for educators what they consider to be important job skills, to offer insight about the focus of educational efforts, to recommend appropriate training programs, and to indicate developing trends which may impact agencies that provide services to this industry.

Throughout this report, data from these three studies—the 1995 Southern California CBEC Biotechnology Industry Training Needs project, the 1998 Central Coast Region Biotechnology Workforce Census and the current 2006 Biotechnology/Bioscience Training and Workforce Needs Assessment—are presented to demonstrate how much the industry has or has not changed over the past 11 years.

The Survey Process

As in the earlier 1998 project, the 2006 Biotechnology/Bioscience Training and Workforce Needs Assessment was conducted in the region of California served by the CCBC. The region consists of a portion of both Kern and Los Angeles Counties, and all of San Luis Obispo County, Santa Barbara County, and Ventura County.

Three business lists were used to make up the survey universe. The first was a list of biotechnology companies identified by the CCBC. The second list was provided by the Ventura County Workforce Investment Board (WIB). The last list was derived using the same major industrial classifications used in the 1998 study.

The following 23 Standard Industrial Classification (SIC) code groupings were again selected since they most likely encompass firms within the biotechnology and bioscience industries.

RELEVANT SIC CODE GROUPINGS USED FOR SURVEY UNIVERSE

0161 Vegetables and melons	3821 Laboratory apparatus/furniture
0181 Ornamental floriculture	3826 Laboratory analytical instruments
0279 Animal specialties	3841 Surgical and medical instruments
2084 Wines and brandy spirits	3842 Orthopedic, prosthetic and surgical
2833 Medicinals and botanicals	3843 Dental equipment and supplies
2834 Pharmaceutical preparations	3845 Electromedical apparatus
2835 Diagnostic substances	3851 Ophthalmic goods
2836 Biological products	5159 Farm-product raw materials
2869 Industrial organic chemicals	8071 Medical laboratories
2879 Agricultural chemicals	8731 Commercial physical research
2899 Chemical and preparations	8734 Testing laboratories
3069 Fabricated rubber products	

Excluding duplicates and organizations that sent back a response indicating the survey did not apply to their business, a resulting database of 1,163 biotechnology/bioscience businesses in the Central Region served as the universe for this project.

The project team distributed the 12- to 15-minute confidential census to identified businesses. Survey instruments were distributed by mail and fax. For key companies, the mailings and faxes were followed by personal telephone follow-up calls and emails. Three separate fielding cycles were employed in order to yield adequate response rates. The first fielding cycle began in April 2006 with subsequent fielding occurring from May 2006 through July 2006. A final effort was made to contact key companies in September 2006. These efforts resulted in 33 usable responses.

Researcher Preface

The Resource Group (TRG) served as research counsel for the 1995 CBEC Biotechnology Industry Training Needs project, the 1998 Biotechnology Workforce Census sponsored by the CCBC and the current Biotechnology/Bioscience Training and Workforce Needs Assessment. The firm assisted with survey design, data collection and analysis, and report production. For information regarding research and survey services for this and related topic areas, please contact TRG at (800) 229-5020.

BIOTECHNOLOGY/BIOSCIENCE TRAINING & WORKFORCE NEEDS ASSESSMENT

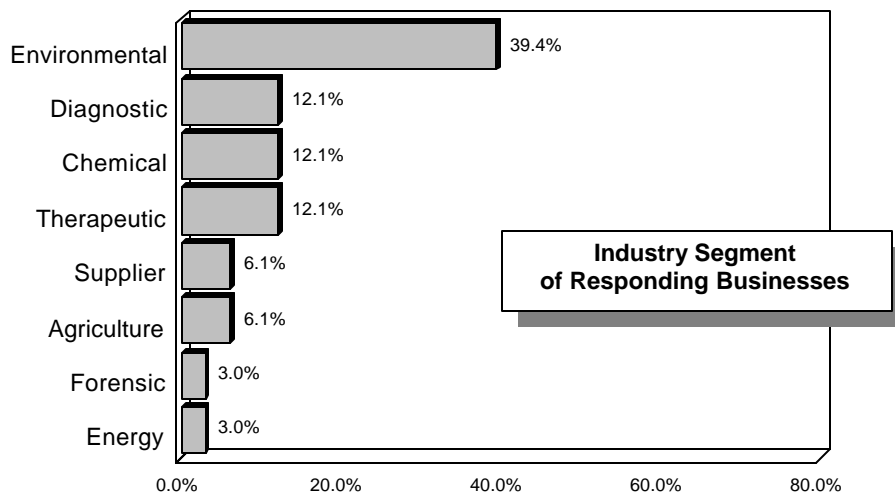
Company Profile

Industry Mix

The type and mix of biotechnology/bioscience firms varies by region and reporting methods of the reviewing authority. A standard measure is market segment, but there are no fixed definitions of segment classification. For the purposes of this study and in the earlier 1998 study, the following market segments and sub-sectors were selected to provide detailed company data.

<i>Market Segment</i>	<i>Market Segment Sub-Sector</i>	
Agriculture	Agriculture, animal	Food/beverage
Chemical	Agriculture, plant	Food additives
Diagnostic	Analytical services/testing	In vivo diagnostics/imaging
Energy	Biomaterials	Medical devices
Environmental	Bioseparations	Medical diagnostic
Food/food additives	Cultured cells and tissues	Medical therapeutics
Forensic	Diagnostics	Pharmaceuticals
Supplier	Energy	Specialty chemicals
Therapeutic	Environment: bioremediation	Veterinary therapeutics
	Evidenciary	

Nearly two out of five responding firms self-identify as fitting within the environmental segment. The diagnostic, chemical and therapeutic clusters were the second largest groups, with 12% of responding firms each identifying with these segments.



As noted in the table below, clinical/technical businesses self-identify into seven industry segment groupings, environmental into five groupings and therapeutic into two groupings.

Industry Segment of Responding Businesses - By Industry Type¹

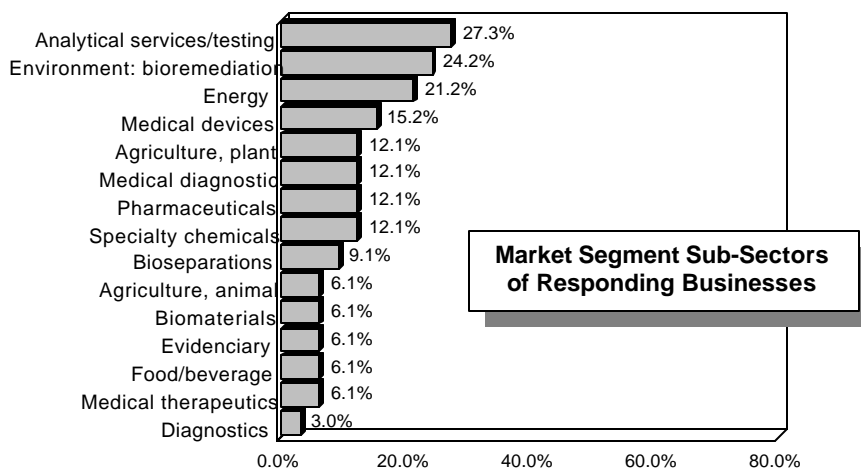
<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
① Chemical	① Environmental	① Therapeutic
② Diagnostic	② Diagnostic	② Biopharmaceuticals
③ Therapeutic	③ Agriculture	
④ Environmental	④ Supplier	
⑤ Agriculture	⑤ Energy	
⑥ Supplier		
⑦ Forensic		

Following is a table that displays the market segmentation from the 1995 CBEC study as compared to the 1998 Central Coast Region census and the current 2006 study. In all three studies, the majority of respondents indicated their company fit in the environmental industry segment.

<i>Market Segment</i>	<i>CBEC Southern California 1995 Survey</i>	<i>Central Coast Region 1998 Survey</i>	<i>Central Coast Region 2006 Survey</i>
Environmental	33.7%	29.3%	39.4%
Diagnostic	21.1	17.2	12.1
Chemical	15.8	12.1	12.1
Therapeutic	17.9	12.1	12.1
Supplier	3.2	19.0	6.1
Agriculture	2.1	17.2	6.1
Forensic	n/a	3.4	3.0
Energy	3.2	1.7	3.0
Food/Food Additives	8.4	15.5	—

The biotechnology/bioscience market segments were further divided into 19 more specific market segment sub-sectors.

Some 27% of responding firms operate in the area of analytical services/testing, while environmental bioremediation is the sub-sector for nearly one out of four businesses.



¹ Data sets by industry type are too small to have a great degree of confidence that they are statistically significant. Therefore, it is suggested that they be viewed by the reader as generalized trend data and for perspective purposes only.

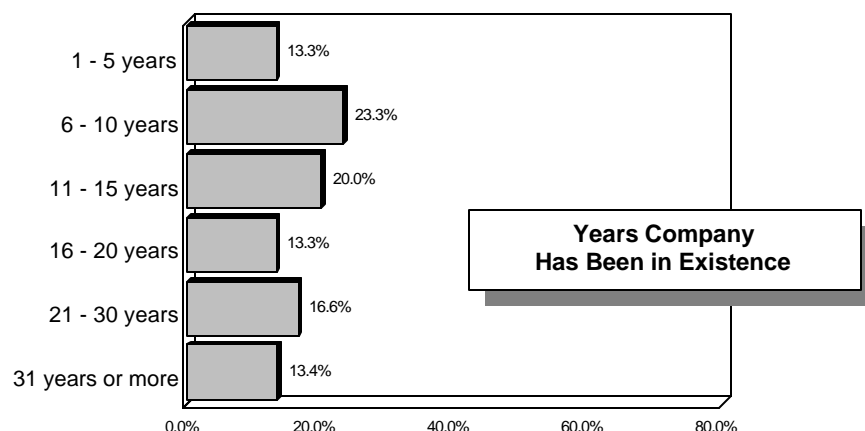
The table below presents the top market segment sub-sectors by industry grouping.

Top Market Segment Sub-Sectors of Responding Businesses- By Industry Type

<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
① Chemical	① Environment: bioremediation	① Pharmaceuticals
② Medical devices	② Analytical services/testing	② Medical therapeutics
③ Analytical services/testing	③ Energy	
④ Medical diagnostic	④ Agriculture, plant	
⑤ Bioseparations	⑤ Specialty chemicals	
⑥ Agriculture, plant		
⑦ Pharmaceuticals		
⑧ Specialty chemicals		
⑨ Biomaterials		

Stage of Company

The responses regarding number of years in existence confirm the longevity of biotechnology/bioscience firms in the Central Coast Region. Some 30% of responding companies have been in business for more than 20 years, resulting in an overall median across all responding firms of 13 years in operation.

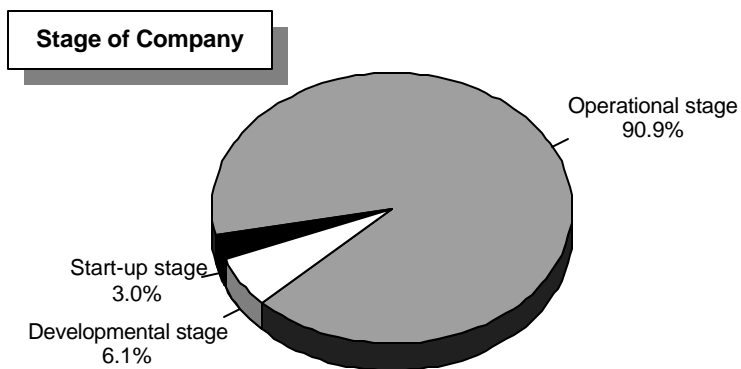


Years Company Has Been in Existence - By Industry Type

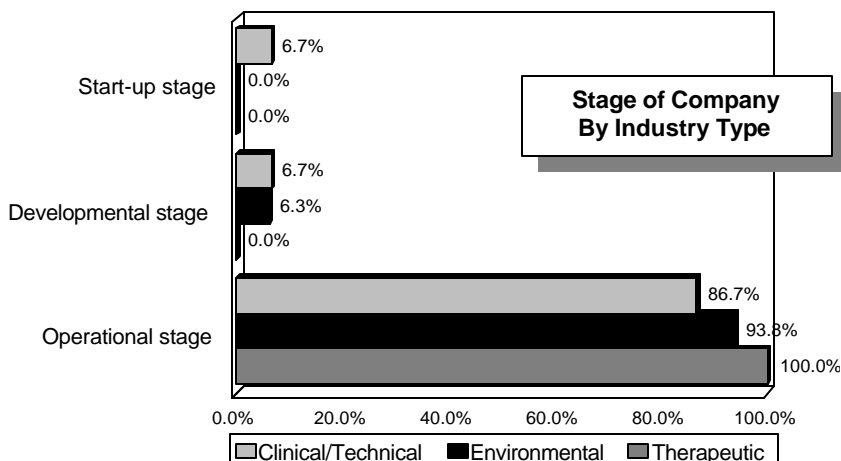
Businesses involved in environmental have been in operation for a median of 11 years, while those involved in clinical and technical work have existed for a median of 17 years. The therapeutic-related firms have much more longevity at a median of 51 years.

	<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
5 years or less	23.1%	6.7%	—
6 - 10 years	15.4	33.3	—
11 - 15 years	7.7	33.3	—
16 - 20 years	23.1	3.7	—
21 - 25 years	7.7	—	—
26 - 30 years	15.4	6.7	50.0
31 - 40 years	—	13.3	—
41 years or more	7.7	—	50.0
Median:	17 years	11 years	51 years

Due to the length of existence of responding companies, it is not surprising that 90% of businesses in the current study indicate they are fully operational. In the 1998 study, 84% of responding firms indicated they were in operational mode. About 6% of respondents in the current study—as compared to 12% in the 1998 study—are in the developmental stage, while 3% are in start-up mode.



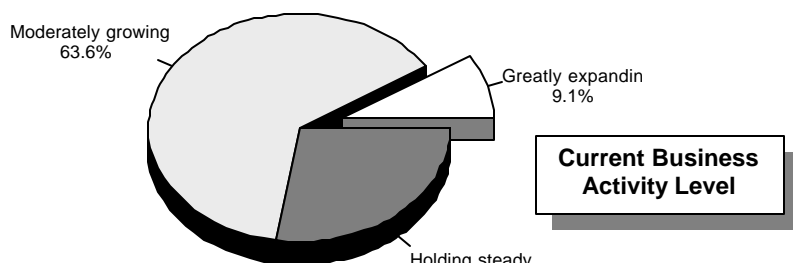
While environmental firms are the youngest of the three selected industry types, 94% are considered to be in the operational stage. Of the companies involved in clinical/technical work, 87% are operational, 7% are in start-up mode and another 7% are in the developmental stage. All therapeutic businesses are fully operational.



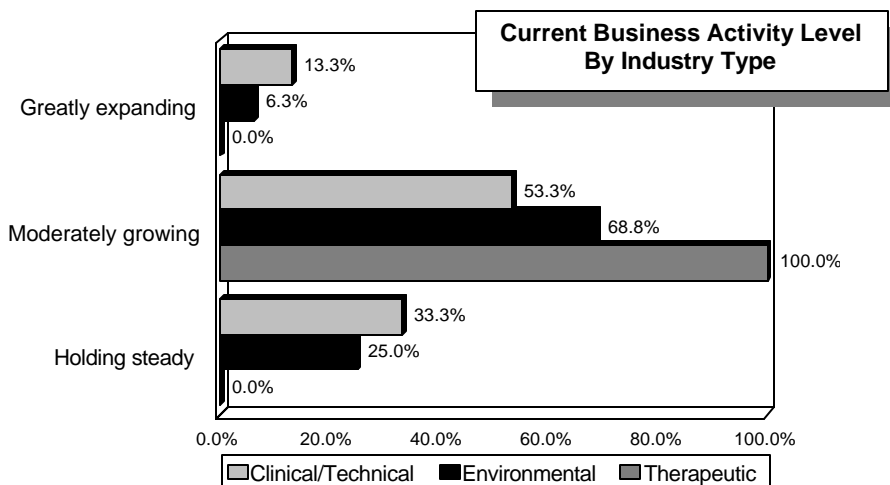
In general, the need for staff and training varies by stage of development. With the majority of businesses in operational mode, the need becomes greater for a larger, more diverse staff. The information obtained from businesses through this project will enable local providers of training and workforce development programs and services to better meet the needs of operational biotechnology/bioscience businesses in the area.

Strength of Business and Industry

Nearly three out of four biotechnology/bioscience businesses in the Central Coast Region indicate that their business is growing to some degree—64% indicate they are experiencing at least moderate growth, and 9% report they are in the midst of major business expansion. Some 27% say they are holding steady, while no firms indicate they are in a decline mode. These latter results are encouraging given that 18% of companies in the earlier 1998 study were holding steady and 4% were in a decline mode.

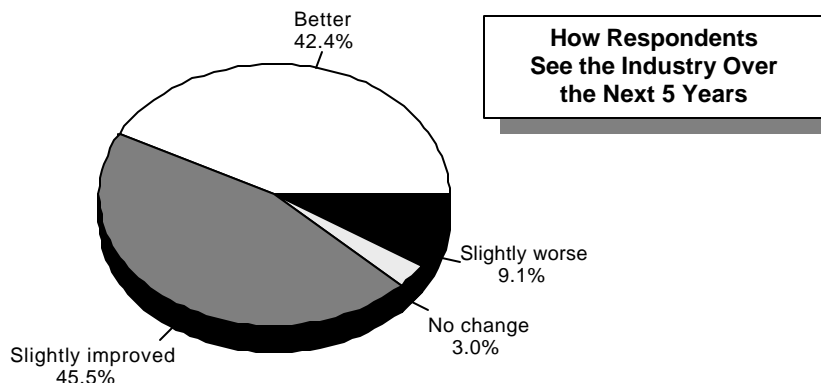


Nearly 69% of environmental businesses and 53% of those involved in clinical and technical work are moderately growing, while 6% and 13% of businesses in these same industries, respectively, are greatly expanding. Responding therapeutic companies indicate their business is growing moderately.



Biotechnology/bioscience companies were asked to indicate their expectations for the industry over the next five years. About nine out of 10 businesses believe the industry will improve at least slightly—46% expect the industry to “slightly improve” over the five-year period, and 42% are confident the industry will be “better.”

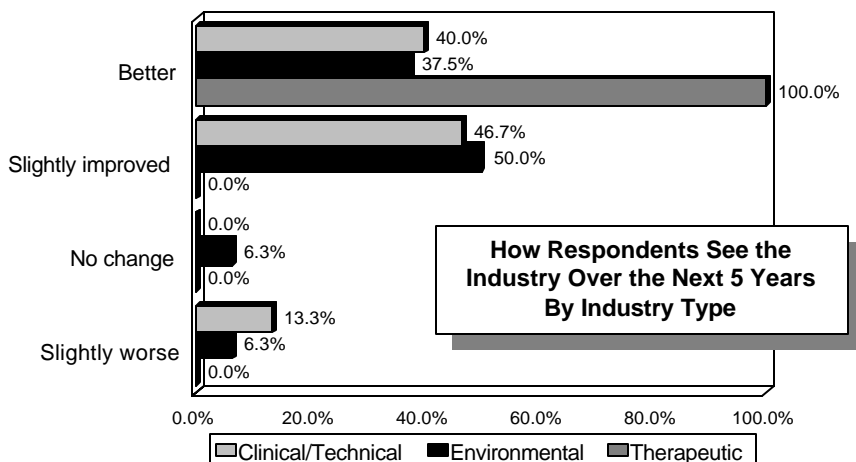
As evidenced in the table below, these expectations are more optimistic than those found among Southern California biotechnology businesses surveyed by the CBEC in their 1995 industry census and in the earlier 1998 CCBC study.



How Respondents See The Industry Over The Next 5 Years

	<i>CBEC Southern California 1995 Survey</i>	<i>Central Coast Region 1998 Survey</i>	<i>Central Coast Region 2006 Survey</i>
Better	29.0%	37.5%	42.4%
Slightly improved	44.1	39.3	45.5
No change	10.8	8.9	3.0
Slightly worse	10.8	14.3	9.1
Worse	5.4	—	—

Responding companies involved in therapeutics expect the industry to be better over the next five years. Environmental and clinical/technical businesses are similarly optimistic, with nearly nine out of 10 in each group projecting at least slight improvements in the industry.



Current Workforce

Important to any study of workforce needs is information on the size and function of the existing workforce.

Number of Employees

Combined, the biotechnology/bioscience companies responding to the current study employ nearly 11,000 individuals. About 73% of employ 25 or fewer employees, resulting in a median of 12 employees across all responding companies.

Total Number of Employees

	<i>Full-Time Employees</i>	<i>Part-Time Employees</i>	<i>All Employees</i>
1 - 5 employees	36.7%	43.3%	18.2%
6 - 25 employees	36.7	13.3	48.5
26 - 50 employees	10.0	—	12.1
51 - 100 employees	6.7	—	9.1
101 - 500 employees	—	—	3.0
501 or more employees	6.7	—	9.1
No employees	3.3	43.3	—
Median number of employees	8 employees	1 employee	12 employees

The therapeutic companies employ more than 500 employees while all responding environmental firms and 87% of clinical/technical businesses have 100 or fewer employees.

Total Number of Employees - By Industry Type

	<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
1 - 5 employees	20.0%	18.8%	—
6 - 25 employees	46.7	56.3	—
26 - 50 employees	13.3	12.5	—
51 - 100 employees	6.7	12.5	—
101 - 500 employees	6.7	—	—
501 or more employees	6.7	—	100.0

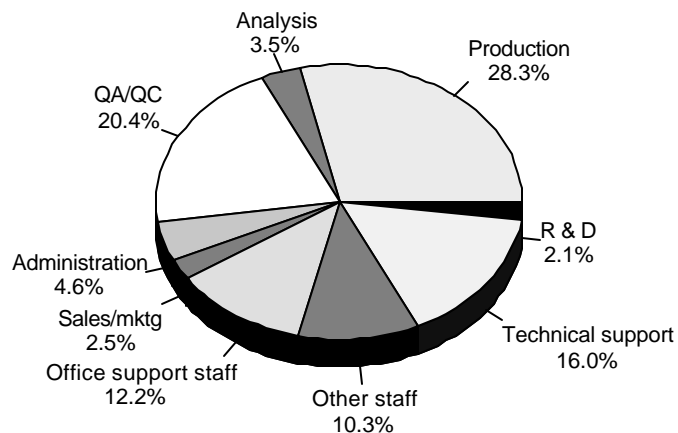
Job Categories and Functions

The present study included a question asking the employer to indicate the breakdown of their employee base by selected job category so that training providers can better understand which classifications of employees will most likely require technical skills and competencies.

Across responding companies, 28% of all employees are involved in production while 20% have QA/QC jobs. Some 16% hold technical support positions and 12% are office support staff.

Considering job category data by industry, therapeutic companies have relatively more employees involved in R&D and QA/QC than businesses involved in clinical/technical and environmental work.

Percent of Employees by Job Category



Top Job Categories - By Industry Type

<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
① Production	① Technical support	① Production
② Technical support	② Production	② QA/QC
③ Administration	③ Administration	③ Office support staff
④ Office support staff	④ Office support staff	④ Technical support
⑤ QA/QC	⑤ Analysis	⑤ R & D

Respondents were further asked to provide details about their workforce. Of the 33 responding businesses, 22 offered specific information about their workforce such as number of employees by specific job title and/or average hourly wages for specific positions. Specific workforce information is detailed in the following table for these employers.

Among responding businesses, 36% of all employees are manufacturing technicians, 23% are QC technicians, and 13% are lab technicians. The highest paid is the administrator or director at an average hourly wage of \$37.67, followed by engineers and manufacturing technicians at an average hourly wage of \$32.40 and \$30.14, respectively.

A greater portion of the staff at therapeutic companies is classified as manufacturing and QC technicians. Environmental companies, in contrast, have a relatively greater portion of field and other technicians, while clinical/technical firms have more phlebotomists and office support personnel.

Current Employees by Job Function		
	% of Current Employees	Entry-Level Average Hourly Wage
Manufacturing Technician	36.4%	\$ 30.14
QC Technician	22.8	\$ 25.61
Laboratory Technician	12.6	\$ 19.70
Media Prep	4.8	\$ 23.90
Misc. Technician	4.8	\$ 23.00
Field Technician	3.8	\$ 14.17
Office Support	3.6	\$ 17.65
Engineer	2.9	\$ 32.40
Phlebotomist	2.9	\$ 18.00
Scientist	1.3	\$ 26.00
Botanist	1.0	\$ 20.00
Environmental Technician	1.0	\$ 25.00
Administrator/Director	0.8	\$ 37.67
Chemist	0.8	\$ 24.00
Biologist	0.2	\$ 18.50
Ecologist	0.2	\$ 22.00

Top Job Functions - By Industry Type

Clinical/Technical	Environmental	Therapeutic
① Phlebotomist	① Misc. Technician	① Manufacturing Technician
② Office Support	② Field Technician	② QC Technician
③ Laboratory Technician	③ Office Support	③ Laboratory Technician
④ Scientist	④ Environmental Technician	④ Media Prep
⑤ Engineer	⑤ Laboratory Technician	⑤ Engineer

Employee Turnover

Average Percentage Rate of Turnover by Job Function	
QA/QC	14.0%
Production	12.7
R & D	11.8
Sales/marketing	9.0
Technical support	7.4
Office support	3.4
Administration	1.1
Analysis	—

Across responding biotechnology/bioscience companies, the greatest average percentage rate of turnover is among QA/QC personnel, production workers and R&D staff, at 12% -14% each. In a year's time, the rate of turnover among those in sales and marketing is 9% and is 7% among technical support staff.

It is important to note that turnover in the industry can represent advancement or lateral movement within or between companies.

As compared to businesses involved in clinical/technical or environmental work, therapeutic companies have a much higher average rate of turnover among R&D employees and office support staff. In contrast, turnover is higher among sales and marketing staff at responding environmental companies.

**Average Percentage Rate of Turnover
for Each Job Function - By Industry Type**

	<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
QA/QC	17.5%	—	14.0
Production	11.0	15.0	17.0
Technical support	5.8	8.3	11.0
Administration	1.9	—	—
R & D	1.3	—	55.0
Sales/marketing	1.0	25.0	—
Office support	0.7	4.0	17.0
Analysis	—	—	—

Given a list of common reasons for turnover, responding firms were asked to indicate which they would primarily attribute turnover for each employee category. Regardless of industry and size, employers primarily attribute turnover to the cost of living in the area and, for all categories except technical support, unmet employee salary expectations is also considered a key reason for turnover. For technical support staff, more employers indicate turnover is due to a lack of skills among employees.

**Reasons for Turnover
by Job Function**

<i>All Respondents</i>	<i>Analysis</i>	<i>Production</i>	<i>QA/QC</i>	<i>R & D</i>	<i>Sales/ Marketing</i>	<i>Technical Support</i>
Cost of living in area	30.0%	46.7%	44.4%	42.9%	42.9%	27.3%
Salary requirements	20.0	26.7	22.2	14.3	28.6	—
Lack of skills/experience	10.0	6.7	11.1	—	—	27.3
Industry changes	—	—	—	—	—	9.1
Other	40.0	20.0	22.2	42.9	28.6	36.4

With 27% of responding employers indicating lack of skills is a key reason for turnover among their technical support staff and given that technicians make up the largest group of workers among these employers, local training providers should focus on developing and/or updating training programs to improve skills among these workers.

Skills & Training Requirements

Education Requirements

Typically, biotechnology is viewed as a cutting-edge, high technology industry requiring advanced educational degrees for many of its key employees. Data from this present study support this, with 59%, 63% and 73% of local biotechnology/bioscience employers requiring entry-level technicians in QA/QC, analysis and R & D, respectively, to have at least a bachelor's degree. Production is the exception with nearly 65% of employers indicating that individuals do not need more than an AA/AS degree or certificate for entry-level production jobs. These findings hold up across industry type and employee size.

Given these findings, local training providers need to continue to offer appropriate post-secondary courses or certificate programs that will enable individuals to obtain entry-level positions with local biotechnology/bioscience companies and to provide relevant training to individuals that plan to continue on to obtain advanced educational degrees.

**Minimum Education Level Requirement for Entry-Level Technicians
By Job Category**

<i>Job Category</i>	<i>High school</i>	<i>AA/AS degree or certificate</i>	<i>BA/BS degree</i>	<i>Graduate degree</i>
Analysis	10.5%	21.1%	63.2%	5.3%
Production	41.2	23.5	35.3	—
QA/QC	23.5	11.8	58.8	5.9
R & D	—	13.3	73.3	13.3

Workforce Skills Requirements

Specific Knowledge and Skills Essential For Entry-Level Technicians

Biotechnology/bioscience firms were asked to indicate the knowledge and skills they find essential for entry-level technicians. The census instrument listed 75 potential skills and areas of knowledge for the responding employer to choose from. The 75 skills and knowledge areas were divided into the following 12 topic areas.

Skills and Knowledge Topic Areas

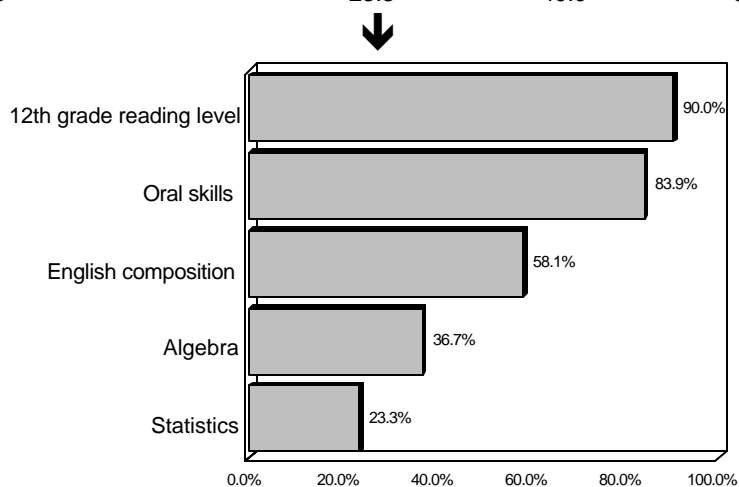
General Education	Chromatography
Computer Related	Fermentation Technology
General Lab Skills	Molecular Techniques
Safety	Microscopy
Animal/Plant Handling	Spectrophotometry
Culture Techniques	Nanotechnology

General Education

Regardless of industry or position, today's employers find it is essential for employees to have a strong basic education. Central Coast Region biotechnology employers are no different, with many wanting employees with basic reading skills and effective oral communication skills. Some 90% expect entry-level employees to minimally be at a 12th grade reading level, and 83% indicate that oral skills are fundamental. These were also the top valued general education skills in the earlier 1998 study.

General Education Knowledge and Skills for Entry-Level Technicians

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
12th grade reading level	90.0%	10.0%	—
Oral skills	83.9	16.1	—
English composition	58.1	38.7	3.2
Algebra	36.7	43.3	20.0
Statistics	23.3	40.0	36.7



When viewing data by industry type and size, a greater portion of larger companies with 230 or more employees consider algebra and statistics to be essential skills than their smaller counterparts. English composition and statistical skills are valued by a greater portion of employers in environmental than those involved in the clinical/technical and therapeutic fields.

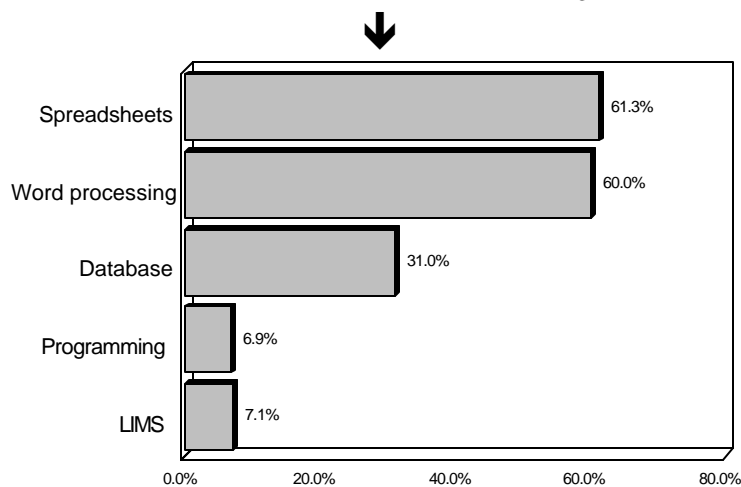
Computer Related

Due to the numerous computer programs available today, the present census simply focused on asking employers to indicate which computer applications, not specific software programs, are needed by their entry level workforce.

About six out of 10 responding employers each consider knowledge of spreadsheets and word processing programs essential, and 31% see the importance of database skills. In the 1995 CBEC study of Southern California biotechnology firms and the 1998 study, these skills also were considered the most important in the computer skill cluster.

Computer-Related Knowledge and Skills for Entry-Level Technicians

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
Spreadsheets	61.3%	25.8%	12.9%
Word processing	60.0	26.7	13.3
Database	31.0	31.0	37.9
Programming	6.9	6.9	86.2
LIMS	7.1	14.3	78.6



A greater portion of businesses involved in environmental work find database skills to be essential for entry-level technicians as compared to clinical/technical and therapeutic companies. Therapeutic employers see a relatively greater need for LIMS skills than employers in the other two industry groupings.

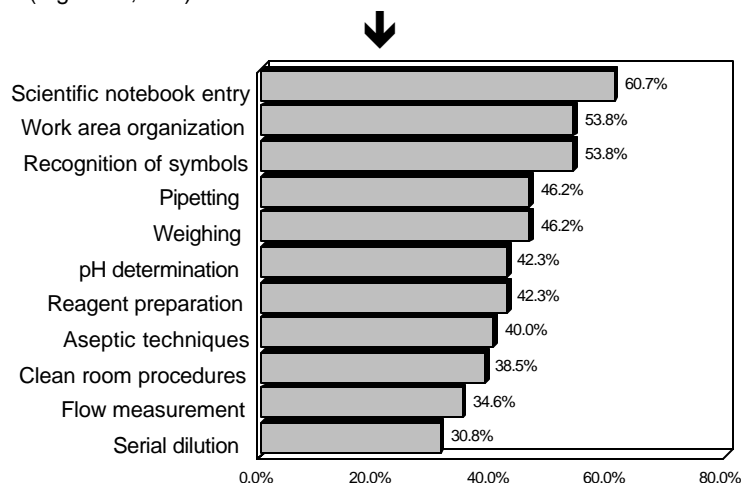
General Lab

Of the 19 different general lab skills listed in the current survey, the skills most frequently marked as essential by responding employers were scientific notebook entry, work area organization and recognition of symbols. At least one out of two responding employers consider these lab skills essential for their entry-level technicians.

Work area organization was also among the top three most essential lab skills in the 1995 CBEC study and the 1998 CCBC study,

General Lab Knowledge and Skills for Entry-Level Technicians

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
Scientific notebook entry	60.7%	14.3%	25.0%
Work area organization	53.8	19.2	26.9
Recognition of symbols	53.8	11.5	34.6
Pipetting	46.2	11.5	42.3
Weighing	46.2	7.7	46.2
pH determination	42.3	19.2	38.5
Reagent preparation	42.3	11.5	46.2
Aseptic techniques	40.0	12.0	48.0
Clean room procedures	38.5	19.2	42.3
Flow measurement	34.6	23.1	42.3
Serial dilution	30.8	11.5	57.7
Autoclaving	28.0	12.0	60.0
Flow diagrams/charts	26.9	38.5	34.6
Pressure measurement	26.9	23.1	50.0
Micropipetting	26.9	11.5	61.5
Centrifugation	20.0	28.0	52.0
Molarity calculations	19.2	19.2	61.5
Sterile filtration	19.2	11.5	69.2
GLP/GMP (e.g. FDA, ISO)	16.0	16.	68



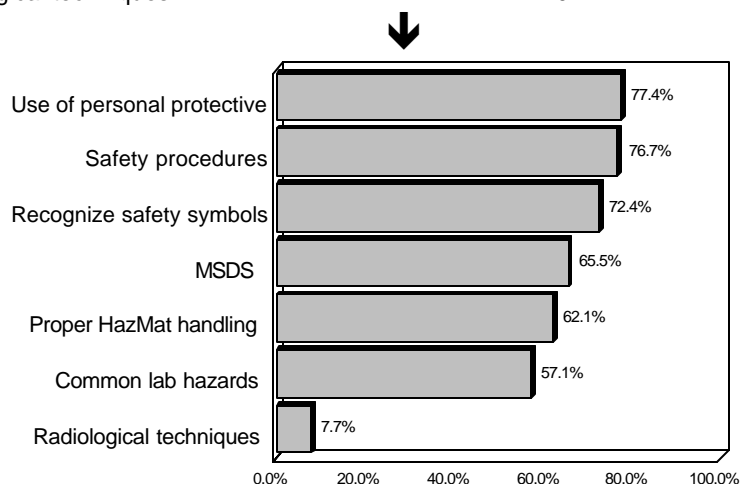
Companies involved in therapeutics value general lab skills among entry-level employees. A greater portion of clinical/technical companies as compared to environmental companies also see a need for entry-level employees to have some knowledge of a lab and skills required to work in a lab.

Safety

Among the group of safety-related skills, use of personal protective equipment and safety procedures are each considered essential to 77% of responding employers. These skills were also the top two essential safety skills reported in the 1995 CBEC and 1998 CCBC studies.

Safety Knowledge and Skills for Entry-Level Technicians

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
Use of personal protective	77.4%	16.1%	6.5%
Safety procedures	76.7	16.7	6.7
Recognize safety symbols	72.4	20.7	6.9
MSDS	65.5	17.2	17.2
Proper HazMat handling	62.1	27.6	10.3
Common lab hazards	57.1	28.6	14.3
Radiological techniques	7.7	19.2	73.1



Responding companies, regardless of size or industry type, consider all safety-related skills, with the exception of radiological techniques, to be essential for their entry-level staff.

Animal/Plant Handling

The National Voluntary Occupational Skill Standards for an Agricultural Biotechnology Technician includes 18 different animal/plant handling skills as necessary for entry-level technicians. For purposes of this workforce census, only three skills were selected.

Some 6% of responding firms self-identify in the agriculture industry segment and 12% and 6% fall within the market segment sub-sector of agriculture-plant and agriculture-animal, respectively. As a result, it is not surprising that a mere 7% of responding employers indicate at least some need for the plant propagation skills and that no respondents see a need for animal husbandry and animal injection skills.

Animal/Plant Handling Knowledge and Skills for Entry-Level Technicians

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
Animal husbandry	—	—	100.0%
Animal injection	—	—	100.0
Plant propagation	3.6	3.6	92.9

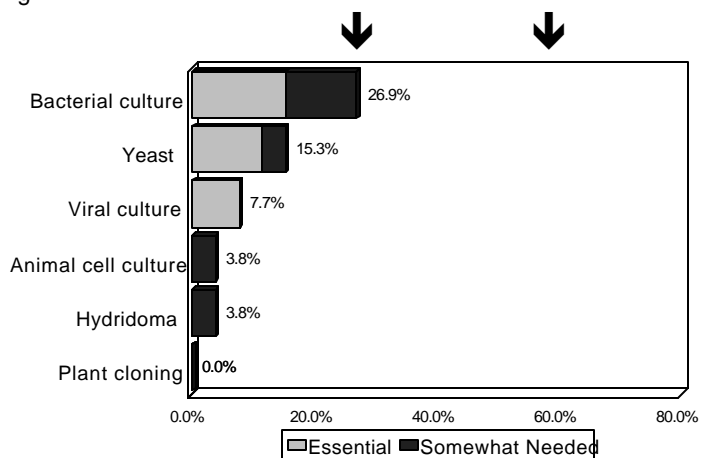
Culture Techniques

Among culture techniques, bacterial culture was most frequently selected by one out of four employers as a skill entry-level technicians need. Bacterial culture skills also topped the list in both the 1995 CBEC study and the 1998 CCBC.

Some 15% and 8% of employers in the current study also indicate that entry-level technicians have some need for yeast and viral culture skills, respectively.

Culture Techniques Knowledge and Skills for Entry-Level Technicians

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
Bacterial culture	15.4%	11.5%	73.1%
Yeast	11.5	3.8	84.6
Viral culture	7.7	—	92.3
Animal cell culture	—	3.8	96.2
Hydridoma	—	3.8	96.2
Plant cloning	—	—	100.0



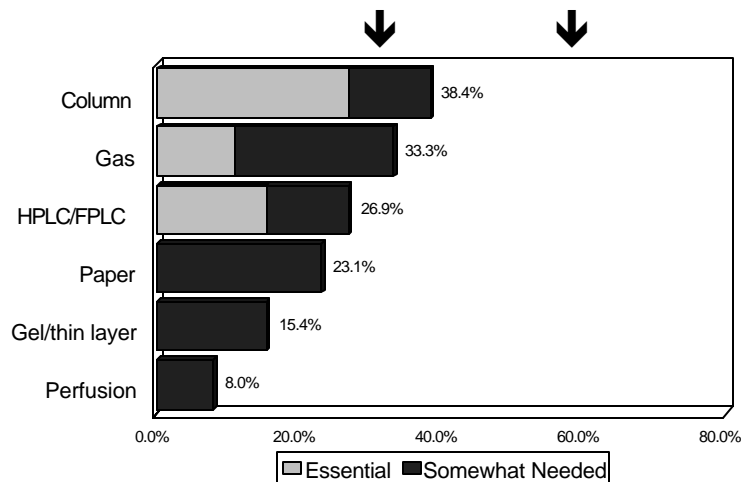
A greater portion of therapeutic companies have some need for entry-level technicians to have knowledge and skills in culture techniques, with the exception of plant cloning. Businesses involved in clinical and technical work have some need for entry-level employees to have bacterial culture, yeast and viral culture skills, while environmental companies have only a slight need for bacterial culture skills and no need for the other skills in the cultural techniques grouping.

Chromatography

Among the chromatography skills grouping, column and gas skills are considered to be at least somewhat needed among entry-level technicians by 38% and 33% of responding employers, respectively. HPLC/FPLC are somewhat needed by 27%. These were the same three skills that topped the list in the earlier 1998 study.

Chromatography Knowledge and Skills for Entry-Level Technicians

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
Column	26.9%	11.5%	61.5%
Gas	11.1	22.2	66.7
HPLC/FPLC	15.4	11.5	73.1
Paper	—	23.1	76.9
Gel/thin layer	—	15.4	84.6
Perfusion	—	8.0	92.0



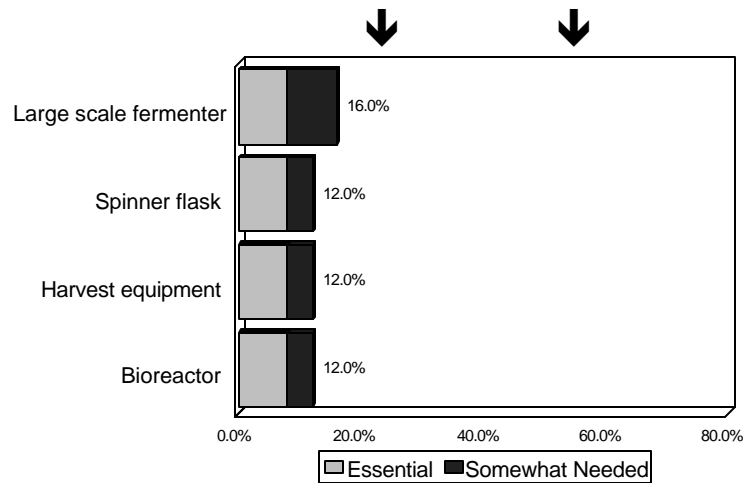
A relatively greater portion of large firms—those with 230 or more employees—consider chromatography knowledge and skills important for entry-level technicians. Of the three industry groupings, environmental firms have the least need for employees with chromatography skills.

Fermentation Technology

Some 16% of responding employers in the current study indicate that large-scale fermenter skills are somewhat needed by technicians. The other skills in this group—spinner flask, harvest equipment and bioreactor—are each considered at least somewhat needed by 12% of employers.

Fermentation Technology Knowledge and Skills for Entry-Level Technicians

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
Large scale fermenter	8.0%	8.0%	84.0%
Spinner flask	8.0	4.0	88.0
Harvest equipment	8.0	4.0	88.0
Bioreactor	8.0	4.0	88.0



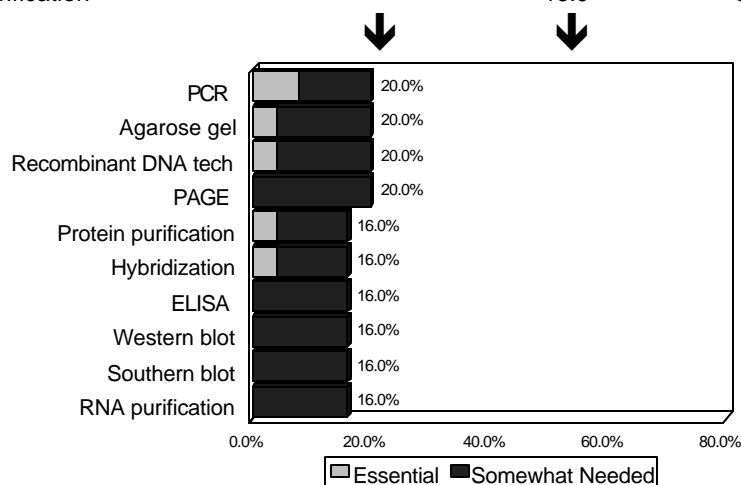
Therapeutic companies value all fermentation technology skills while environmental firms have no need for entry-level technicians to have such skills. Those involved in clinical and technical work also have a limited need for entry-level employees to have such skills.

Molecular Techniques

Area biotechnology/bioscience employers were asked which of 10 skills related to molecular techniques are essential for entry-level technicians in their organization. One out of five responding employers each considered PCR, agarose gel, recombinant DNA techniques and PAGE skills to be at least somewhat needed among entry-level technicians. Three of these four skills—agarose gel, PCR and PAGE—topped the list in the earlier 1998 study.

Molecular Techniques Knowledge and Skills for Entry-Level Technicians

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
PCR	8.0%	12.0%	80.0%
Agarose gel	4.0	16.0	80.0
Recombinant DNA tech	4.0	16.0	80.0
PAGE	—	20.0	80.0
Protein purification	4.0	12.0	84.0
Hybridization	4.0	12.0	84.0
ELISA	—	16.0	84.0
Western blot	—	16.0	84.0
Southern blot	—	16.0	84.0
RNA purification	—	16.0	84.0



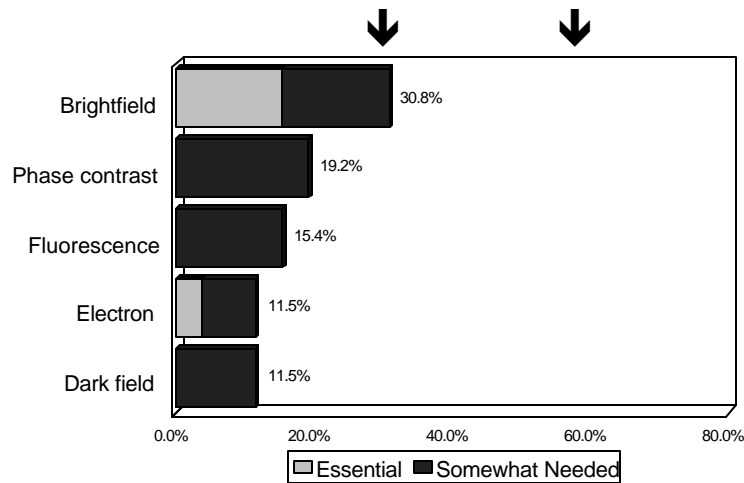
All molecular techniques are of some value to therapeutic employers but of less importance to those in the clinical/technical industry. Environmental firms only have a limited need for entry-level technicians to have PCR, agarose gel and recombinant DNA tech skills.

Microscopy

Within the group of microscopy skills, 31% of respondents in the current study have some need for their entry-level technical staff to have knowledge of brightfield. This skill was also considered key among respondents of the 1998 study.

**Microscopy Knowledge and Skills
for Entry-Level Technicians**

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
Brightfield	15.4%	15.4%	69.2%
Phase contrast	—	19.2	80.8
Fluorescence	—	15.4	84.6
Electron	3.8	7.7	88.5
Dark field	—	11.5	88.5



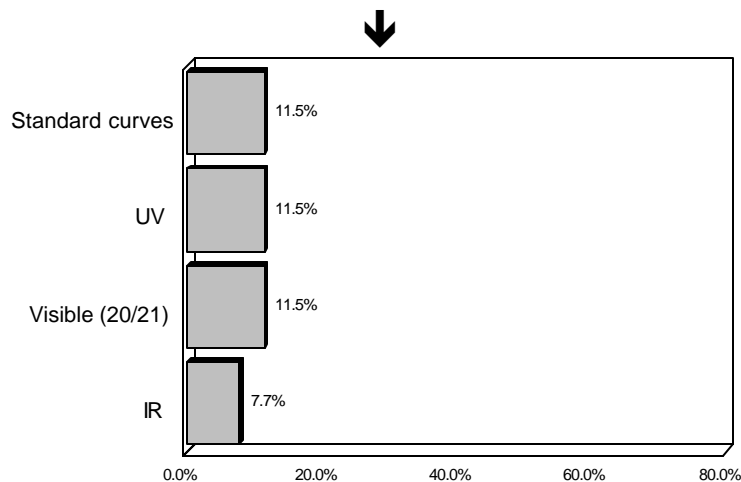
A greater portion of businesses involved in the clinical/technical industry have some need for entry-level employees to have microscopy skills. Environmental companies have relatively little need for such skills and, with the exception of brightfield, therapeutic companies have no need for entry-level technicians to have any skills in the microscopy grouping.

Spectrophotometry

Of the four spectrophotometry knowledge and skills, standard curves, UV and visible (20/21) are each considered essential skills for entry-level technicians by 12% of employers.

Spectrophotometry Knowledge and Skills for Entry-Level Technicians

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
Standard curves	11.5%	30.8%	57.7%
UV	11.5	26.9	61.5
Visible (20/21)	11.5	23.1	65.4
IR	7.7	26.9	65.4



The select spectrophotometry skills are considered essential for entry-level technicians among a number of clinical/technical firms. None of the therapeutic companies value any such skills.

Nanotechnology

Nanotechnology—a new skill area added in the 2006 survey—“is the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications.”² “While nanotechnology is in the ‘pre-competitive’ stage (meaning its applied use is limited), nanoparticles are being used in a number of industries. Nanoscale materials are used in electronic, magnetic and optoelectronic, biomedical, pharmaceutical, cosmetic, energy, catalytic and materials applications.”³

In the current study, 8% of responding biotechnology/bioscience employers consider nanotechnology to be “somewhat needed” by entry-level technicians.

Nanotechnology Knowledge and Skills for Entry-Level Technicians

<i>All Respondents</i>	<i>Essential</i>	<i>Somewhat Needed</i>	<i>Not Needed</i>
Nanotechnology	—	8.3%	91.7%

² National Nanotechnology Initiative. “What is Nanotechnology?” <http://www.nano.gov/html/facts/whatIsNano.html> (January 22, 2007).

³ National Nanotechnology Initiative. “Applications/Products.” <http://www.nano.gov/html/facts/appsprod.html> (January 22, 2007).

Summary of Top Skills Needed by Entry-Level Technicians

This section presents summaries by industry grouping of the top skills responding biotechnology/bioscience employers consider to be essential for individuals entering their workforce.

Top Skills Considered "Essential" For Entry-Level Technicians - By Industry Type

CLINICAL/TECHNICAL	
Skill	Topic Area
1. 12th grade reading level	General Education
2. Safety procedures	Safety
3. Recognize safety symbols	Safety
4. Oral skills	General Education
5. Use of personal protective	Safety
6. Common lab hazards	Safety
7. MSDS	Safety
8. Proper HazMat handling	Safety
9. Scientific notebook entry	General Lab Skills
10. Word processing	Computer
ENVIRONMENTAL	
Skill	Topic Area
1. Oral skills	General Education
2. Spreadsheets	Computer Related
3. 12th grade reading level	General Education
4. English composition	General Education
5. Use of personal protective	Safety
6. Word processing	Computer
7. Safety procedures	Safety
8. Scientific notebook entry	General Lab Skills
9. Recognize safety symbols	Safety
10. Word processing	Computer
THERAPEUTIC	
Skill	Topic Area
1. 12th grade reading level	General Education
2. Oral skills	General Education
3. Recognition of symbols	General Lab Skills
4. Pipetting	General Lab Skills
5. Weighing	General Lab Skills
6. pH determination	General Lab Skills
7. Aseptic techniques	General Lab Skills
8. Clean room procedures	General Lab Skills
9. Flow measurement	General Lab Skills
10. Autoclaving	General Lab Skills
11. Pressure measurement	General Lab Skills
12. Molarity calculations	General Lab Skills
13. GLP/GMP (e.g. FDA, ISO)	General Lab Skills
14. Use of personal protective	Safety
15. MSDS	Safety
16. Column	Chromatography
17. Large scale fermenter	Fermentation Technology
18. Spinner flask	Fermentation Technology
19. Harvest equipment	Fermentation Technology
20. Bioractor	Fermentation Technology

Following is a presentation of top skills needed by entry-level technicians by topic area for each of the three industry groupings—clinical/technical, environmental and therapeutic.

Top Skills Needed By Entry-Level Technicians - By Industry Type

CLINICAL/TECHNICAL	
Topic Area	Skill
Chromatography	HPLC/FPLC
Computer	Word processing Spreadsheets
Culture Techniques	Yeast Bacterial culture Viral culture
Fermentation Technology	Large scale fermenter
General Education	12th grade reading level Oral skills
General Lab	Scientific notebook entry
Microscopy	Brightfield Phase contrast
Molecular Techniques	PAGE
Safety	Safety procedures Recognize safety symbols Use of personal protective equipment
Spectrophotometry	Standard curves Visible (20/21)

ENVIRONMENTAL	
Topic Area	Skill
Chromatography	Column Gas
Computer	Spreadsheets Word processing Database
Culture Techniques	Bacterial culture
General Education	Oral skills 12th grade reading level English composition
General Lab	Scientific notebook entry Work area organization Recognition of symbols
Microscopy	Brightfield Phase contrast Fluorescence Dark field
Molecular Techniques	PCR Agarose gel Recombinant DNA tech
Safety	Use of personal protective equipment Safety procedures
Spectrophotometry	UV IR

Top Skills Needed By Entry-Level Technicians - By Industry Type

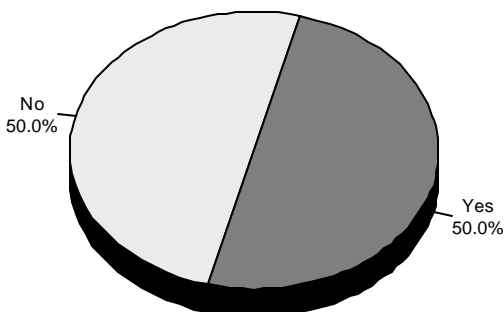
THERAPEUTIC	
Topic Area	Skill
Chromatography	Column
Computer	Spreadsheets Word processing LIMS
Culture Techniques	Bacterial culture Yeast Animal cell culture Hybridoma
General Education	12th grade reading level Oral skills
General Lab	Recognition of symbols Pipetting Weighing pH determination Aseptic techniques Clean room procedures Flow measurement Autoclaving Pressure measurement Molarity calculations GLP/GMP (e.g. FDA, ISO)
Microscopy	Brightfield
Molecular Techniques	PCR Agarose gel Recombinant DNA tech PAGE Protein purification Hybridization ELISA Western blot Southern blot RNA purification
Safety	Use of personal protective equipment MSDS

Current Workforce Skills

One-half of all surveyed area employers indicate there are industry-specific skills needed by their current workforce that, if improved by training, would strengthen their ability to compete.

Considering responses by employee size and industry type, the only difference is seen among larger-size businesses. Three out of four of these latter businesses do not believe their current workforce is in need of industry-specific skills.

Are there industry-specific skills needed by current workforce?



Employers cited the skill areas that could use improvement, and for each skill, indicated which employees—by educational level—would benefit from the skills upgrade. Four skill areas listed in the following table—engineering, equipment calibration, field biology and phlebotomy—had more than one mention.

**Key Industry-Specific Skills For Current Employees
That Could Use Improvement**

Skill	Key skill needed among employees with . . .			
	High school	AA/AS degree or certificate	BA/BS degree	Graduate degree
Chemistry	—	—	✓	—
Computer skills	—	—	✓	—
Electrical	—	—	—	—
Engineering - 3	✓	✓	✓	—
Equipment calibration - 2	—	✓	✓	—
Field biology - 2	—	—	✓	✓
Field botany	—	—	✓	✓
GIS/GPS	—	—	✓	✓
HazMat	—	✓	—	—
Lyophilization	✓	✓	✓	✓
Machinist skills	—	—	—	—
Marketing	—	—	✓	—
Medical terminology	✓	✓	✓	✓
Phlebotomy - 2	✓	✓	✓	✓
Regulatory affairs	—	—	✓	—
Research skills	—	—	✓	—
Safety skills	—	✓	—	—

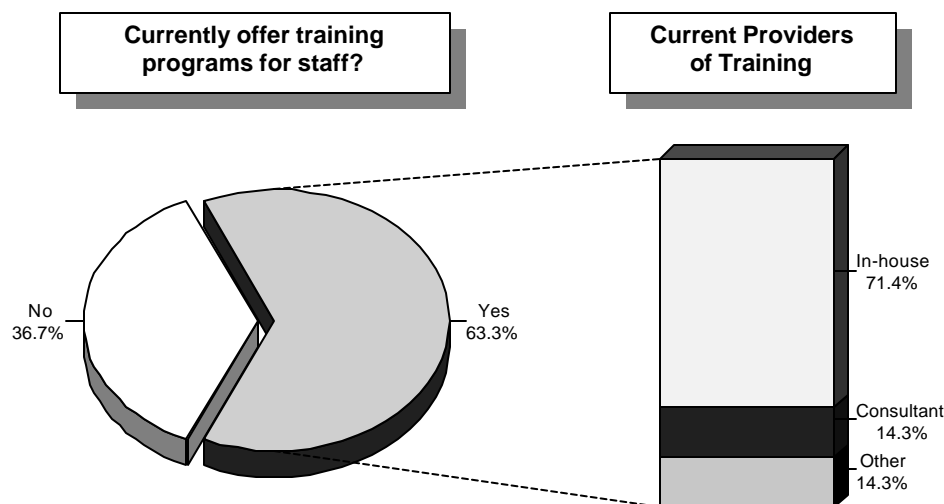
As demonstrated in the table below, the industry-specific skills employers say are needed among their current employees varies by industry type.

**Key Industry-Specific Skills For Current Employees
That Could Use Improvement - By Industry Type**

	<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
Chemistry		X	
Computer skills		X	
Electrical	X		
Engineering	X	X	X
Equipment calibration	X		
Field biology		X	
Field botany		X	
GIS/GPS		X	
HazMat	X		
Lyophilization			X
Machinist skills	X		
Marketing		X	
Medical terminology	X		
Phlebotomy	X		
Regulatory affairs	X		
Research skills		X	
Safety skills	X		

Training Programs & Delivery

Three out of five responding organizations currently offer training programs to staff, especially pertaining to practical lab skill.



In the 1995 CBEC study of Southern California biotechnology firms, nearly 44% responding companies offered training programs to staff. The percentage was found to be higher in the 1998 and 2006 CCBC studies with 51% and 63% of Central Coast Region employers, respectively, indicating that they offer training for their employees.

Some 71% of responding biotechnology/bioscience companies that offer training programs to staff offer training in-house and 14% use outside consultants or vendors. These findings are similar to those found in the 1995 CBEC and 1998 CCBC studies, as indicated in the table below.

	<i>CBEC Southern California 1995 Survey</i>	<i>Central Coast Region 1998 Survey</i>	<i>Central Coast Region 2006 Survey</i>
<i>Currently offer training programs to staff</i>	43.7%	50.9%	63.3%
<i>Training Source</i>			
In-house	65.7%	70.4%	71.4%
Outside consultant/vendor	11.4	14.8	14.3
College/university	8.6	3.7	—
Other	14.3	18.5	14.3

The majority of companies involved in clinical/technical work and therapeutics offer training programs for employees. In contrast, about one-half of environmental firms have training available for their staff.

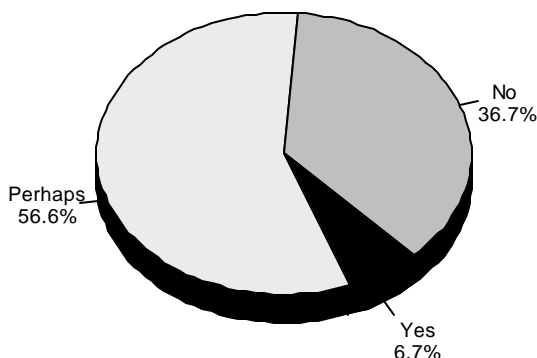
Regardless of industry type, the majority of companies use in-house training providers. One exception is that environmental firms are equally split between using in-house trainers and outside consultants/resources.

	<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
<i>Currently offer training programs to staff</i>	69.2%	53.3%	100.0%
<i>Training Source</i>			
In-house	85.7%	50.0%	100.0%
Outside consultant/vendor	—	33.3	—
Other	14.3	16.7	—

Some 63% of responding firms indicate some interest in low-cost, effective training for staff.

Would you be interested in very low-cost effective training programs for your staff members?

Interest in training is higher in the current study of Central Coast Region biotechnology/bioscience businesses than in the 1995 CBEC and 1998 CCBC studies where 42% and 59% of responding businesses, respectively, indicated they would be interested in such training programs.



Would you be interested in very low-cost, effective training programs for your staff members?

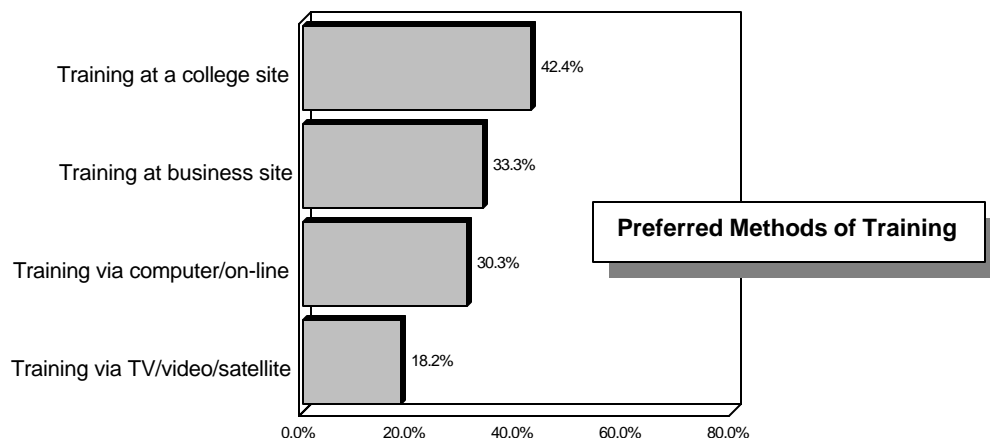
	<i>CBEC Southern California 1995 Survey</i>	<i>Central Coast Region 1998 Survey</i>	<i>Central Coast Region 2006 Survey</i>
Yes	2.2%	7.7%	6.7%
Perhaps	39.6	41.0	56.6
No	58.2	51.3	36.7

With the exception of larger companies that possibly have employee training covered with in-house providers, the majority of businesses across all industries have some interest in low-cost, effective training for their staff.

**Would you be interested in very low-cost, effective training programs for your staff members?
By Industry Type**

	<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
Yes	15.4%	—	—
Perhaps	46.2	66.7	50.0
No	38.5	33.3	50.0

Biotechnology/bioscience companies were asked to indicate their preferences for training delivery. They were given the option of choosing one or more of the following training methods—on-campus training, on-site training, on-line training or training via TV/video/satellite. Some 42% organizations indicated a preference for training at a college or other district training sites. On-site training and training via computer or Internet were each of interest to about one-third of responding employers.



Comparing current findings regarding preferred methods of training with those from the 1998 CCBC study, a greater portion of respondents in the present study have an interest in on-campus training and on-line training, and a slightly smaller portion selected training via TV/video/satellite than the Central Coast Region employers surveyed in 1998.

<i>Method of Training</i>	<i>Central Coast Region 1998 Survey</i>	<i>Central Coast Region 2006 Survey</i>
Training at a college site	33.3%	42.4%
Training at business site	33.3	33.3
Training via computer/on-line	24.6	30.3
Training via TV/video/satellite	24.6	18.2

Companies involved in therapeutics and clinical/technical work prefer training offered at a college. Among environmental firms, on-campus training is as much of a preference as on-line and on-site training.

Preferred Methods of Training

	<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
Training at a college or other district training sites	40.0%	37.5%	100.0%
Training offered right at your business site	20.0	43.8	50.0
Training via computer/ on-line/Internet	26.7	37.5	—
Training via TV/video/ satellite downlinks	6.7	31.3	—

Regardless of industry or number of employees, training on-campus would be best during weekday evenings and on-site training is preferred weekdays during the day.

Preferred Timing of Training

<i>All Respondents</i>	Preferred Class Time		
	<i>Weekdays Daytime</i>	<i>Weekdays Evening</i>	<i>Weekends</i>
Training at a college or other district training sites	10.5%	57.9%	31.6%
Training offered right at your business site	69.2	23.1	7.7
Training via TV/video/satellite downlinks	57.1	28.6	14.3
Training via computer/on-line/Internet	41.2	35.3	23.5

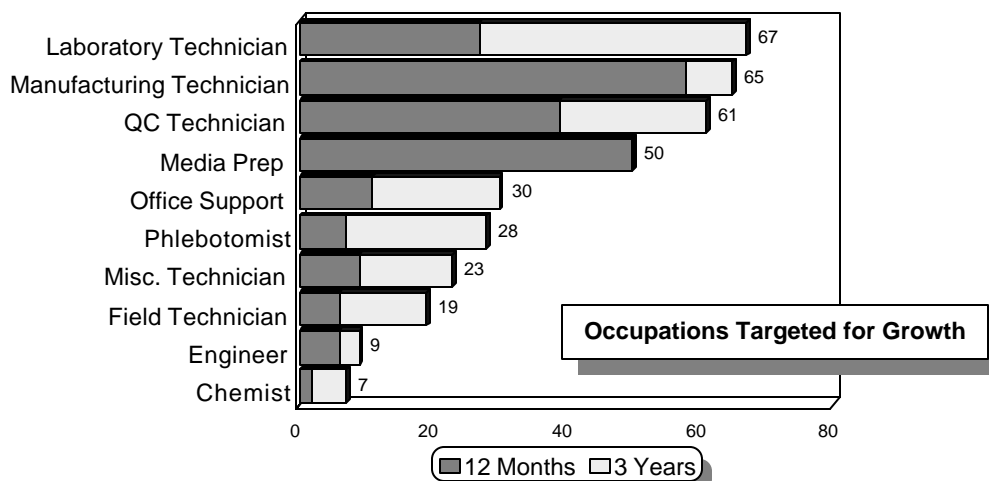
Future Workforce Needs

Future Occupations

Some 22 employers of the entire respondent group of 33 offered detailed information about their workforce. Among this group of 22 employers, a total of 219 hires are expected for new or vacant positions over the next 12 months and a total of 158 hires are expected by 2009. The five occupations targeted for the most growth—laboratory, manufacturing and QC technicians, media prep and office support—account for 72% of all expected job vacancies or opportunities in 12 months and 3 years from now.

Job Positions Projected to be Filled

	<i>Next 12 months</i>	<i>2-3 Years</i>	<i>TOTAL</i>
Laboratory Technician	27	40	67
Manufacturing Technician	58	7	65
QC Technician	39	22	61
Media Prep	50	—	50
Office Support	11	19	30
Phlebotomist	7	21	28
Misc. Technician	9	14	23
Field Technician	6	13	19
Engineer	6	3	9
Chemist	2	5	7
Botanist	2	4	6
Scientist	1	4	5
Environmental Technician	1	3	4
Biologist	—	1	1
Ecologist	—	1	1
Glasswasher	—	1	1
TOTAL	219	158	377



One responding business within the therapeutic industry expects to hire almost as many employees over the next three years as the other 21 responding companies that offered specific information about their workforce. Specifically, the therapeutic firm is responsible for 45% of the 377 anticipated job openings. Environmental companies expect to fill slightly more positions over the next three years than those companies involved in clinical/technical work.

One-third of the job positions to be filled in therapeutics over the next three years will be for manufacturing technicians, followed closely by media prep. Among responding environmental firms, the need will be the greatest for laboratory and QC technicians—each will be responsible for 23% and 20%, respectively, of all job openings in that industry group. Nearly 30% of all jobs to be filled among companies involved with clinical/technical work will be for phlebotomists.

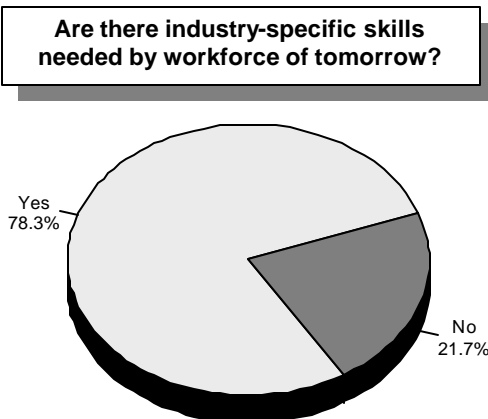
**Percent of Total Job Positions Projected to be Filled - By Industry Type
Next 3 Years**

	<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
Laboratory Technician	22.3%	22.6%	11.9%
Manufacturing Technician	8.5	—	33.9
QC Technician	2.1	20.0	21.4
Media Prep	—	—	29.8
Office Support	23.4	7.0	—
Phlebotomist	29.8	—	—
Misc. Technician	2.1	18.3	—
Field Technician	4.3	13.0	—
Engineer	2.1	1.7	3.0
Chemist	—	6.1	—
Botanist	—	5.2	—
Scientist	4.3	0.9	—
Environmental Technician	—	3.5	—
Biologist	—	0.9	—
Ecologist	—	0.9	—
Glasswasher	1.1	—	—
TOTAL	100.0	100.0	100.0

Preparing Tomorrow's Workforce

Future Workforce Skills

Regardless of employee size and industry type, the majority of Central Coast Region biotechnology and bioscience firms confirmed there are specific skills and abilities they would like to see in a pool of applicants for their industry.



Responding employers named the types of industry-specific skills the future workforce would need and identified which employees—based on education level—would need the particular skill. Suggestions resulted in the following laundry list of unique skills. Six skill areas—basic skills, chemistry, computer, engineering, environmental and lab—had more than one mention.

Key Industry-Specific Skills Needed by Workforce of Tomorrow

Skill	Key skill needed among employees with . . .			
	High school	AA/AS degree or certificate	BA/BS degree	Graduate degree
Basic skills (math, English) - 3	—	—	—	—
Chemistry - 3	—	—	✓	✓
Chromatography	—	—	—	—
Communication	—	—	—	—
Computer skills - 4	—	✓	✓	✓
Engineering - 3	✓	✓	✓	—
Environmental - 2	—	—	—	—
Field biology	—	—	✓	✓
Field botany	—	—	✓	✓
Lab skills/lab notebook skills - 3	—	—	—	—
Isolator technology	✓	✓	✓	✓
Machinist skills	—	—	✓	—
Medical	—	—	—	—
Phlebotomy	—	—	—	—
Safety skills	—	—	—	—

As indicated in the table below, the industry-specific skills employers say are needed for their future workforce varies by company size and industry type.

Key Industry-Specific Skills Needed by Workforce of Tomorrow - By Industry Type

	<i>Clinical/Technical</i>	<i>Environmental</i>	<i>Therapeutic</i>
Basic skills (math, English)	X	X	
Chemistry	X	X	
Chromatography	X		
Communication	X		
Computer skills	X	X	
Engineering	X	X	X
Environmental		X	
Field biology		X	
Field botany		X	
Lab skills/lab notebook skills	X	X	
Isolator technology			X
Machinist skills	X		
Medical	X		
Phlebotomy	X		
Safety skills	X		

Career Preparation Activities

To help prepare individuals for work in biotechnology, educators understand the importance of teaming with local businesses to help develop and refine appropriate training programs.

Part of the emphasis of this study was to find out the interest level of local biotechnology/bioscience businesses in assisting the Ventura County WIB, the CCBC, Moorpark College and Ventura College in the preparation of the industry's workforce through various activities.

Some 33% of responding firms indicated an interest in serving as a guest speaker to a class or offering course instruction. About 24% have an interest in hosting worksite visits for students, while 18% each would be willing to donate equipment and materials, offer worksite internships or provide entry-level jobs for screened program graduates.

