Application Date

California Community Colleges

APPLICATION FOR APPROVAL—NEW OCCUPATIONAL PROGRAM

Biotechnology PROPOSED PROGRAM TITLE	Dr. Ron Quinta CONTACT PERSON
Ohlone College COLLEGE	Dean, Science & Technology TITLE
Ohlone College Community College District DISTRICT	(510) 659-6024 PHONE NUMBER
Fall 2008 PROJECTED PROGRAM START DATE	rquinta@ohlone.edu E-MAIL ADDRESS

☒ CERTIFICATE ☐ A.A. DEGREE ☒ A.S. DEGREE ☐ LIMITED DURATION, until _____

PLANNING SUMMARY

Recommended T.O.P. Code	0430.00	Estimated FTE Faculty Workload	3.0
Units for Major—Degree	35.5	Number of New Faculty Positions	1 (faculty in place)
Total Units for Degree	60	Est. Cost, New Equipment	0 (equip in place)
Required Units—Certificate	16.5-29.5	Type of New/Remodeled Facility	0 (new facility in place)
Projected Annual Completers	30-60	Est. Cost, Library Acquisitions	0 (library supports program)
Projected Net Annual Labor Demand	100s-1000s	Listed as "projected" on Inventory?	☒ **Yes** ☐ **No**

APPROVAL CRITERIA

Approval Criterion	Pg. # in App.	Section	Chancellor's Office Use
MISSION	3	1. Statement of Program Goals and Objectives	
	3-7	2. Catalog Description	
	7-8	3. Program Requirements	
	8-9	4. Background and Rationale	
NEED	9	5. Enrollment and Completer Projections	
	9-10	6. Place of Program in Curriculum/Similar Programs	
	10-11	7. Similar Programs at Other Colleges in Service Area	
	11-12, 23	8. Labor Market Information	
	12-15, 24	9. Job Market Analysis	
	15-17	10. Employer Survey	
	17	11. Explanation of Employer Relationship	
	18	12. List of Members of Advisory Committee	
	19, 25	13. Minutes of Key Meetings/Recommendations	
	19	14. Recommendation of Regional Consortium	
QUALITY	19	15. Display of Proposed Sequence	
	20, 26	16. Outlines of Record for Required Courses	
	20	17. Transfer Applicability	
	20, 27	18. Program Evaluation Plan	
FEASIBILITY	20	19. Library and/or Learning Resources Plan	
	20	20. Facilities and Equipment Plan	
	20	21. Financial Support Plan	
	20	22. Faculty Qualifications and Availability	
COMPLIANCE	21	23. Model Curriculum	
	21	24. Licensing or Accreditation Standards	
	21	25. Student Selection and Fees	
	21	26. Programs Involving Contracts	

REQUIRED SIGNATURES—NEW OCCUPATIONAL PROGRAM

Program AS Degree in Biotechnology College Ohlone College

LIBRARY AND LEARNING RESOURCES

Library and learning resources needed to fulfill the objectives of the program are currently available or are adequately budgeted for.

DATE	SIGNATURE, CHIEF LIBRARIAN/LEARNING RESOURCES MANAGER	Lesley Buehler TYPED OR PRINTED NAME

VOCATIONAL REQUIREMENTS

Program fulfills the requirements of employers in the occupation, provides students with appropriate occupational competencies, and meets any relevant professional or licensing standards.

DATE	SIGNATURE, DEAN OF OCCUPATIONAL EDUCATION	Dr. Ron Quinta TYPED OR PRINTED NAME
DATE	SIGNATURE, CHAIR, OCCUPATIONAL ADVISORY COMMITTEE	Dr. James Baxter TYPED OR PRINTED NAME

Program was recommended for approval by Regional Occupational Consortium on May 15, 2008 (date).

DATE	SIGNATURE, CHAIR, REGIONAL CONSORTIUM	Phyllis McGuire TYPED OR PRINTED NAME

LOCAL CURRICULUM APPROVAL

Program and courses within the program have been approved by the curriculum committee and instructional administration, and satisfy all applicable requirements of Title 5 regulations.

DATE	SIGNATURE, CHAIR, CURRICULUM COMMITTEE	Chris Warden TYPED OR PRINTED NAME
DATE	SIGNATURE, CHIEF INSTRUCTIONAL OFFICER	Dr. Jim Wright TYPED OR PRINTED NAME
DATE	SIGNATURE, PRESIDENT, ACADEMIC SENATE	Susan Myers TYPED OR PRINTED NAME

COLLEGE PRESIDENT

All provisions of Title 5, Section 55130(b) have been considered. All factors, taken as a whole, support establishment and maintenance of the proposed instructional program.

DATE	SIGNATURE, PRESIDENT OF THE COLLEGE	Dr. Doug Treadway TYPED OR PRINTED NAME

DISTRICT APPROVAL

On _____, the governing board of _____
District approved the instructional program attached to this application.

DATE	SIGNATURE, SUPERINTENDENT/CHANCELLOR OF DISTRICT	Dr. Doug Treadway TYPED OR PRINTED NAME

MISSION

1. *Statement of Program Goals and Objectives*

The Biotechnology Degree and Certificate Programs prepares students for entry level jobs in the biotechnology/biosciences field such as Bio-manufacturing Assistant, Bio-manufacturing Technician, Quality Control Technician, Quality Assurance Technician, Bioinformatics Specialist, Instrumentation/Calibration Technician, Lab Assistant, Lab Support Worker, Lab Technician, Research Associate. Students who complete the biotechnology program will have the following skills and competencies: basic math skills; read & follow instructions; written & oral communication; attention to details; observational skills; organizational skills; work in a team; work independently; analyze/evaluate technical data; biotechnology lab techniques; computer skills; knowledge of life science & chemistry; knowledge of SOPs, GMPs and GLPs; Problem-solving/critical thinking skills; read and interpret technical materials; record keeping skills and technical writing skills.

2. *Catalog Description*

A.S. Degree in Biotechnology

The AS Degree in Biotechnology is a program designed to train students in the methods and techniques used in biotechnology—in such areas as cell production & fermentation; quality assurance; research assistance /associate; and/or biostatistics used in a manufacturing setting. Students in this degree program complete the biotechnology may petition to have courses with equivalent content substitute for BIOT 105 or CHEM 109. Courses in this program train students in DNA and protein laboratory techniques and assays; laboratory record keeping; sterile techniques; cell culturing techniques; genomic and cDNA library construction and analysis; rt-PCR; and mathematical analysis of laboratory outcomes. This degree program prepares students for entry-level positions in bio-manufacturing, quality assurance/control, and research assistant/technician positions requiring skills in statistics.

Students will be awarded the Associate of Science Degree in Biotechnology upon completion of all required courses plus Ohlone College General Education Plan A, for a total of 60 units.

First Semester
BIOT 105 Introduction to Cell & Molecular Biology (4u)
CHEM 109 Biochemistry to Health Science & Biotechnology (4u)
BIOT 113 GMP/GLP (1u)
BIOT 123 Writing SOPs (0.5u)
BIOT 121 Biotech Careers (1u)
GE—CS 101 (3u) or other
GE—BIOT 100 (3u) or other
Total Semester Units: 16.5

Second Semester
BIOT 119 Clean Room Techniques (0.5u)
BIOT 110A1 DNA Structure (1u)
BIOT 110A2 PCR/DNA Sequencing (1u)
BIOT 110A3 Protein Purification (1u)
GE—Elective 1 (3u)
GE—ART 100 (3u) or other
GE—ENGL 101A (4u) or other
Total Semester Units: 16.5

Third Semester
BIOT 115A Animal Cell Culture (2u)
BIOT 115B Bioreactor Techniques (2u)
BIOT 111A cDNA Library Construction (1u)
BIOT 111B rt-PCR (1u)
MATH 159 Statistics & Probability (5u)
GE—PE 300 (1u) or other
GE—ANTH 103 (3u) or other
Total Semester Units: 15

Fourth Semester
BIOT 117 Immunology (1u)
BIOT 112 Bioinformatics (2u)
BIOT 114 Plant Biotech (3u) or
BIOT 122 Nanotechnology (3u) or
BIOT 133 SAS Programming (3u)
GE—Elective 2 (3u)
GE—Elective 3 (3u)
Total Semester Units: 12
Total Program Units: 60

Certificate of Achievement: Cell Production/Fermentation

The Certificate of Achievement in Cell Production/Fermentation is a 22.5 unit program designed to train students in methods and techniques used in biotechnology, with emphasis on cell production used in manufacturing settings. Courses in this program train students in DNA and protein laboratory techniques and assays, laboratory record keeping, sterile techniques, and cell-culturing techniques. The program prepares students for entry-level positions in bio-manufacturing and pharmo-manufacturing positions requiring skills in cell culturing and fermentation. The concepts and skills learned in this program prepare students for positions such as Cell Culture Lab Assistant/Technician; Life Sciences Lab Assistant/Technician.

Students awarded this certificate will have completed all required courses described for the program with a "C" grade or better.

First Semester
BIOT 105 Introduction to Cell & Molecular Biology (4u)
BIOT 148 Computer Applications in Biotechnology (0.5u)
BIOT 113 GMP/GLP (1u)
BIOT 121 Careers in Biotechnology (1u)
BIOT 123 Writing SOPs (0.5u)
CHEM 109 Biochemistry for Health Science & Biotechnology (4u)
Total SemesterUnits = 11

Second Semester
BIOT 110A1 Introduction to DNA Technology-1 (1u)
BIOT 110A2 PCR I and DNA Sequencing (1u)
BIOT 110A3 Protein Isolation and Assays (1u)
BIOT 115A Animal Cell Culture Techniques (2u)
BIOT 115B Bioreactor Cell Culture Techniques (2u)
BIOT 117 Immunology (1u)
BIOT 119 Clean Room Techniques (0.5u)
ENGL 156 Report & Technical Writing (3u)
Total Semester Units = 11.5
Total Certificate Units: 22.5

Certificate of Achievement: Quality Control/Research Associate

The Certificate of Achievement in Biotech Quality Control/Quality Assurance/Research is a 23.5 unit program designed to train students in methods and techniques used in biotechnology QA/QC and research settings. Courses in this program train students in DNA and protein laboratory techniques and assays, laboratory record keeping, sterile techniques, advanced PCR procedures, and genomic/cDNA library construction and analytical skills. The program prepares students for entry-level positions biotechnology/pharmaceutical companies as research assistants, quality control and/or quality assurance assistants/technicians and laboratory assistants/technicians

Students awarded this certificate will have completed all required courses described for the program with a "C" grade or better.

First Semester
BIOT 105 Introduction to Cell & Molecular Biology (4u)
BIOT 148 Computer Applications in Biotechnology (0.5u)
BIOT 113 GMP/GLP (1u)
BIOT 121 Careers in Biotechnology (1u)
BIOT 123 Writing SOPs (0.5u)
CHEM 109 Biochemistry for Health Science & Biotechnology (4u)
Units = 11

Second Semester
BIOT 110A1 Introduction to DNA Technology (1u)
BIOT 110A2 PCR I and DNA Sequencing (1u)
BIOT 110A3 Protein Isolation and Assays (1u)
BIOT 115A Animal Cell Culture Techniques (2u)
BIOT 115B Bioreactor Cell Culture Techniques (2u)
BIOT 111A Genomic and cDNA Lilbrary Construction & Analysis (1u)
BIOT 111B PCR Primer Optimization & rt-PCR (1u)
ENGL 156 Report & Technical Writing (3u)
Units = 12
Total Units: 23.5

Certificate of Achievement: Biostatistics

The Certificate of Achievement in Biostatistics is a 31.5 unit program designed to train students in methods and techniques used in biotechnology statistical analysis. Courses in this program train students in DNA and protein laboratory techniques and assays, laboratory record keeping, sterile techniques, and mathematical analysis of laboratory outcomes. The program prepares students for entry-level positions in bio-manufacturing, biostatistician assistant, clinical data assistant/associate, validation assistant/technician, production planner/scheduler, and research assistant/associate positions requiring skills in statistics.

The student will be awarded this certificate after completion of all required courses with a "C" grade or better.

First Semester
BIOT 105 Introduction to Cell & Molecular Biology (4u)
BIOT 148 Computer Applications in Biotechnology (0.5u)
BIOT 113 GMP/GLP (1u)
BIOT 121 Careers in Biotechnology (1u)
BIOT 123 Writing SOPs (0.5u)
CHEM 109 Biochemistry for Health Science & Biotechnology (4u)
BIOT 119 Clean Room Techniques (0.5)
BIOT/CS 133 SAS Programming (3u)
Units = 14.5

Second Semester
BIOT 110A1 Introduction to DNA Technology-1 (1u)
BIOT 110A2 PCR I and DNA Sequencing (1u)
BIOT 110A3 Protein Isolation and Assays (1u)
BIOT 115A Animal Cell Culture Techniques (2u)
BIOT 115B Bioreactor Cell Culture Techniques (2u)
BIOT 112 Introduction to Bioinformatics (2u)
Math 159 Statistics & Probability (5u)
ENGL 156 Report & Technical Writing (3u)
Units = 17
Total Units: 31.5

Certificate of Achievement: Bio-manufacturing

This program introduces students to the conceptual foundation and laboratory/industry skills in the bio-pharmaceutical-bio-manufacturing function of biotechnology-bioscience-pharmaceutical companies. Students will learn concept and skills related to cell & molecular biology, biochemistry, SOPs, GMPs & GLPs, DNA techniques & PCR, Protein Isolation & Purification, Cell Culture and Clean room techniques. Some entry-level positions that use these skills include Manufacturing-Production Assistant/Technician; Media Preparation Technician; Lab Assistant/Associate/Technician.

The student will be awarded this certificate after completion of all required courses with a “C” grade or better.

First Semester
BIOT 105 Introduction to Cell & Molecular Biology (4u)
BIOT 148 Computer Applications in Biotechnology (0.5u)
BIOT 113 GMP/GLP (1u)
BIOT 121 Careers in Biotechnology (1u)
BIOT 123 Writing SOPs (0.5u)
BIOT 121 Careers in Biotechnology (1u)
CHEM 109 Biochemistry for Health Science & Biotechnology (4u)
Units = 11

Second Semester
BIOT 110A1 Introduction to DNA Technology-1 (1u)
BIOT 110A2 PCR I and DNA Sequencing (1u)
BIOT 110A3 Protein Isolation and Assays (1u)
BIOT 115A Animal Cell Culture Techniques (2u)
BIOT 111A Genomic and cDNA Lilbrary Construction & Analysis (1u)

BIOT 111B PCR Primer Optimization & rt-PCR (1u)
BIOT 119 Clean Room Techniques (0.5u)
Units = 7.5
Total Units: 18.5

3. *Program Requirements*

Biotechnology Courses: Degrees & Certificates of Achievement

	Degree	Certificates of Achievement			
Course (Dept/No./Title/ Semester Units)	AS Degree Biotechnology	Cell Production/ Fermentation	Quality Control/ Assurance/ Research	Biostatistics	Biomanufacturing
BIOT 105 Cell/Molec Biol (4)*	4	4	4	4	4
CHEM 109 Biochemistry (4)*	4	4	4	4	4
CAOT 148 Computer Apps in Biotech (0.5)	0.5	0.5	0.5	0.5	0.5
BIOT 113 GMP/GLP (1)	1	1	1	1	1
BIOT 123 Writing SOPs (.5)	0.5	0.5	0.5	0.5	0.5
BIOT 121 Biotech Careers (1)	1	1	1	1	1
BIOT 110A1 DNA Struct/Rep (1)	1	1	1	1	1
BIOT 110A2 PCR/DNA Seq (1)	1	1	1	1	1
BIOT 110A3 Protein Iso/Assay (1)	1	1	1	1	1
BIOT 115A Animal Cell Culture (2)	2	2	2	2	2
BIOT 115B Bioreactor Cell Culture (2)	2	2	2	2	
BIOT 119 Clean Room Techniques (.5)	0.5	0.5	0.5	0.5	0.5
BIOT 111A Genomic/cDNA Library (1)	1		1		1
BIOT 111B PCR Primer Optim./RT PCR (1)	1		1		1
BIOT 117 Immunology (1)	1	1			
BIOT 112 Bioinformatics (2)	2			2	
BIOT 114 Plant Biology/Biotech (3)	3				
BIOT 122 Nanotechnology (3)	3				
BIOT 133 SAS Programming (3)	3			3	
ENGL 156 Report & Technical Writing (3)	3	3	3	3	
MATH 159 Statistics & Prob (5)	5			5	
Core course total	38.5				
General Education Plan A	21.5				
Note: Take 1 of the following 3 courses: BIOT 114 (3), 122 (3) and/or 133 (3) for AS Degree					
*Equivalent courses may be petitioned for Substitution for BIOT 105 or CHEM 109 only					
Total Units Required	60	22.5	23.5	31.5	18.5

General Education Plans Offered by Ohlone College

GENERAL EDUCATION
General Education Philosophy and Student Learning Outcomes
The three patterns of General Education courses (Plans A, B, and C) provide a comprehensive and well-rounded education that promotes the tudent's
personal, cultural, and intellectual growth. Completing these courses will promote personal awareness and growth as students adapt and grow in a changing world with a comprehension of the past, present, and future and an enhanced ability to address

social, ethical, and philosophical issues. Students will grow culturally, developing an appreciation of human differences and cultural heritages which will enhance their ability to live interdependently as ethical citizens within a culturally diverse and complex world. Finally, completing general education courses will instill intellectual curiosity and analytical thinking conducive to lifelong learning. Development of skills in such varied fields as the natural
sciences, the social sciences, fine arts and humanities, English composition, mathematics, critical thinking, foreign languages, cultural diversity, physical education, and information competency will enable students to transfer and apply knowledge in multiple domains and solve everyday life problems.
General Education: Plan A

Ohlone College General Education Pattern
The Plan A General Education pattern requires a minimum of 18 units in completing an Ohlone-specific general education pattern, including cultural
diversity, wellness, and information competency components. Plan A requirements may also be met through the reciprocity agreement explained on
page 42. The Plan A General Education pattern is recommended for students whose immediate goal is to complete an associate degree with either a general, occupational, or transfer major. By coupling this pattern with an approved transfer major, students may meet most of the lower division major preparation for transfer within that major. In some occupational majors students may be required to complete more than 60 units to obtain an associate degree. Students are advised to consult with a counselor. The following information presents the General Education Philosophy and
Student Learning Outcomes for the Plan A General Education pattern. The major areas include:
I. Natural Sciences
II. Social and Behavioral Sciences
III. Fine Arts and Humanities
IV. Language and Rationality
V. Physical Education/Wellness
VI. Cultural Diversity
VII. Information Competency
Area I Natural Sciences (6 units)—should be covered by core courses
Area II Social and Behavioral Sciences/American Institutions (3 units)
Area III Fine Arts/Humanities (3 units)
Area IV Language and Rationality 6 units)
Area V. Physical Education/Wellness
Area VI Cultural Diversity, AA, AS Degree (3 units)

4. *Background and Rationale*

Ohlone College has been offering the Certificate of Completion in “Biotechnology: Bio-manufacturing/Research Associate” for approximately 7 years. All of the courses to be included in the new degree and certificates of achievement have already been developed and approved by the Curriculum Committee, and they are being offered as individual courses. Since the beginning of the Biotechnology Program, approximately 90% of the enrolled students are post-baccalaureate (i.e., acquiring skills for a career change). These students already possess the BA/BS Degree or higher, and were not interested in earning the associate degree. However, for the past 2.5 years Ohlone has been engaged in an NSF and CCCCEWD sponsored project to work with regional high schools to create career and technical education (CTE) pathways in the bioscience/biotechnology area (These CTE pathway are referred to as the Learning Alliance for Bioscience, LAB). Presently, 6 high schools have successfully articulated courses with the College’s BIOT 105 “Introduction to Cell & Molecular Biology,” and CHEM 109 “Biochemistry for Health Sciences & Biotechnology” (i.e., the fist two courses in the biotechnology certificate and/or degree program). Approximately 250 high schools students are participating in CTE-LAB programs. During the Fall 2008 term, Ohlone will be establishing a LAB Learning Community for these students. This

pipeline of high school students will represent the first significant enrollment if pre-baccalaureate students in our biotech program. This application is to provide the associate degree in biotechnology, as well as specific certificates in achievement for students who have not yet earned a college degree.

NEED

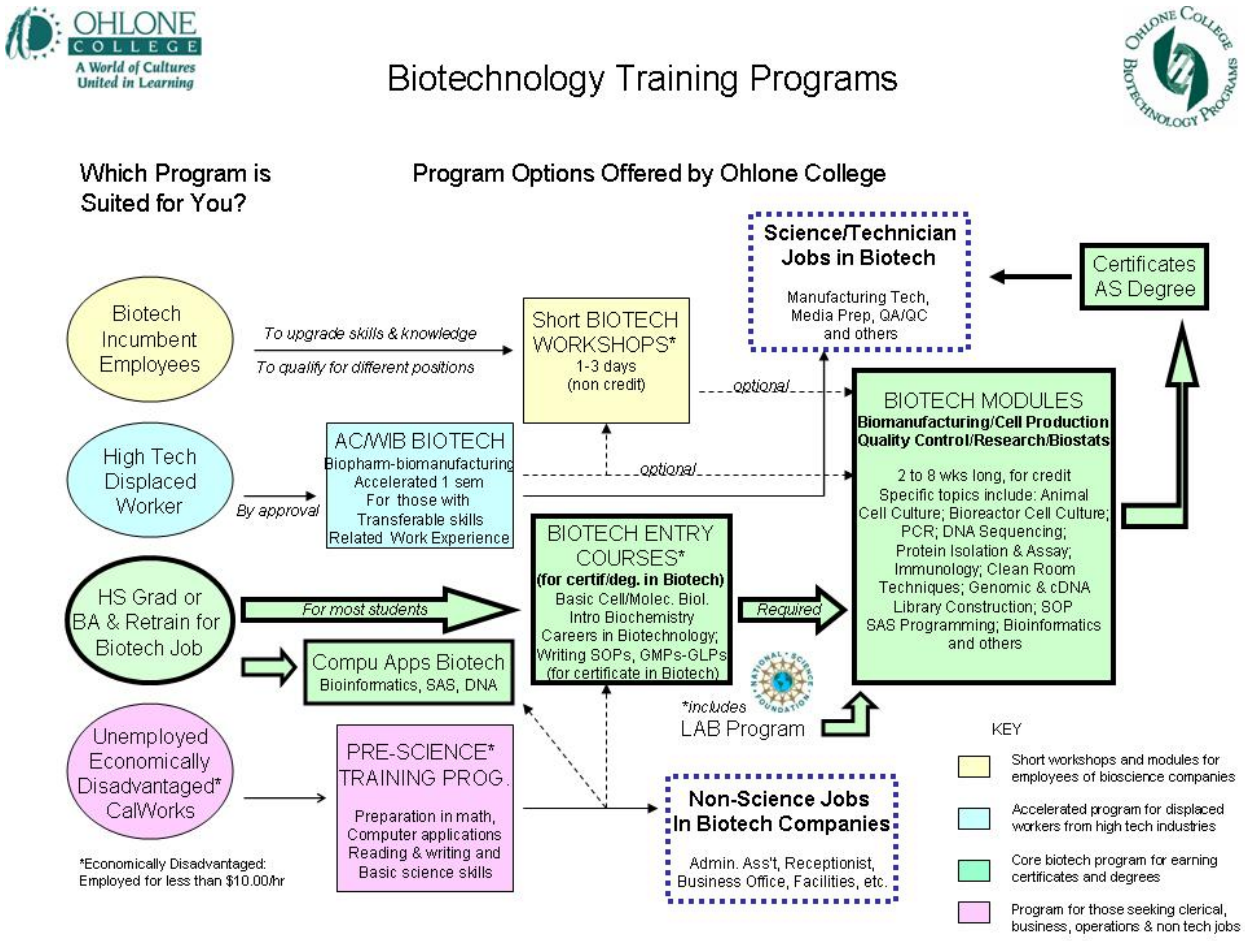
5. *Enrollment and Completer Projections*

- the number of sections of core courses to be offered annually: *32 courses (46 sections) per year*
- the student annual enrollment in the number of sections estimated above. *600*
- the number of estimated program completers per year at the end of the first year of program operation: *30 projected completers after 1st year of program*
- the number of estimated program completers per year at the end of the third year of program operation: *~50-60 projected completers after 3rd year of program*

6. *Place of Program in Curriculum/Similar Programs*

For the past 8 years the college has successfully offered a certificate of completion in biotechnology. Approximately 95% of the several hundred students who have earned this certificate come to the program already possessing a bachelor's degree or higher, and are retraining for a career change. However, during the past 2 years NSF & CCCEWD grants have supported the development of Bioscience CTE pathways at 6 regional high schools (i.e., Newark Memorial HS (Fremont), Kennedy HS (Fremont), James Logan HS (Union City), Tennyson HS (Hayward), Granada HS (Livermore) and the California School for the Deaf (Fremont). There are approximately 250 high school students (~50% from underrepresented groups, such as Latino/Hispanic) enrolled in these CTE pathways referred as the Learning Alliance for Bioscience (LAB) Program. During the LAB Program/Pathway, high school student complete courses that are articulated with the first two courses in the college's biotechnology certificate program, and proposed degree and certificates of achievement, BIOT 105 (4 sem. units) and CHEM 109 (4 sem. units). We anticipate that as many as 50% of these LAB students upon graduating from high school will transfer to the college to complete the requirements for the biotechnology program. This influx of recent high school graduates will be pre-baccalaureate, and many of them will be interested in pursuing the associate degree— making them stronger applicants for entry-level positions in the biotech/bioscience industry in this region.

The following diagram shows how the degree and certificate program relates to our present biotechnology offerings.



7. *Similar Programs at Other Colleges in Service Area*

None of the colleges closest to Ohlone College in this geographical area (i.e., Chabot, Las Positas, and Mission Colleges) possess a biotechnology program at this time. Ohlone College is working with Chabot in the development of a biotech program, and we are interested in also collaborating with the other colleges, enabling this region to adequately serve the large biotech/bioscience industry sector with a well-trained, entry-level workforce—and thereby supporting companies that are moving from R & D to the manufacturing phase of product development during the next 5 years.

Ohlone College is also presently a member of the following regional collaborative directed by Dr. Nora Lem:

California Applied Biotechnology Center - Bay Area,
395 Oyster Point Blvd., suite 117

South San Francisco, CA 94080

Funded by the Economic and Workforce Development Program of the California Community Colleges Chancellor's Office.

Recently Ohlone was awarded an Economic & Workforce Development Grant in Applied Biotechnologies (#08-0304) to implement a California Applied Biotechnology Center at our Newark Center for Health Sciences and Technology. This center will cover Regions 5 and 6 and will serve the community college districts located in the Central Region (Gavalan, Hartnell, Merced, Monterey, San Joaquin Delta, State Center, Sequoias, West Hills, West Kern, and Yosemite) and the Contra Costa, Chabot-Las Positas, Foothill-De Anza, Ohlone, Peralta and Solano districts that formerly were included in the Bay Area Region. This Center will serve to bridge the gap between education, job training, economic development, and employment advancement in the region through job training programs, skill-enhancement biotechnology workshops, pathway programs, and contract education. Ohlone College has the demonstrated capacity and strengths that can be leveraged collectively by other community colleges in the region to meet the educational and training needs of the employers and workers of the biotechnology industry. Here is a copy of the communication from the State Initiative Director, Dr. Mary Pat Huxley:

Hello Ron:

The news is out, I copied you on an earlier email. Congratulations on your college's success in the awarding of the biotech center grant! That's great news.

Mary Pat Huxley, M.Sc., Ed.D.
Applied Biotechnology Centers Initiative
Economic & Workforce Development Program
through the California Community Colleges
www.cccbiotech.org

These memberships and communications demonstrate both widespread knowledge and support for the Biotechnology Programs we offer.

8. *Labor Market Information* (also refer to Appendix 1, page 22)

The San Francisco Bay Area is home to the largest biotech cluster in the United States, with about 900 bioscience companies employing more than 85,600 workers. As Biotechnology companies enter their product development stage, their sustainable competitive advantage depends increasingly on the preparation of the workforce to supply job creation needs. For the past several years, Ohlone College has worked with the bioscience companies on our advisory board to offer the necessary training to provide employers with a better skilled workforce, as well as providing bioscience employees with better opportunities for expanding their knowledge and skill sets.

The sources used for labor market information:

California's Biotechnology Workforce Training Needs For The 21st Century
G. Koehler, V Koehler-Jones
Holden Research
Sacramento, CA
Spring 2006

Under the Microscope—Biotechnology Jobs in California
Employment Development Dept., Labor Market Information Division, Information Services Group,
Occupational Research Unit
J. Peters, S Slotterbeck
June 2004

- US Biotech firms employ 146,000 to 187,000+ workers. By 2015, the industry may employ as many as 250,000 or more The job multiplier for biotechnology is 1.9
- The US Dept. of Labor projects that between 2002 and 2012, US employment in the Life Sciences will grow by 18% (19% for life scientists, 19% for biological technicians, and 23% for workers in pharmaceutical and medicine manufacturing
- A total of 43,600 technicians with AA degrees are projected to be needed in 2010, an increase of 17% over 2000—an additional 8,100 technician level positions could open up due to separations and internal promotions
- In California, when 16 biotech business executives were surveyed in 2005 by Time Structures, they responded that the fastest growing biotechnologies are fermentation; bio-processing; biotransformation; and bio-manufacturing; followed by advanced drug delivery systems, drug design, culture and manipulation of cells, stem cells, tissues and embryos; diagnostic tests; and nanotechnology

9. *Labor Market Analysis* (also refer to Appendix 2, page 23)

- Given the number of enrollments projected for the program and necessary to support the program, are there enough openings locally to permit placement of the expected number of graduates, taking account of the numbers of graduates available from similar programs within the same geographic region?

  - $\geq$ 250,000 by 2015 and possible extra 8,100 @ technician level (pp. 4-5 of *CA's Biotech Workforce Training Needs*)

- Has the job market been: declining slowly? steady? growing slowly? growing rapidly? newly emerging?

  - Some are growing slowly, some are growing rapidly, also newly emerging (see charts in *CA's Biotech Workforce Training Needs* and in *Under the Microscope*)
  - Statistics on occupational projections of employment for Biological Technicians, Medical and Clinical Laboratory Technicians, and Chemical Technicians are attached. Each sheet represents a particular are (all of California, Oakland-Fremont-Hayward, San Francisco-San Mateo-Redwood City, and San Jose-Sunnyvale-Santa Clara). These statistics were taken from the Date Library of http://www.labormarketinfo.edd.ca.gov/

Earning Potential

- What is the average initial salary ?

  - A Chart of median Salaries can be found in *CA's Biotech Workforce Training Needs* on pages 43 (from a 2004 EDD/LMID survey.
  - Note also the following chart of Entry-level Hiring Intentions by Job (for 2006-2007)--Some Entry-Level Positions and Salary Average starting salary (2006/2007 Biotech Workforce Hiring Needs Survey—San Mateo & Alameda Counties, PriceWaterhHouse Coopers, Inc.)

Entry-Level Position	Average Starting Salary
Manufacturing/Production Technician	$38,584
Research Associate	$38,930
Clinical Data Manager Associate	$42,200
Clinical Laboratory Assistant	$43,848
Facilities Technician	$44,980
Validation Technician	$44,980
Instrumentation/Calibration Technician	$45,984
Production Planner/Scheduler	$46,384
Regulatory Affairs Documentation Coordinator	$59,394

  - More specific data on particular jobs can be found in *Under the microscope* (Lab Assistants—pages 39-40; Lab Support Workers—pages 41-42; Instrumentation/Calibration Technicians—pages 69-70; Manufacturing Technicians—pages 75-76; Quality Control Inspectors—pages 99-100; Validation Technicians—pages 103-104) & Exhibit 5—page 33.

- What is the average percentage of salary increase in 2 years? 5 years?

  - There is information on mean hourly and annual wages for jobs in the biotechnology industry, sorted by percentile, but nothing that calculates salary increase

- Statistics on occupational wages for Biological Technicians, Medical and Clinical Laboratory Technicians, and Chemical Technicians are attached. Each sheet represents a particular area (all of California, Oakland-Fremont-Hayward, San Francisco-San Mateo-Redwood City, and San Jose-Sunnyvale-Santa Clara). These statistics were taken from the Data Library of http//www.labormarketinfo.edd.ca.gov/

Program Credibility/Career Potential

- Is there sufficient evidence that employers would preferentially hire or promote graduates with this education, other things being equal?

  - "The industry is increasingly relying upon highly-trained specialists." (page 41 of *CA's Biotech Workforce Training Needs*)

- How likely is it that employees with only the education provided by this program, and lacking experience, will be hired at all? Or that experienced employees with only this education would be promoted?

  - "We are increasing in Bio-manufacturing. We don't need (people with) four-year degrees for this." (page 55 of *CA's Biotech Workforce Training Needs*)

- If advanced degrees are typically needed for career advancement, will the courses required for this program transfer towards completion of the requirements for those degrees?

  - Often in the biotechnology industry, career advancement can result from employer training and/or completion of the baccalaureate degree or higher in areas such as biological science, chemistry, etc. The college offers AS Transfer Degrees in all of the STEM disciplines for students who desire to begin work towards the baccalaureate degree.

- Will this preparation permit students to stay current in their field? Does the program teach basic principles and theory, as well as applications? Is it current? Is it of sufficient rigor to assure the capacity to continue to follow the literature and learn new techniques? Is it of sufficient generality to allow for later shifts in career?

  - In addition to the biotechnology degrees and certificates of achievement, the college offers short workshops for incumbent employees of biotechnology companies. These workshops and the for-credit modules of longer duration are typically taught by adjunct faculty who are working in the biotechnology industry, and therefore train our students on the latest applications and theory.

- Does this preparation provide a significant secondary expertise to primary careers? Is it designed primarily or in part to meet the needs of those already employed for upward mobility, entrepreneurship, or other career upgrade?

  - Students in the biotechnology degree program will be training for entry-level jobs in the biotechnology industry. However, students who are already employed in the industry may seek to benefit by completing our certificate of achievement programs and/or by taking individual modules and workshops offered by the college on specific topics (such as DNA Sequencing; PCR; RT-PCR; Animal Cell Culture; Writing SOPs; GMPs & GLPs, etc.

- Does it prepare students to work in an ethnically diverse workforce and an ethnically diverse, global market?

  - Yes, the college is also engaged in collaborative CTE pathways with local high schools that encourages a greater diversity of students to explore and prepare for jobs in biotechnology and other emerging technologies. In this geographical area, Latino/Hispanic and Deaf students are two of our target groups.

10. */Employer Survey/Other Evidence of Need/*

The following grid shows the results of a survey of local biotech companies—entry-level jobs, necessary skills

Matrix for Life Sciences Employment

Company	Job Title	Entry	Job Specific
Abbott	Mfg Prep Technician	yes	Lab instruments Aseptic processing Practice BMP
Allergan	Assist, Admin II	Yes	AA degree 3-5 exp or training, Computer proficiency in Word, Excel, PP
Allergan	Mech, Maintenance	3-5 yrs in moderate to highly engineered manufacturing facility	Read prints/schematics Diagnose /troubleshoot equipment system problems

Amgen	Quality Technician	AA in Life Science 1 year exp in biotech, chemical, food industry	Knowledge of Word & Excel Preferred GMP Quality group a plus Reading and interpreting drawings and schematics
Bayer	General Worker	yes	Maintain on checklists housekeeping & department cleaning documentation Pickup supplies and restock as necessary
Cell Gensys	Materials Handler 1	HS or equivalent required Clear DMV Operate forklift Knowledge of transport of hazardous materials	Receive, verify & Distribute supplies File purchase orders
Food and Drug Admin.	Consumer Safety Officer	30 hours minimum in combination Of biological, chemistry, physical sci, Engineering etc	Plan & conduct regulatory inspections of industry establishments, Perform analyses, evaluate data

Company	Job Title	Entry	Job Specific
Foxhollow Techno-logies	Machinist III, ATG	AA in Machine Technology or equivalent training/exp.; Computer lit.	Machine and assemble prototype Devices, equipment, & tooling, safety) cleanliness of machine shop

Genitope	Admin/ Assistant (Exec Level admin duties & projects		Schedule & prioritize meetings, set-up & maintain data bases, collect & Analyze data Expertise with MS Office products
Genitope	Corporate Services Receptionist	HS w/ 2yrs Admin exp.	Proficient with MS Word, MS Excel Process & distribute mail Operate multi-line switchboard Order & stock office supplies
Genitope	Document Control Clerk	HS w/ 1-2 yrs Exp in office	Coordinate Documents. Issue, copy, file, distribute controlled documents
Genitope	Buyer I/II	BS/BA in business, science, engineering or Equivalent w/ 5-8 yrs in purchase, procure lab/mfg equipment in GMP environment	Procurement of capital lab/production equipment Works proactively with other depts. to develop equipment requirements, purchase orders

11. */Explanation of Employer Relationship/*

Representatives of many of the biotech/bioscience companies in our region are members of the Biotechnology Advisory Committee (referred to as the BETA Group), and they provide important information regarding our biotech curriculum, the skill sets they want, and present job announcements.

12. */List of Members of Advisory Committee/*

Following is the list for the Biotechnology Advisory Committee updated 1/11/2008

*Dr. Mark Barnby
Biology Faculty
Ohlone College

Dr. Jim Bazter
Biology Faculty
Ohlone College

*Ms. Holly J. Clark, Scientist
Metabolex
3876 Bay Center Place
Hayward, CA 94545

*Mr. Clay Colvin, Econ. Devel. Mgr.
City of Newark
37101 Newark Blvd.
Newark, CA 94560

Mr. Michael Yoshida, Mgr. Mfg/ Tech Spt.
Allergan
503 Vandelle Way, Suite B
Campbell, CA 95008

Mr. Jesse Casados, Manager R&D
Boston Scientific
47900 Bayside Parkway
Fremont, CA 94538

*Mr. Ed Louie, Production Director
Genitope Corporation
6900 Dumbarton Circle
Fremont, CA 94555-3651

*Ms. Paige Lloyd, Education Relations
Genentech
1 DNA Way
So. San Francisco, CA 94080-4990

Ms. Kesinee Yip, Ass. Dir. Site Comm.
Novartis
4560 Horton Street
Emeryville, CA 94608

*Ms. Christine Friday, Econ. Development
Coordinator
City of Union City
34009 Alvarado-Niles Rd.
Union City, CA 94587

(*) Previously submitted to
Board of Trustees

*Mr. Tim Morken, Director
Thermo Fisher Scientific/ Lab Vision
47790 Westinghouse Dr.
Fremont, CA 94539

*Ms. Sally Porfido, Econ. Development Mgr.
City of Hayward
777 B Street
Hayward, CA 94541-5007

*Dr. Ron Quinta
Dean, Ohlone College
Science, Engineering & Technology

*Mr. Chuck Olson, VP Operations/CGI
CellGenesys Inc.
24590 Clawiter Road
Hayward, CA 94545

Dr. Bipin Gupta, President & CEO
Diagnostic Biosystems
1020 Serpentine Lane, Suite 114
Pleasanton, CA 94566

*Mr. Robert Sakai, Technology &
Trade Director
Economic Development Alliance
For Business (EDAB)
1221 Oak Street, Suite 555
Oakland, CA 94612

*Ms. Lori Taylor, Economic Devel. Mgr.
City of Fremont
3300 Capitol Avenue, Bldg. A
Fremont, CA 94537

*Dr. Ken Olson, Scientist
Inamed/ Allergan
48490 Milmont Drive
Fremont, CA 94538

Ms. Peggy Kraus
Amgen
6701 Kaiser Drive
Fremont, CA 94555

Dr. Fred Hempel, Owner
Baia Nicchia
P.O. Box 428
Sunol, CA 94586

13. */Minutes of Key Meetings/Recommendations/*

Refer to Appendix 3 (page 24)

14. */Recommendation of Regional Consortium/*

Refer to Appendix 4 (page 25)

QUALITY

15. *Display of Proposed Sequence*

AS Degree in Biotechnology (2-year Curriculum Guide)						
Curriclum Guide (2 year): AS Degree in Biotechnology						
Semester 1	***units***	***Semester 2***	***units***	***Semester 3***	***units***	***Semester 4***
BIOT 105 Cell/Molec Biol. (4)	4	BIOT 119 Clean Room (0.5)	0.5	BIOT 115A An Cell Cult (2)	2	BIOT 117 Immuno (
CHEM 109 Biochemistry (4)	4	BIOT 110A1 DNA Struc (1)	1	BIOT 115B Bioreactor (2)	2	BIOT 112 Bioinfo (2
BIOT 113 GMP/GLP (1)	1	BIOT 110A2 PCR/DNA (1)	1	BIOT 111A cDNA Library	1	Biotech Electives
BIOT 123 SOPs (0.5)	0.5	BIOT 110A3 Proteins (1)	1	BIOT 111B PCR Primer	1	one of the following
BIOT 121 Biotech Careers (1)	1	Engl 156 Tech Reports (3)	3	Math 159 Statistics (5)	5	BIOT 114 Plant (2)
		GE--Elective 1 (3)	3			BIOT 122 Nano (3)
GE--CS 101(3)	3	GE--ART 100 (3)	3	GE--PE 300 (1)	1	BIOT 133 SAS Prog
GE--BIOT 100 (3)	3	GE--ENGL 101A (4)	4	GE-ANTH102(3)/PHIL110(3)3	3	GE--Elective 2 (3)
						GE--Elective 3 (3)
Total Sem Units	16.5	Total Sem Units	16.5	Total Sem Units	15	Total Sem Units
						Total Semester U

16. *Outlines of Record for Required Courses*

Refer to Appendix 5 (page 26)

17. *Transfer Applicability*

Not Applicable

18. *Program Evaluation Plan*

Refer to Appendix 6 (page 27)

FEASIBILITY

19. *Library and Learning Resources Plan*

The Library and Learning Resource Center adequately meets the needs of this program.

20. *Facilities and Equipment Plan*

The facilities and equipment required for implementation of this new degree program are already in place at the college. For example, during spring 2008 the new Center for Health Sciences & Technology opened in Newark, CA. The opening of this Center quadruples the space available to train students in biotechnology—and includes a specialized laboratory for cell culture training. In addition, the program continues to acquire through donations, grant funding and foundation funding the state-of-the-art equipment and instruments required to implement the new degree program. For example, some equipment and instrumentation acquired in support of this program includes: spectrophotometers (visible and UV); microscopes (light-compound, fluorescent, scanning electron and atomic force); protein purification instrumentation (HPLCs and FPLCs); DNA PCR instrumentation; DNA Sequencer; cell culture hoods; carbon dioxide incubators; ELISA reader; real time PCR instrumentation; bioreactor; etc. Ohlone College is in a good place both in terms of facilities and equipment to implement the new degree program in biotechnology.

21. *Financial Support Plan*

The biotechnology program at the college has benefited through awards from the following grants, which included some funding for equipment purchase: National Science Foundation, supporting the development of CTE pathways in 6 local high schools as part of the Learning Alliance for Bioscience (LAB) Program; SB 70 Quick Start EWD Grant, supporting the use of the LAB Program as a model for expansion of LAB Program to include more schools and students; SP 70 Strengthening EWD Grant, supporting curriculum development to provide more course options for high school seniors in the LAB Program; SP 70 Middle School Careers Exploration Grant, supporting programs to introduce all 15 California career sectors, and to identify biotech and science CTE pathways available to students when then enter high school; and the JDIF EWD Grant, supporting training workshops for incumbent employees in biotechnology companies, and supporting development of training curricula for those who desire to secure non science and non manufacturing jobs in biotechnology companies.

22. *Faculty Qualifications and Availability*

The biotechnology program is taught by a mix of full time and adjunct faculty. The list below shows the faculty and topics they teach in this program. The college is also in the process of hiring two more full time faculty positions that will each have teaching assignments in biotechnology:

Full Time Faculty Teaching Biotechnology:
Dr. Mark Barnby: BIOT 110A1, 110A2, 110A3, 116
Dr. Jim Baxter: BIOT 111A, 111B
Dr. Laurie Issel-Tarver: BIOT 105
New Biotechnology Instructor: BIOT 105 (and others) & LAB Program Coordination
New Biotechnology Instructor: BIOT 105, 123, 113 (and others)

Adjunct Faculty Teaching Biotechnology: (Note: many of the following adjunct faculty are also employed full time in regional biotechnology companies, and are providing specific, up-to-date training in their field)
#1: CHEM 109
#2: BIOT 105
#3: BIOT 113
#4: BIOT 123
#5: BIOT 119
#6: BIOT 115A, 115B
#7. BIOT 117
#8. BIOT 114
#9: BIOT 121

COMPLIANCE

23. *Model Curriculum:* Not Applicable

24. *Licensing, Accreditation, or Professional Certification Standards:* Not Applicable

25. *Student Selection and Fees:* Not Applicable

26. Programs Involving Contracts: Not Applicable