

PROGRAM REVIEW OF BIOTECHNOLOGY

2015-2016



This page intentionally left blank

1.1 Introduction. Introduce the program. Include the program's catalogue description, its mission, the degrees and certificates offered, and a brief history of the program. Include the number and names of full-time faculty, adjunct faculty, and classified staff. Discuss any recent changes to the program or degrees (limit to 2-3 pages max).

In the last review cycle, the Solano College biotechnology program has enjoyed spectacular success. The program has placed many students into high wage, high impact, high potential for advancement careers; it received and fulfilled a Department of Labor grant; it received a National Science Foundation grant; it received part of four Career Pathways Trust grants; it used its national contacts to apply (unsuccessfully) for several \$25 million Department of Labor grants; it was part of a \$70 million national National Institute of Standards and Technology grant; it planned for a new facility on the Vacaville campus; and it successfully competed for and won a baccalaureate program to become one of the first community college programs in California history to offer a Bachelor's degree.

The Industrial Biotechnology program prepares graduates to work in the biotech/biomanufacturing/pharmaceutical industry as technicians. Students learn how to operate and maintain the equipment used to manufacture protein pharmaceutical products; they culture bacterial, yeast and mammalian cells and the recover and purify the proteins that those cells produce. Students follow good manufacturing practices by maintaining records in order to comply with quality assurance procedures and government regulations.

Solano College founded the Biotechnology program in 1997 in response to the announcement that the pioneering biotechnology company Genentech would site the largest multiuse cell culture manufacturing facility in the world in the City of Vacaville within Solano County. This company's decision followed the establishment of facilities by Large Scale Biology (now out of business), Chiron (which became Novartis which was then sold to Eli Lilly – that facility is now vacant and for sale), and Alza (now Janssen Pharmaceuticals, a Division of Johnson and Johnson).

Solano College responded by designing the Biotechnology program whose curriculum was and continues to be crafted with extensive input by industry partners. This program was the first college program, two-year or four-year, to teach students the skills and knowledge required to enter the manufacturing sector of the biotechnology industry. Over the years many colleges have used the Solano College curriculum as a model. Although the program contains many academic elements (with biology and chemistry courses serving as prerequisites), the program has been formally designated as a CTE (Career Technological Education) program and the certificates have been formally approved by the Community College Chancellors Office as part of a CTE program. Over its history the program has worked with national, regional, and local workforce and economic development groups to develop a curriculum relevant to the field. The Solano College curriculum has served as a model for many colleges, 2 year and 4 year. Faculty members from 38 states and from 8 countries have visited the biotechnology facilities to learn from the Solano College experience.

The Biotechnology Program offered at Solano College offers several degrees that can serve as a terminal degree, or as electives for students transferring to universities as life sciences majors. In the near future the current program will serve as a prerequisite for the Bachelors in Biomanufacturing.

The catalog description of the program is:

Program Description

This program prepares graduates to work in the biotechnology industry as production technicians. A production technician operates and maintains the equipment used to manufacture protein pharmaceutical products. Students will grow bacterial, yeast, and mammalian cells and recover the proteins that they produce. They will follow good manufacturing practices by maintaining records in order to comply with quality assurance procedures and government regulations. Students in the program must be able to adjust their time to a flexible schedule.

The program allows students to earn one of two certificates or an Associates of Science degree (with the addition of completed General Education courses).

Certificate of Achievement and Associate in Science Degree

The Certificate of Achievement can be obtained upon completion of the 22-24-unit major with a grade of C (2.0) or better in each course. The Associate in Science Degree can be obtained upon completion of 60 units, including the major, general education requirements and electives. All courses in the major must be completed with a grade of C or better or a P if the course is taken on a Pass/No Pass basis.

REQUIRED COURSES	Units
BIOT 051 Principles of Biotechnology	3
BIOT 052 Business and Regulatory Practices in Biotechnology	3
BIOT 062 Cell Culture and Protein Recovery.	4
BIOT 063 Biotechnology Instrumentation: Quality Control & Genetic Engineering	4

Prerequisites

BIO 014 Principles of Microbiology	4
OR	
BIO 002 Principles of Cell and Molecular Biology	5
CHEM 010 Intermediate Chemistry	4
OR	
CHEM 001 General Chemistry	5
Total Units	22 – 24

NOTE: Prior knowledge and use of computers is advised, including word processing, spreadsheets, and databases.

The Solano College Biotechnology program is staffed by two full time faculty, James DeKloe and Edward Re, four adjunct faculty, Michael Silva, Victor Asego, Laura Reina, Francis Faranak, and two laboratory technicians, Jennifer Low and Christine Kucala (in the future). Professor Rennee Moore may join the effort in the future.

Currently we run one section of each course in the program every year. We run Biotech 51 and Biotech 62 during the Fall semester, and Biotech 160, Biotech 52 and Biotech 63 during the Spring semester. For the three summers we ran a 10 week “Bootcamp” called IBIS, the Industrial Biotechnology Summer Intensive program, where the four courses were compressed into a short, full-time, intensive program. This program had been funded by a Department of Labor TAACCCT grant.

During the upcoming year the faculty will have to re-examine the curriculum and the Associates Degree to respond to the release of the C-ID (course identification descriptors) for these courses and to design the Bachelors in Biomanufacturing that the Board of Governors of the California Community College system authorized in May 2015.

1.2 Relationship to College Mission and Strategic Goals. Describe the program's relationship to the overall mission of the college: "Solano Community College educates an ethnically and academically diverse student population drawn from our local communities and beyond. We are committed to help our students to achieve their educational, professional and personal goals centered on thoughtful curricula in basic skills education, workforce development and training, and transfer level education. The College accomplishes this three-fold mission through its dedicated teaching, innovative programs, broad curricula, and services that are responsive to the complex needs of all students."

The Biotechnology program supports Solano College's Mission and Strategic Goals. We serve a culturally and academically diverse student population from the local community and beyond. All Biotechnology courses are devised to introduce key concepts from chemistry, biology, and engineering required to enter into the biotechnology field. The laboratory courses require the students to keep laboratory notebooks using legal scientific format, teach them to analyze and evaluate scientific data, and have them develop laboratory skills in current techniques using state-of-the-art equipment. The Biotechnology staff and faculty are deeply committed to providing the rigorous training required by students succeed after transfer as a major in the life sciences or in finding a career in the biotechnology field.

As a part of the biotechnology program's success, the College Mission had to be changed to incorporate the new mission of Solano College to offer a baccalaureate degree. The Board of Trustees adopted this new Mission Statement at their June 15, 2016 meeting:

*Solano Community College's mission is to educate a culturally and academically diverse student population drawn from our local communities and beyond. We are committed to student learning and achievement and to helping our students achieve their educational, professional, and personal goals. Solano transforms students' lives **with undergraduate education**, transfer courses, career-and-technical education, certificate programs, workforce development and training, basic-skills education, and lifelong-learning opportunities. The mission shall be evaluated and revised on a regular basis. (bold-italics added for emphasis)*

Table 1. SCC's Strategic Directions and Goals

Goal 1: Foster Excellence in Learning	Program Evidence
<p>Obj. 1.1 Create an environment that is conducive to student learning.</p>	<p>The Solano College Biotechnology courses are offered in the evening or in an all-day Friday format to meet the needs of individuals who work full-time and are working toward a career change. Each course is designed to create an atmosphere of professionalism – the goal is to create the atmosphere of the workplace rather than of a classroom. For that reason the students gown up, as they would in a biotechnology manufacturing plant, and follow strict Standard Operating Procedures. The real strength of the program lies in the courses that provide extensive hands-on laboratory training. Students learn essential laboratory skills such as aseptic technique, cell culture, SDS-PAGE, DNA gel electrophoresis, PCR, bioreactor sterilization and operation, chromatography, tangential flow filtration, centrifugation, immunoblotting and genomic cloning. The emphasis in the lab is for students to gain hands-on experience and basic laboratory skills to aid them in their future careers in science and technology.</p> <p>We provide an ideal ecosystem to nurture skills and build workplace simulations. We achieve this through a number of approaches including having the students work in groups to build teamwork dynamics, designing integrated and sequential experiments modeled on real life workplace experiences, offering a simulated bioreactor run over the course of a week which involves working in shifts over 24 hour periods and provides the students with the effect of a real-time production facility experience. Having guest lecturers from industry and 4 year institutions to provide diversity in approach. We would like to add work shadowing and potential internships in the future to add to the realism and skills development for the course.</p>

Obj. 1.2
Create an
environment
that supports
quality
teaching.

There are regional and national consortia of faculty who teach biotechnology and the faculty of the Solano College program interact extensively with these networks. Faculty regularly incorporate new ideas gained from this national effort into these courses and into this program. Faculty who teach biotechnology participate in extensive professional development workshops and conferences in both their fields and in pedagogy. The full-time faculty members of the biotechnology program are committed to providing support and mentoring to new faculty to ensure that we maintain quality instruction in our courses. We also insure that the classroom, laboratories and courses are constantly reworked and updated to include state of the art equipment, materials and methods to increase the possibility that the students are exposed to the most effective tools, techniques and approaches for their field of study. For example we recreate an industrial working production run for the biotech course.

The opening of the Biotechnology building on the Vacaville campus, scheduled for Fall 2017, will take the program to the next level.

Many new innovations will be introduced into the program as part of the new Bachelors of Science in Biomanufacturing degree.

Obj. 1.3
Optimize
student
performance
on
Institutional
Core
Competencies

I. Communication

During lectures, demonstrations, and lab work, students develop competence in listening and responding to questions, reading comprehension, giving presentations, and communicating with faculty and fellow students. In the laboratory courses, the students are required to keep a detailed laboratory notebook using the legal notebook format. Most faculty require group presentations on laboratory or other topics that involve the development of a comprehensive powerpoint presentation where they must present a compelling narrative on their subject matter, with well-developed and articulated ideas, and logical conclusions. This must be presented to and critiqued by their peers and faculty. As part of the Bachelors degree, an upper division technical writing program will be added. And an English courses is an integral part of the proposed Bridge to Biosciences program.

II. Critical Thinking and Information Competency

In both the lecture and laboratory sessions, students are constantly challenged on their critical thinking and subject knowledge. Especially in the lab they are provided with opportunities to demonstrate core competency for example they are required to collect and analyze data, perform intricate calculations, draw conclusions, solve problems and on occasion design their own experiments. Through this experience students must use their critical thinking skills to determine the relevancy of data and demonstrate the ability to draw accurate conclusions from same.

III. Global Awareness

Through lectures, discussions and lab work, students develop an understanding of scientific methodology and its application in experimentation. An integral part of the biotechnology program requires the students to learn about global markets for pharmaceutical products and how these products contribute to global public health and alleviate the suffering cause by disease mortality and morbidity. Another component of the discussions examines questions of bioethics – which countries have access to affordable drugs and which countries do not.

IV. Personal Responsibility and Professional Development. The goal of the biotechnology program is to have each student gain the skills and knowledge and the professional skills (soft skills) to enter the biotechnology field. As a part of this our students develop the professional habits that lead to the level of personal responsibility required to succeed in this community and they learn the avenues of professional development that they will encounter in their professional careers (seminars, professional talks). The development of resumes and interview skills are also part of this program.

Social and Physical Wellness

The extensive exposure to the laboratory requires students to develop appropriate social skills that lead to teamwork in a group setting. In biotechnology, students learn the fundamental concepts required to critically examine health claims, especially those of dietary supplements.

Goal 2: Maximize Student Access & Success	Program Evidence
Obj. 2.1 Identify and provide appropriate support for underprepared students	<p>The biotechnology program, as a CTE program, has had a dedicated counselor. The proposed Bridge to Biosciences program intends to bring new students into the program from our underserved communities and to counter the disadvantage of underprepared students by giving them the mathematics and English background to succeed in the program. The faculty has worked closely with library staff and through these efforts the Solano College Library has an excellent collection of biotechnology books. Instructors provide one-on-one guidance to students where appropriate when requested or when obvious that they are struggling with course work, and we have used embedded tutors in our program to great effect.</p>
Obj. 2.2 Update and strengthen career/technic al curricula	<p>The laboratory courses have a six-hour per week laboratory, and this provides the faculty-student contact that allows one-on-one science mentoring and career mentoring. Encouragement by the faculty helps the students build self-confidence and strengthen their resolve and increases their opportunities to continue in a life science career. This program is formally designated as a career/technical education program by the California Community College Chancellors Office that can lead to a professional certificate. The biotechnology program provides the opportunity to experience a simulation of working in a real-world production facility. Through our interactions with industry and following the literature we are made aware of evolving techniques and technologies and strive to incorporate in our curricula. In future we plan to provide opportunities for independent research through our collaboration with the Joint BioEnergy Institute in Berkeley. The curriculum will be reexamined and redesigned to comply with state C-IDs as part of the curriculum review process.</p>
Obj. 2.3 Identify and provide appropriate support for transfer students	<p>Each class in the biotech program is transferable to the UC and state universities as units, but they do not count in a major. This fact provided a major incentive for the college to apply for, and successfully gain, our own baccalaureate degree. So, this program will seamlessly transfer to the new Bachelors of Science in Biomanufacturing degree. Also, since it's origination the biotech program has had a large number of state university and UC students who are coming back to take these classes in a "reverse transfer"; this demographic might increase if we offer more classes in Vacaville which is closer to the local universities.</p>

<p>Obj. 2.4 Improve student access to college facilities and services to students</p>	<p>We will improve student access with the launch of the biomanufacturing baccalaureate in Fall 2017. The faculty has been working closely with architects to design a new biotechnology/science building at the Vacaville Center and a new science building on the main campus. These buildings will be equipped with up to date and task-appropriate equipment much of it sourced from the biotech industry which will insure that students will be well prepared to pursue future careers in this field. In addition, we are designing a Bridge to Biosciences program to be offered at the Vallejo campus to provide an additional outreach to that community. Also, the biotech faculty have been working closely with high school teachers and administrators in the Career Pathways Trust grants and will offer outreach opportunities during the summer.</p>
<p>Obj. 2.5 Develop and implement an effective Enrollment Management Plan</p>	<p>Using the Trade Adjustment Act Community College Career Training grant, the offerings of the biotechnology program have been dramatically expanded; we have introduced the summer IBIS program (Industrial Biotechnology Intensive Summer program), a boot camp formatted program that has doubled or tripled the number of students earning a certificate or an Associates degree. This funding ended, and we are struggling to accommodate the number of students who would like to enter the program. In the past few years the biotech program has generated more certificates, by far, than any other CTE program on campus. The new biomanufacturing baccalaureate program has generated additional interest. With the Bridge to Biosciences program, we intend to boost the enrollment of students who do not think of themselves as science-oriented. The new baccalaureate degree will further boost enrollment.</p>
<p>Goal 3: Strengthen Community Connections</p>	
<p>Obj. 3.1 Respond to community needs</p>	<p>The Biotechnology program has been involved in projects providing support to instructors and students in the public school system. Through our biotechnology program, we have worked with every high school in the county and in neighboring counties. We have a relationship with Vacaville High School, Vanden High, Will C. Wood High, Buckingham Charter High, Vacaville Christian Schools, Dixon High, Rodriguez High, Armijo High, Vallejo High, and Jesse Bethel High in Solano County. We also have relationships with American Canyon High, St. Helena High, Davis High, and Winters High. This interaction includes serving on advisory committees, advising on curriculum, forming partnerships that support grant applications, and serving as guest speakers. In additional we have worked with several elementary schools and community groups (e.g. Boy Scouts) to provide STEM education. The availability of a technically well-trained workforce has helped to attract and retain biotech companies (most notably Genentech and BioMarin) to the region which is of considerable value to the local community. We work closely with the Solano Economic Development Corporation and several cities to try to attract additional companies. We work with the local Workforce Investment Boards.</p>

Obj. 3.2 Expand ties to the community	We will continue to pursue all of the activities in Objective 3.1 above, and look to expand interactions with high school and middle school faculty. We will also continue to work with local authorities like the Solano Economic Development Corporation and the Workforce Investment Boards in helping to target and attract high tech industry to the region. We are in four partnerships with consortia of secondary schools in the Career Pathways Trust grants; in this program will have founded SCORE, the Solano College Outreach in Research and Education, a program to run summer outreach programs.
Goal 4: Optimize Resources	Program Evidence
Obj. 4.1 Develop and manage resources to support institutional effectiveness	The biotechnology classes need a variety of resources to support institutional effectiveness including the extensive use of classrooms and well-equipped laboratories. Currently all classes offered at the Fairfield campus and Vacaville and Vallejo Centers are adequately supported in terms of equipment and teaching resources. We make every effort to supplement support for equipping labs and classrooms through donations and grants.
Obj. 4.2 Maximize organization efficiency and effectiveness	Materials necessary to support the biotechnology program, especially the laboratory courses, include extensive chemical reagents, cultures, equipment, and software. All the material is currently provided to all classes. In order for this to happen there is a need for extensive technical help. One full-time technician prepares the biotechnology laboratories (in addition to supporting additional biology classes) at the Fairfield campus. A separate full-time technician supports all of the science courses at the Vallejo Center and has some capacity to support the proposed Bridges to Biosciences. In the future as the program expands it will be necessary to hire an additional technician at the Vacaville center to accommodate the additional growth of biotechnology offerings after a new Science building is built.
Obj. 4.3 Maintain up-to-date technology to support the curriculum and business functions.	<p>The biotechnology program has an advisory committee that routinely advises the faculty on developments within the field; the faculty members have worked at cultivating relationships with companies in the greater Bay Area. Through these relationships they have kept abreast of evolving techniques and state of the art equipment. In addition they routinely succeed in sourcing relevant equipment and having it donated to our program (e. g. Real Time PCR apparatus, Gel Imaging systems, etc.)</p> <p>Biotech faculty members have been very successful at winning competitive grants including NSF ATE and Department of Labor TAACCCT grants.</p> <p>Solano College succeeded in winning a bond measure, Measure Q, which will enabled the construction of a state-of-the-art Biotech/Science teaching laboratory in Vacaville and a new science building on the Fairfield campus. The Vacaville building is planned to open in Fall 2017. The faculty members participate in extensive professional development and attend many conferences every year.</p>

1.3 Enrollment. Utilizing data from Institutional Research and Planning (ITRP), analyze enrollment data. In table format, include the number of sections offered, headcounts, the full-time equivalent enrollment (FTES), and the WSCH for each semester since the last program review cycle. If data is available for the number of declared majors in the discipline, please include as well. Compare the enrollment pattern to that of the college as a whole, and explain some of the possible causal reasons for any identified trends. The following chart provides data on courses and students from Fall 2010-Fall 2014 for the Biotechnology program as compared to the college as a whole.

Solano Biotechnology Sections, FTES, and FTES per Section											
Biotechnology	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	Spring 2013	Summer 2013	Fall 2013	Spring 2014	Summer 2014	Fall 2014
Sections	2	2	2	3	2	3	4	2	3	6	2
Unduplicated Headcount	25	36	20	50	25	54	32	38	75	60	29
Enrollment	39	50	31	63	38	77	122	55	103	222	49
FTES	6.7	8.0	5.6	12.9	7.2	13.9	21.7	12.2	19.9	38.5	8.9
FTES/Section	3.35	4.0	2.8	4.3	3.6	4.6	5.3	6.1	6.6	6.4	4.4
Solano College	Fall 2010	Spring 2011	Fall 2011	Spring 2012	Fall 2012	Spring 2013	Summer 2013	Fall 2013	Spring 2014	Summer 2014	Fall 2014
Sections	1,317	1,355	1,345	1,186	1,170	1,168		1261			
FTES	4,052	3,906	3,975	3,753	3,591	3,474		3546			
FTES/Section	3.08	2.88	2.96	3.16	3.07	2.97		2.81			

For the period from Fall 2010 through Fall 2014 the number of Biotechnology sections dramatically increased. The Biotechnology program has a significantly higher FTES per section than the average FTES per section that is the college average, although the FTEs per course varies widely with some having high enrollments and some very low enrollments. This indicates the higher demand on average for biotechnology than other subjects. During the economic downturn following the 2008 financial crisis, one of the few areas of the economy to have remained relatively immune is the mature life science industry with relatively few lay-offs and downsizing. Indeed, locally, Genentech continues in a growth phase following a number of therapeutic approvals. This industry is one of the principal job sources for our students.

1.4 Population Served. Utilizing data obtained from Institutional Research and Planning, analyze the population served by the program (gender, age, and ethnicity) and discuss any trends in enrollment since the last program review. Explain possible causal reasons for these trends, and discuss any actions taken by the program to recruit underrepresented groups.

Ethnic, gender and age representations for biotechnology courses are listed in the tables below. For biotechnology, the population fluctuates with females having an edge most years which is comparable to the ratio for the college as a whole and of a national trend. The ethnicity and age demographics for biotechnology are similar to the college as a whole, although we serve a greater percentage of Asian students and a lower percentage of black non-hispanic students. In most semesters, the age of the majority of the students (>50%) falls within the 18-25 age range, although this number is significantly lower than the 70-80% typical of biology majors.

Enrollment of Students by Gender 2010-2014

	F 2010	S 2011	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Sum 2015	Fall 2015	Spring 2016	Solano County	SCC
Female	60%	50%	40%	28%	48%	48%	47%	61%	48%	62%	76%	54%	48%	44%	55%	50.1	57.4
Male	36%	47%	60%	72%	52%	52%	47%	39%	51%	35%	24%	43%	52%	50%	39%	49.9	41.4
Not report	4%	3%					6%		1%	3%		2%	0	6%	5%		1.2
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%	100%	99%		

Percentage of students by ethnicity 2010-2014

	F 2010	S 2011	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Sum 2015	Fall 2015	Spring 2016	County	SCC
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Am. Ind. or AK	0%	0%	0%	4%	0%	4%	0%	8%	4%	3%	0%	2%	3%	6%	6%	0.5%	0.4%
Asian or PI	28%	25%	30%	22%	24%	15%	41%	32%	31%	30%	3%	29%	27%	41%	33%	15.1%	14.1%
Black Non-Hispanic	0%	3%	5%	6%	4%	2%	3%	3%	4%	3%	14%	13%	12%		2%	14.2%	16%
Hispanic	12%	19%	20%	20%	24%	26%	22%	13%	20%	20%	28%	17%	21%	29%	26%	24%	23.3%
White, Non-Hispanic	40%	33%	35%	40%	36%	41%	31%	29%	35%	37%	38%	35%	33%	18%	24%	40.8%	32.1%
Other	20%	19%	10%	8%	12%	13%	3%	16%	7%	7%	17%	4%	3%	6%	9%	5.1%	13.5%

Enrollment of students by age 2010-2014

	F 2010	S 2011	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014		S 2015	Sum 2015	F 2015	S 2016
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		100%	99%	100%	101%
0-17				2%			13%			2%	3%	0-17			3%	
18-25	60%	64%	60%	50%	48%	56%	44%	42%	61%	72%	48%	18-24	46%*	48%*	32%*	47%*
26-30	12%	22%	15%	20%	24%	15%	22%	21%	15%	12%	14%	25-29	22%*	27%*	41%*	24%*
31-35		3%	10%	8%	8%	7%	6%	8%	7%	2%	10%	30+	32%*	24%*	24%*	30%*
36-40	12%	6%		10%	8%	9%	6%	13%	8%	2%	14%					
41-45	4%			6%	4%	6%	3%	8%	3%	3%	3%					
46+	12%	6%	15%	4%	8%	7%	6%	8%	7%	8%	7%					

Enrollment by Student Type

	F 2010	S 2011	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Sum 2015	F 2015	S 2016
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%				
Continuing	88%	97%	90%	84%	88%	81%	78%	84%	80%	72%	79%				
First Time	0%	0%	0%	0%	0%	2%	3%	0%	1%	0%	0%				
First Time Transfer	8%	3%	10%	6%	12%	6%	9%	8%	4%	10%	7%				
Returning	4%	0%	0%	10%	0%	11%	9%	8%	15%	17%	10%				
Special Admit K-12	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%	3%				

Conclusions:

For biotechnology, the relatively equal number of male to female enrollment over the years indicates that foundational nature of the biotechnology major as it provides the platform for many career options whether it be going straight into technical employment or transferring to a four year institution to pursue professional careers in the medical field or further certification training. Clearly, the biotech courses mostly train technicians for the biotech industry and this course is equally attractive to both males and females. Biotechnology students are still majority aged 18-25, although this ratio is lower than the college as a whole. Those taking biotechnology courses tend to skew somewhat older than the college as a whole because many students are returning students or retraining following other careers. The demographic group most underrepresented are black, non-Hispanic students and outreach to this community remains a major goal of the program; this goal will be addressed with the introduction of the Bridge to Biosciences.

1.5 Status of Progress toward Goals and Recommendations. Report on the status of goals or recommendations identified in the previous educational master plan and program review.

Alignment with Educational Master Plan

Educational Master Plan Goals

The following Educational Program Plan goals establish an overarching structure for SCCD Educational program development.

Goal A: Align program offerings, policies and communications with transfer goals.

Goal B: Develop workforce-ready career/technical graduates.

Goal C: Improve basic skills of all students.

Goal D: Reduce gaps in achievement.

Goal E: Create a district-wide policy framework for program development and management.

Goal F: Improve student access to courses and services.

Goal G: Engage as a partner in community efforts.

Goal H: Connect students to the Campus community.

Goal I: Build alternative funding and revenue sources.

Goal J: Optimize existing campus and centers.

Expanding the existing Industrial Biotechnology program with the proposed Bachelors in Biomanufacturing furthers the program's ability to support many of these goals and objectives of the college listed above. This offering provides a transfer option designed to be perfectly aligned with community college lower division offerings. The design of this program has been specifically tailored to develop workforce-ready graduates with the required technical expertise. The program supports the community by generating a trained workforce that supports one of the most important industries locally, regionally, and nationally. The trained workforce serves as a tool used by economic development agencies to retain and attract biotechnology companies.

The Educational Master Plan included the following analysis specifically targeting Biotechnology:

Program Name: Biotechnology

Strategies:

- * *Expand course offerings to meet industry trends and needs (training for maintenance workers, stem cells, biofuel production, synthetic life, etc.)*

- * *Examine the demand for workers and the potential for developing course offerings in imaging (electron microscopy, atomic force microscopy)*
- * *Diversify course delivery modes (online courses, short-term specialty courses, accelerated courses or accelerated program)*
- * *Introduce a Contract Research Organization into the program – this generates in-house internships and adds an entrepreneurship training component to the biotech program*
- * *Add a basic skills introductory component to the program (modeled on the highly successful Bridge to Biotechnology)*
- * *Continue and expand workforce training partnerships with local high schools*
- * *Increase recruitment strategies for discharged veterans*
- * *Increase recruitment of disenfranchised populations using a program like CCSF's Bridge to Biotechnology*
- * *Outreach to students from fields with comparable prerequisite requirements like nursing or water/wastewater*
- * *Develop new instruction tools like computer simulations*
- * *Prepare for a dramatic expansion of the program by planning for additional facilities like the planned biomanufacturing training facility on the Vacaville campus*
- * *Increase the web presence of the program*
- * *Explore founding a company incubator that could use biotechnology program equipment and facilities, generate some revenue, and use students as interns*

Rationale:

General growth in enrollment and FTES, low competition from other educational providers, and projected industry growth in the county and greater Bay Area and Sacramento regions suggest the potential for program expansion. Providing a short-term program component to "fast track" students who have a degree could increase interest in the program and respond to the need for trained workers. The delivery of short courses could be designed to meet the particular needs of job seekers. Expansion in emerging areas like synthetic biology, biofuels, stem cell science, and imaging (used in nanotechnology) would lead to career possibilities for program graduates. A dedicated training facility on the Vacaville campus would increase the capacity for training students and would dramatically increase the potential to strengthen the partnership with the nearby biotech companies Genentech and Novartis. The introduction of a Bridge to Biotech (basic skills) program would expand the outreach of the program to economically disadvantaged populations within our county. The strategy of providing in-house internships and entrepreneurial training using a Contract Research Organization has been used successfully in other parts of the country and would increase the workforce readiness of our students.

Table 2. Educational Master Plan

Educational Master Plan	Status
-------------------------	--------

<p>Expand course offerings to meet industry trends and needs (training for maintenance workers, stem cells, biofuel production, synthetic life, etc.)</p> <p>1.</p>	<p>The Biotechnology department strives to meet the needs of students by providing state of the art equipment, hands on laboratory experiences, real-time simulations of actual production run in biotech facility, industry placements and transfer assistance to 4 year universities. Student access to biotechnology classes will be greatly improved with the addition of new facilities at the Vacaville campus and with the development of the Bridge to Biosciences program. We have been working on the development of single use technologies curriculum, algal biofuels curriculum, and have been exploring stem cell curriculum, but have not implemented these in the program. The curriculum will dramatically expand with the biomanufacturing baccalaureate degree; with the implementation of this degree the department will add classes in process control, facilities, supply chain, quality assurance, Six Sigma, design of experiments, and other emerging technologies.</p>
<p>Examine the demand for workers and the potential for developing course offerings in imaging (electron microscopy, atomic force microscopy)</p> <p>2.</p> <p>Diversify course delivery modes (online courses, short-term specialty courses, accelerated courses or accelerated program)</p> <p>3.</p>	<p>After further discussion the faculty decided that this is currently beyond the scope of the biotechnology program. We are working closely with Merritt College that has an extensive microscopy program serving the whole bay area.</p> <p>The major innovation in this category has been the introduction of the summer IBIS bootcamp (Industrial Biotechnology Intensive Summer) program. This program was initially funded by the TAACCCT (Department of Labor) grant but it has the potential to be institutionalized with the addition of staff.</p>
<p>Introduce a Contract Research Organization into the program – this generates in-house internships and adds an entrepreneurship training component to the biotech program</p> <p>4.</p>	<p>There is a potential for a national and regional effort to expand this model, and a local pilot program effort is going to be funded by the Deputy Sector Navigator.</p>

5.	Add a basic skills introductory component to the program (modeled on the highly successful Bridge to Biotechnology)	The Bridge to Biosciences is designed and half way through the curriculum approval process. It is currently being taken through the 10 step Chancellors office process for a CTE program.
6.	Continue and expand workforce training partnerships with local high schools	This part of the program remains strong. We have relationships with every local high school that has a biotechnology program, and we are helping others to develop one. One of our faculty members serves on the advisory committee of each of the high schools with biotech programs. We have entered into Career Pathways Trust grants with four different regional consortia and are designing a summer outreach program called SCORE (the Solano College Outreach for Research and Education). The Biotechnology program is serving as the pilot program for Dual Enrollment.
7.	Increase recruitment strategies for discharged veterans	We have been in conversation with the Swords to Ploughshares veterans group, but so far no program has developed from these interactions.
8.	Increase recruitment of disenfranchised populations using a program like CCSF's Bridge to Biotechnology	The Bridge to Biosciences program has gone through the curriculum approval process and has been submitted as a Laboratory Assistant certificate to the Chancellors Office for final approval.
9.	Outreach to students from fields with comparable prerequisite requirements like nursing or water/wastewater	An outreach to nursing students occurs during the microbiology course that serves as a pre-nursing prerequisite. And outreach to water/wastewater students occurs during the Biotech 160 course that serves both programs.
10.	Develop new instruction tools like computer simulations	We have added new laboratories and new laboratory techniques, but not new pedagogy.
11.	Prepare for a dramatic expansion of the program by planning for additional facilities like the planned biomanufacturing training facility on the Vacaville campus	Faculty members have spent thousands of person-hours on working with architects to plan the new Biotech/Science building on the Vacaville campus.

12.	Increase the web presence of the program	A professional art designer was hired to design a webpage for the biotechnology program, but this webpage has not yet been posted.
13.	Explore founding a company incubator that could use biotechnology program equipment and facilities, generate some revenue, and use students as interns	This goal will have to wait for the completion of the Biotechnology/Science building in Vacaville.

The faculty will improve student access by continuing the IBIS program, and by expanding to the Vacaville center. The Bridge to Biosciences program will be taught at the Vallejo Center, expanding the offerings there and serving as a major outreach, especially to underrepresented populations. Once the new Biotechnology/Science building is opened on the Vacaville campus in 2017, there will be room for dramatic expansion.

Table 3. Program Review Recommendations

Program Review Recommendations (Previous Cycle)	Status
1. Explore New Offerings at the Vacaville campus	Room 114 has been converted into a laboratory suitable for biotechnology. Also, the building for the future of the biotechnology program with 4 specialized suites has been finalized with architects. A technician has been hired at the Vacaville Center to support Biotechnology/Chemistry courses. We still Require one full-time Biotechnology technician at the Vacaville campus.to support future programs.
2. Explore the possibility of generating a new lab	(a) The new Biotech/Science Building at Vacaville Center will include new teaching classrooms and laboratories outfitted with state of the art equipment and support facilities. This project is in the planning stage and is scheduled to finish in Fall 2017. (b) The new labs are designed to the highest standards and will incorporate the most up to date equipment and infrastructure. We are in constant communication with industry and domain experts to insure our facilities meet the most current standards. (c) As the new labs are planned, we are including interactive 'smart' technology for use in the labs and lecture hall.
3. Explore new curriculuim and the integration of new techniques into the program	The college has been exploring a partnership with the Joint BioEnergy Institute. Also, the department has received an NSF – ATE grant to introduce single use technologies into the classroom.

1.6 Future Outlook.

The training of young biological scientists remains an important goal if the US is to remain competitive in the 21st century Bioeconomy. Students majoring in biotechnology can enter biomanufacturing upon the completion of their certificate, or can transfer and enter biotechnology after graduating from a university; the extensive laboratory component of this field makes it a strong major for transfer students to the UCs and state universities. Biotechnology provides a well-defined career pathway from high school through graduate studies, especially with the implementation of the biomanufacturing baccalaureate degree. Given the stability of the biotech sector during the economic downturn, the growth of this area in the region and Solano's reputation for high quality training, the future career prospects for majors who pursue the biotech certification is strong provided that they build on their training. Labor Market information gathered by the Center of Excellence based at City College of San Francisco indicates ongoing demand in this field. However, an issue of concern is maintaining the quality of the program and meeting demand given the variability of state support from year to year. It is difficult to attract, and especially to retain, quality faculty in an environment of uncertainty and in a situation where academic

salaries cannot compete with corporate salaries, especially at Solano College whose salaries lag far behind virtually every other community college in the state. That being said, the new science/biotech facility being developed in Vacaville will allow us to expand offerings in the future. The quality of the facility, infrastructure, and equipment should insure that we can attract both first class instructors and students and assure the continuing growth of this major into the future.

CURRICULUM DEVELOPMENT, ASSESSMENT, AND OUTCOMES

Program Learning Outcomes

2.1 Using the chart provided, list the Program Learning Outcomes (PLOs) and which of the “core four” institutional learning outcomes (ILOs) they address. In the same chart, specifically state (in measurable terms) how your department assesses each PLO. For example, is there a capstone course (which one), is it a passing grade on certain assignments or exams that demonstrate acquisition of the PLO, is it acquiring specific skills necessary for a licensing exam, completing a portfolio, etc.?

Students who complete the Certificate of Achievement/Associate Degree will be able to complete the following PLOs:

1. A successful student should understand the structure and function of protein pharmaceuticals and evaluate which protein properties a production facility can exploit to purify a particular protein from other cellular components.
2. In preparation for working at a biotechnology company, a successful student should be able to construct a pathway analyzing how a drug or biologic is produced by genetically engineered cells and subsequently purified.

Table 4. Program Learning Outcomes

Program Learning Outcomes		ILO (Core 4)	How PLO is assessed
1.	A successful student should understand the structure and function of protein pharmaceuticals and evaluate which protein properties a production facility can exploit to purify a particular protein from other cellular components.	II. Critical Thinking and Information Competency Communication	Laboratory assignments with lab notebook evaluation and exam questions

2.	In preparation for working at a biotechnology company, a successful student should be able to construct a pathway analyzing how a drug or biologic is produced by genetically engineered cells and subsequently	II. Critical Thinking and Information Competency	Assessed using test questions in BIOT 160, BIOT 52, and BIOT 51
----	---	--	---

2.2 Report on how courses support the Program Level Outcomes at which level (introduced (I), developing (D), or mastered (M))

Table 5. Program Courses and Program Learning Outcomes

Course	PL01	PL02
Biot 160	D	D
Biot 51	M	M
Biot 52	I	I
Biot 62	M	M
Biot 63	M	M

Although the baccalaureate program will not be implemented until Fall 2017, the PLOs for this program have been written:

Program Learning Outcomes will be assessed by a number of projects designed and presented by the student during the senior Year. Each project will require the integration of knowledge acquired in different classes. There will be PLOs for each emphasis of the major – Biomanufacturing Technology and Quality Assurance. There will also be learning outcomes that integrate the two areas of emphasis.

Baccalaureate Program Learning Outcomes

Biomanufacturing Technology:

1. Students will demonstrate the ability to identify and critically analyze two viable options for a biomanufacturing process. The critical analysis will include the technical, financial, and environmental impact of the two options as well as the identification of the benefits and disadvantages of each.
2. Students will be able to produce a professional report and presentation representing their opinion regarding the advantages of selecting a specific biomanufacturing process

Quality:

3. Students will demonstrate the skills needed to conduct an investigation and analysis of an Out of Specification deviation that occurred during a production step in the manufacturing of a pharmaceutical protein. The student will be able to determine the impact of the OOS deviation on the batch of protein.
4. Students will be able to produce a written Corrective Action Preventative Action report in a format standard to the industry. The report will include evidence to justify their conclusions and action plan.

5. Student will demonstrate the ability to apply Quality by Design (QbD) principles (understanding of the product, the process, and the process control) as adopted by the U.S. Food and Drug Administration (FDA) to design a robust, stable, and controlled manufacturing process for a protein pharmaceutical that can be carried out under current Good Manufacturing Practices (cGMPs). This includes the ability to predetermine values and potential ranges of the critical quality attributes (CQAs) of the product and the critical material attributes (CMAs) of the materials. Students will also be able to determine which parameters would benefit from a Design of Experiments (DoE) approach for their optimization, and construct a strategy for experimental planning and data analysis.
6. Students will use a quality risk assessment approach to perform a criticality assessment to determine the Critical Process Parameters (CPPs) that would need to be monitored and controlled.

2.3 Utilizing table 6, describe the results of the program level assessments and any changes/planned actions made based on the outcomes of program level student learning assessments. Results should be both quantitative and qualitative in nature, describing student strengths and areas of needed improvement. Action plans should be specific and link to any needed resources to achieve desired results.

Table 6. Program Learning Assessments

Program Learning Outcomes		Date(s) Assessed	Results	Action Plan
1.	A successful student should understand the structure and function of protein pharmaceuticals and evaluate which protein properties a production facility can exploit to purify a particular protein from other cellular components.	12/2008 (62) 12/2010 (51) 7/2013 (51) 12/2016 (51)	12/2008 (55%) 12/2010 (83%) 7/2013 (78%) 12/2016 (76%)	The assessment process shows that a high percentage of students achieve this PLO in the assessed classes. The next step is to extend a common assessment to all classes.

2.	In preparation for working at a biotechnology company, a successful student should be able to construct a pathway analyzing how a drug or biologic is produced by	12/2010 (51) 12/2016 (62)	12/2010 (100%) 12/2016 (86%)	The assessment process shows that an acceptable percentage of students achieve this PLO in the assessed classes. The next step is to extend a common assessment to all classes.
----	---	------------------------------	---------------------------------	---

2.4 Describe any changes made to the program or courses that were a direct result of program level assessments.

Since these classes have a well-defined curriculum and experienced instructors, the PLO assessments exceed the criterion of having 70% of the students achieving the PLO.

Student Learning Outcomes

2.5 Describe the current status of SLOs in your program. Are SLOs being updated as necessary, are they being assessed yearly? Are assessment results driving course level planning? If deficiencies are noted, describe planned actions for change. Address how courses with multiple sections have been aligned so that a common tool is utilized to assess student learning outcomes; describe any steps taken to standardize measures.

Assessment of SLOs for BIOT 051, BIOT 052, BIOT 62, BIOT 63, and BIOT 160 have been reviewed yearly since 2013. The data indicate that these course level SLOs are consistently achieved, with few exceptions. These SLOs will be reviewed during the curriculum review process that follows program review.

The SLOs for the courses of the Bachelors of Science degree have been written and will begin to be assessed after the program starts in Fall 2017.

Discipline faculty have subsequently reviewed and revised extensively the Learning Outcomes to better reflect the depth and rigor of each course. SCC has equally improved outcomes for the proposed program, called Program Level Outcomes (PLOs). Faculty designed the Course Outlines of Record, the Student Learning Outcomes, and all class activities and exercises explicitly to meet identified criteria of upper division curriculum, including appropriate reference to higher levels of Bloom's Taxonomy and the highest level of Webb's Depth of Knowledge. For Bloom's Taxonomy, the categories "Create" and, where appropriate, "Evaluate" were the target for each class. For Webb's Depth of Knowledge, the target

remained “Depth of Knowledge 4: Extended Thinking.” The learning outcomes for each course (SLOs), as well as the baccalaureate program (PLOs), now more accurately reflect the depth and rigor as specified in the SCC curriculum approval process for upper division curriculum, including the corresponding highest levels of Bloom’s taxonomy.

Where additional outcomes reference lower levels of Bloom’s taxonomy, these courses also prepare graduates for a certification test from a professional organization, to better position the student for placement in the workforce and to assess relevant aspects of the course for how it co-aligns with industry requirements.

Additionally, we communicate a clear process by which these outcomes will be regularly assessed to assure on-going high-quality and effective upper division curriculum and instruction. Faculty will conduct formative, summative, and cumulative assessments in each class during the first year to evaluate the progress of each student and guide instruction. These assessments and continuous feedback from industry experts and students will allow faculty to reevaluate the structure of each new course. Moreover, at the end of each academic year, faculty will review the results with the industry advisory committee. Program Level Outcomes will be evaluated during the students’ Senior Year, and these outcomes will be assessed in the second year of the pilot and every year thereafter. These reviews of SLOs and PLOs will inform the process of making changes in the curriculum and in the pedagogy and will become an integral part of the continuous improvement process of the program.

2.6 Review the course level SLOs completed by the program in the last year to ensure accuracy of information provided (core four, level of mastery, assessment tool, etc.). Note if any changes are needed.

While reviewing the substantive change application for the biomanufacturing baccalaureate, the ACCJC commented on these SLOs. In a May 20, 2016 letter the Substantive Change Committee of the ACCJC states: “The College should also consider revisions to its lower division course SLOs so that they also reflect the level and rigor of learning expected in higher education.” In the Solano College response, we stated “The lower division program is up for its periodic curriculum review process during the 2016-17 academic year, and a review of SLOs comprises an integral part of that review. Current lower-division course SLOs and PLOs will receive a rigorous review during that time. In addition, where appropriate, these courses will be reviewed and updated to conform to statewide standards, in compliance with the Course Identification Descriptors (C-ID) and CCCCCO approval. It is likely that these changes will be accomplished prior to the ACCJC site visit.”

2.7 Describe any changes made to the program or courses that were a direct result of student learning outcomes assessments.

In general faculty report positive outcomes from the SLOs assessment reflecting the fact that these classes have a well-defined curriculum and experienced instructors. However some changes have been introduced by some faculty such as:

In response to the several cases where student SLO assessment results did not meet the 70% success criteria, faculty took action: “I have implemented additional problem sets, lab reports and presentations in the course but need to continually evaluate the value of these activities.”

Curricular Offerings

2.8 Course offerings. Attach a copy of the course descriptions from the most current catalogue. Describe any changes to the course offering since the last program review cycle (course content, methods of instruction, etc.) and provide rationale for deletion or addition of new course offerings. Also state whether a transfer degree has been established in accordance with SB 1440. Include a discussion of courses offered at Centers (Vacaville, Vallejo, Travis) and any plans for expansions/contraction of offerings at the Centers.

BIOT 051 3.0 Units

Principles of Biotechnology

Prerequisite: BIO 014 or BIO 002.0 or BIOT 160.

Course Advisory: Eligibility for English 001 and SCC minimum Math standard. This course covers topics important in the development, production, recovery, and analysis of products produced by biotechnology.

The course traces the path of a drug or biologic from the cell through the production facility, the final processing, and into the human body. It discusses the growth characteristics of the organisms used to produce pharmaceutical proteins, the techniques used in product recovery, and the techniques used in product analysis. Three hours lecture.

BIOT 052 3.0 Units

Business and Regulatory Practices in Biotechnology

Course Advisory: Eligibility for ENGL 001 and SCC minimum Math standard.

Examines how basic business principles and sound manufacturing procedures assure the quality and safety of a product as the manufacturing team moves a product down the biotechnology production pipeline. It explores the role of governmental oversight and regulation during the discovery, development, and manufacturing of new products produced by biotechnology.

Three hours lecture.

BIOT 062 4.0 Units

Cell Culture and Protein Recovery

Prerequisite: BIO 014 or BIO 002.0 or BIOT 160.

Course Advisory: Eligibility for English 001. This laboratory course teaches the skills needed to serve as a technician in biotechnology production. Students grow and monitor bacterial, yeast, and mammalian cells on a laboratory scale that emulates the large-scale production used in industry. Students will become familiar with the cleaning, sterilization, aseptic inoculation, operation, and monitoring of fermenters and bioreactors. Students then recover and purify proteins produced by those cell cultures. They recover and purify proteins using centrifugation, ultrafiltration, and chromatography techniques. The course emphasizes the use of current Good Manufacturing

Practices (cGMP), and students gain experience following Standard Operating Procedures (SOP). Two hours lecture, six hours lab.

BIOT 063 4.0 Units

Biotechnology Instrumentation:

Quality Control & Genetic Engineering

Prerequisite: BIO 014 or BIO 002.0 or BIOT 160.

Course Advisory: Eligibility for English 001.

Familiarizes students with small scale laboratory practices, both those used in a research

laboratory and those used by a quality control department in industry, to analyze the quality of a cell culture process and the purity of protein products produced by cells in culture. The course emphasizes the use of Good Laboratory Practices (GLP) in these analyses. Students will gain experience in techniques used to analyze nucleic acids and in the genetic engineering of cells. They will also gain experience with the common assays used in Quality Control including electrophoresis, High Performance Liquid Chromatography (HPLC), Enzyme Linked Immunosorbant Assay (ELISA), and Polymerase Chain Reaction (PCR) to test products generated using cell culture. Two hours lecture, six hours lab.

BIOT 160 4.0 Units

Basic Concepts/Methods in Biotechnology

Course Advisory: MATH 330; SCC minimum English standard. This course is not designed for students intending to transfer. This course serves as a prerequisite to Solano College's biotechnology courses by giving students knowledge of the basic concepts in biology and chemistry used in biotechnology while also developing the basic laboratory skills required to succeed in the field. Two hours lecture, six hours lab.

The Math 330 prerequisite for Biotech 160 has been removed in the last curriculum review.

With the remodeling of Room 114 at the Vacaville Center, and with the building of the Biotechnology/Science building in Vacaville, a major portion of the biotechnology program will be moving to Vacaville. At the same time, the faculty intend to dramatically increase the presence of the program in Vallejo in the form of outreach.

As part of the Bachelors degree effort, the faculty have just had 10 upper division courses for the major (and 3 upper division General Education courses) approved by the curriculum committee. These courses will first be taught in Fall 2017.

Biomanufacturing Upper Division Courses	
Biomanufacturing Process Sciences and Engineering Principles (Lecture/Lab) BIOT 401 (5 Units) Physical and chemical principles of biochemical engineering that enable large cell culture Thermodynamics and the properties of fluids; mass and heat transfer, fluid flow, and the energy relationships in fluid systems Biomanufacturing technologies enabling large	Supply Chain and Enterprise Resource Planning (Lecture) BIOT 406 (3 Units) Manage flow of materials in a supply chain Understand the design, planning and execution of raw material procurement and use Eligibility for certification test
Design of Experiments for Biomanufacturing (Lecture/Lab) BIOT 402 (4 Units) Established methods to systematically vary process parameters to improve and optimize a biomanufacturing process	Advanced Topics in Quality Assurance and Regulatory Affairs (Lecture) BIOT 407 (4 Units) Study of the harmonized quality system approaches of ICH Q8, 9, 10, and 11, including quality risk management, qualification, and

Design of Biomanufacturing Facilities, Critical Utilities, Processes, and Equipment (Lecture) BIOT 403 (4 Units) An examination of how the robust design of all aspects of a biomanufacturing facility minimizes errors The role of Quality by Design (ICH Q8) in facility design Processes and equipment in biological production, recovery, and purification. Aseptic process design	Six Sigma and Lean Manufacturing (Lecture/Discussion) BIOT 408 (4 Units) Study of key six sigma concepts and tools; the DMAIC phases: design, measure, analyze, improve, and control Use and implementation of lean tools to reduce waste Completion of this course prepares students to earn a certification in six sigma.
Bioprocess Monitoring and Control (Lecture/Lab) BIOT 404 (5 Units) The measurement, monitoring, modeling, and control of biomanufacturing processes.	Methods in Quality Improvements, Investigations, and Audits (Lecture) BIOT 409 (4 Units) The study of continuous quality improvement techniques, including investigational methods into process deviations
Emerging Biomanufacturing Technologies (Seminar) BIOT 405 (3 Units) An examination of new technologies in biological production and purification operations.	Emerging Trends in Biomanufacturing Quality (Seminar) BIOT 410 (3 Units) An examination of new regulatory requirements and changes to current practices in biomanufacturing quality

In addition, in Spring 2016 the faculty took two classes, Human Genetics and Infectious Diseases, Plagues, and Public Health through the curriculum review process. These are now available to serve as electives within this program. We intend to take two additional classes that could serve as electives for the baccalaureate program through the curriculum approval process in the next year.

The Associates program is not a transfer program in the classic sense of the term; it will not transfer to a CSU or a UC. Formally, it is a Career Technical Education program that does not fall under the criterion of SB 1440. But, it will transfer to the Biomanufacturing baccalaureate degree.

2.9 Fill rates/Class size. Based on data from ITRP, discuss the trends in course fill rates and possible causes for these trends (include comparison/analysis of courses by modality if applicable). Address how the size of classes affects courses and if there are any necessary adjustments to course classroom maximums. If there are courses that are historically under-enrolled, discuss strategies that might increase enrollment.

The number of students has dramatically increased because of the summer offerings; these increases in enrollment are driven by the high rate of placement of graduates into high wage, high growth potential jobs. The fill rates for biotechnology courses have been high and remain high. Maximum classroom sizes are appropriate for the laboratory courses BIOT 062, BIOT 063, and BIOT 160 but the faculty believe that the class maxima are artificially high for the lecture courses BIOT 51 and BIOT 52; it does not seem to make sense that the lecture courses that accompany a laboratory course would have such a dramatically different class maximum; these students are enrolled in a program not merely in classes.

Section Counts

	F 2010	S 2011	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Sum 2015	F 2015	S 2016
Total	2	2	2	3	2	3	4	2	3	6	2	4	4	2	3
BIOT 51	1		1		1	1	1	1		1	1		1	1	
BIOT 52		1		1			1		1	1		1	1		1
BIOT 62	1		1		1		1	1		2	1		1	1	
BIOT 63		1		1		1	1		1	2		1	1		1
BIOT 160				1		1			1			2			1

Headcounts

	F 2010	S 2011	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Sum 2015	F 2015	S 2016
Total	25	36	20	52	25	54	32	38	76	60	29	83	33	34	66
BIOT 51	22		17		19		32	33		58	25				
BIOT 52		32		22		39	26		44	47					
BIOT 62	17		14		19		32	32		60	24				
BIOT 63		18		17		23	32		33	57					
BIOT 160				24		15			26						

FTEs

	F 2010	S 2011	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Sum 2015	F 2015	S 2016
Total	6.7	8.0	5.6	12.9	7.2	13.9	21.7	12.2	20.2	38.5	8.9	20.6	21.7	10.1	16.6
BIOT 51	2.2		1.7		1.9	1	3.0	3.3		5.3	2.5		3.0	2.6	
BIOT 52		3.2		2.2		3.8	2.4		4.4	4.2		4.1	2.6		4.1
BIOT 62	4.5		1		1		8.1	8.9		14.9	6.4		8.0	7.5	
BIOT 63		4.8		4.5		6.1	8.1		8.8	14.1		5.1	8.0		6.9
BIOT 160				6.1		4.0			6.7			11.5			5.6

WSCH

	F 2010	S 2011	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Sum 2015	F 2015	S 2016
Total			169	405	217	408	651	365	607	1154	267	619	650	302	499
BIOT 51			51		57		90	99		159	75		91	78	
BIOT 52				69		114	73		135	126		123	77		123
BIOT 62			118		160		244	266		446	192		241	224	

BIOT 63				136		184	244		272	423		152	241		208
BIOT 160				200		120			200			344			168

Fill Rates

	F 2010	S 2011	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Sum 2015	F 2015	S 2016
Total			46	82	59	85	123	100	122	80	75	77	83	84	101
BIOT 51			34		38		128	66		83	50		97	52	
BIOT 52				51		84	104		100	66		91	82		91
BIOT 62			58		79		128	133		86	100		97	117	
BIOT 63				71		96	133		142	81		79	97		108
BIOT 160				125		75			125			72			105

The biotechnology industry is undergoing dramatic growth and the program will continue to expand, driven by this growth. The lack of faculty members remains a major limiting factor. For example, there was plenty of demand for a large summer 2016 course but the lack of available faculty made offering the course untenable.

2.10 Course sequencing. Report on whether courses have been sequenced for student progression through the major, how students are informed of this progression, and the efficacy of this sequencing. Report on whether curriculum is being offered in a reasonable time frame

The courses have been sequenced for the students to efficiently progress through toward a biotechnology certificate or degree. Students will complete the prerequisite, EITHER Biotech 160 OR Biology 14 AND Chem 10 OR Biology 2 and Chem 1. The latter two options are standard in any curriculum at any college in the United States; Biology 14 AND Chem 10 represents the common Pre-Allied Health chemistry and Biology 2 and Chem 1 represents the Biology majors tract taught at every college.

Once a student has completed the prerequisites, the four course program can be completed within a year.

In the last three summers, the Biotechnology department has offered an accelerated option where students can complete the program during a 10 week summer “Bootcamp”. This program, the Industrial Biotechnology Intensive Summer program is funded by a Department of Labor Trade Adjustment Assistance Community College and Career Training (TAACCCT) grant program. Solano College has participated as part of a 10 college consortium of San Francisco Bay Area Colleges called DBS, Design It-Build It-Ship It. This program has proven to be very popular. The first summer 32 students completed the program. For the second summer, the program was doubled and graduated 58 students. The program had more applicants than spots and turned student away both summers. Lack of staffing meant that we could not offer the program this summer (Summer 2016) despite a high demand for the program. The lack of this program has dramatically increased the demand for courses that will be taught in Fall 2016.

The lower division program will serve as a prerequisite for entry into the Biomanufacturing Baccalaureate program.

Associate in Science, Biotech, Lower Division Coursework Unit Distribution, and Baccalaureate Coursework Unit Distribution	
Required Courses	Unit Distribution
Lower Division Major Courses	22-24
General Education Courses	38
Subtotal major and GE	60-62
Subtract units that can be double-counted for major and GE	-10
Subtotal major and GE (adjusted)	50-52
Elective Courses	8-10
Associate Coursework Subtotal:	60
Baccalaureate Coursework Unit Distribution	
Upper Division Major Courses	39
Upper Division GE Courses	9
Elective Courses	12
Baccalaureate Coursework Subtotal:	60
Baccalaureate Total:	120

Solano College Biomanufacturing Pathways

SCORE

(Solano College Outreach and Research and Education)

Potential AS and Baccalaureate Students

Articulated High Schools
with Biotechnology
Programs

Bridge to Biosciences

Solano College Science
Students

Solano College AS
Industrial Biotechnology

Graduates of intensive
bootcamps (IBIS)

Incumbent
biomanufacturing workers
seeking a four year
degree

Other Community
Colleges with AS
programs in
Biotechnology (CCSF,
Ohlone, Laney, and
Contra Costa)

Solano College Baccalaureate Degree in Biomanufacturing

2.11 Basic Skills (if applicable). Describe the basic skills component of the program, including how the basic skills offerings prepare students for success in transfer-level courses. Analyze courses with prerequisites and co-requisites, and whether this level of preparation supports student success.

In the last year the faculty has designed a Bridge to Biosciences program designed to integrate basic skills training with the laboratory training contained in Biotech 160. This program has been modeled on a very successful program offered at City College of San Francisco that has also been adopted in colleges across the country. Students in this program earn a Biotechnology Laboratory Assistant certificate that the Industrial Biotechnology technician certificate can be stacked upon. This certificate is also latticed with Water/Wastewater technician certificates. Because of the time demands placed upon the faculty by the development of the Bachelors degree, this program has stalled in the curriculum committee. The faculty intend to bring it through final approval in Fall 2016 for an implementation in Spring 2017.

Laboratory Assistant Certificate

Mathematics 330	5 units
English 360	5 units
Biotechnology 160	4 units
Total units	14 units

The program uses a conceptualized learning approach where the data generated in the Biotech 160 course will be analyzed in the

This program utilizes existing courses and the program is currently being taken through the approval processes of the campus curriculum committee and also through the California Chancellors Office program approval process. This program has not yet been offered.

The courses of the baccalaureate degree also have a specific sequence:

Lower Division	Biotechnology Associate Degree or equivalent preparation	
Upper Division, Year One	Fall Term Biomanufacturing Process Sciences- BIOT401 (5 Units) Advanced Topics in Quality Assurance and Regulatory Affairs BIOT407 (4 Units) Upper division GE: Technical Writing ENG 400 (3 Units) Elective (3 Units)	Spring Term Design of Biomanufacturing Facilities, Critical Utilities, Processes and Equipment BIOT403 (4 Units) Bioprocess Monitoring and Control BIOT404 (5 Units) Design of Experiments for Biomanufacturing BIOT402 (4 Units) Elective (3 Units)
Upper Division, Year Two	Fall Term Supply Chain and Enterprise Resource Planning BIOT 406 (3 Units) Emerging Biomanufacturing Technologies BIOT405 (3 Units) Six Sigma and Lean Manufacturing BIOT408 (4 Units) Upper division GE: Bioethics PHIL 400 (3 Units) Electives (3 Units)	Spring Term Methods in Quality Improvements, Investigations and Audits BIOT409 (4 Units) Emerging Trends in Biomanufacturing Quality BIOT410 (3 Units) Upper division GE: Project Management and Enterprise Resource Planning BUS400 (3 Units) Elective (3 Units)

2.12 Student Survey. Describe the student survey feedback related to course offerings. In terms of the timing, course offerings, and instructional format, how does what your program currently offer compare to student responses?

A student survey was administered to current students and offered to alumni in May 2014. The responses were generally positive, with major complements to the hands-on nature of the laboratory and to the faculty. Students were satisfied, in general, with class availability, location, instructional materials, and the classroom. There was interest in online offerings and potentially with offerings at other times.

2.13 Four-year articulation. Utilizing the most current data from the articulation officer, and tools such as ASSIST.org, state which of your courses articulate with the local four year institutions and whether additional courses should be planned for articulation (limit to one or two paragraphs).

Biotechnology courses (except for BIOT 160) transfer to UC and CSU four-year institutions as units but do not fulfill the requirements of any major. This fact served as a major motivation for Solano College to apply to become one of the 15 colleges to pilot a baccalaureate degree.

With the Solano College biomanufacturing baccalaureate, students will be able to seamlessly enter upper division without a loss of a single unit.

2.14 High school articulation (if applicable). Describe the status of any courses with articulation/Tech Prep agreements at local high schools. What (if any) are your plans for increasing/strengthening ties with area high schools and advertising your program to prospective students? (limit to one or two paragraphs).

The Solano College biotechnology program interacts extensively with the high schools and the Industrial Biotechnology certificate and degree is articulated with many of the local high schools. The faculty who teach Biotechnology interact extensively with Biotechnology faculty from every high school within the Solano Community College District, with every principal in the District, and with the Solano County Office of Education. With biotechnology the college is involved in four Career Pathways Trust grants which requires extensive interaction. During the last semester there has been a major conversation with the high schools about Dual Enrollment and the Solano College Faculty Association agreed to allow biotechnology to serve as the pilot program for AB 288 Dual Enrollment; the Academic Senate is working out the details but this program should be launched in the near future.

2.15 Distance Education (if applicable). Describe the distance education courses offered in your program, and any particular successes or challenges with these courses. Include the percentage of courses offered by modality and the rationale for this ratio.

Then:

- 1) Discuss your program's plans to expand or contract distance education offerings;
- 2) State how you ensure your online courses are comparable to in-class offerings

Not applicable. We currently do not have any Distance Education offerings and do not plan to develop them in the near future. We have discussed the potential, but the extensive laboratory requirements for the courses within the majors program limits the DE possibilities. There is potential for offering the lecture courses in an online format and this will be discussed during curriculum review. The student survey showed some interest in Distance Education or Hybrid Courses.

2.16 Advisory Boards/Licensing (CTE) (if applicable). Describe how program curriculum has been influenced by advisory board/licensing feedback. How often are advisory board meetings held, provide membership information and what specific actions have been taken. Attach minutes from the past two years.

The Solano College Biotechnology Advisory Committee consists of:

Dr. Karen MacDonald	UC Davis (Asst Dean and Professor of Chemical Engineering)
Dr. Martina McGloughlin	UC Davis (former head of the University of California biotech program, founder of the UC Davis biotech program.)
Dr. Judith Kjeldstrom	UC Davis (Director of the UC Davis biotechnology program)
Dr. David McGee	UC Davis Tech Transfer
Connie Ross	Director of Human Resources, Genentech
Stephen Judd	Axenia Biologics
Dr. Matthew Croughan	Professor, Keck Graduate Institute, Sapphire Energy

Chris Flask
Scott Zimmerman

Genentech Incorporated
Genentech Incorporated

Meetings:

April 8, 2016
December 4, 2015
January 16, 2015
December 12, 2014

Much of these meetings concerned themselves with the planning of the new Biotechnology/Science building on the Vacaville campus and with the curriculum of the new program.

STUDENT EQUITY & SUCCESS

3.1 Course Completion and Retention. Anecdotally describe how the program works to promote student success. Include teaching innovations, use of student support services (library, counseling, DSP, etc), community partnerships, etc.

Then, utilizing data from the office of Institutional Research and Planning, report on student success through course completion and retention data. Analyze by gender, age, ethnicity, and on-line (may analyze other variables such as disability, English as a second language, day vs. night courses, etc. as appropriate).

Provide possible reasons for these trends AND planned action to equalize student success.

Biotechnology Course completion and Biotechnology Course Retention

	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Sum 2015	F 2015	S 2016
Total Success	96.8%	82.5%	94.7%	85.7%	100%	93.8%	89.5%	96.4%	93.9%	90.4%	100%	88.9%	85.4%
EOT Ret	96.8%	87.3%	94.7%	94.8%	100%	95.4%	95.2%	96.4%	95.9%	93.3%	100%	88.9%	93.3%
BIOT 51 Success													
EOT Ret	100%		95%		100%	91%		97%	96%		100%	92%	
	100%		95%		100%	94%		97%	100%		100%	92%	
BIOT 52 Success													
EOT Ret		77%		82%	100%		84%	96%		90%	100%		81%
		86%		92%	100%		93%	96%		90%	100%		93%
BIOT 62 Success													
EOT Ret	93%		95%		100%	97%		97%	92%		100%	86%	
	93%		95%		100%	97%		97%	92%		100%	86%	
BIOT 63 Success													
EOT Ret		88%		91%	100%		97%	96%		100%	100%		92%
		88%		96%	100%		97%	96%		100%	100%		96%
BIOT 160 Success													
		83%		87%			88%			86%			86%

EOT Ret		88%		100%			96%			93%			90%
---------	--	-----	--	------	--	--	-----	--	--	-----	--	--	-----

Success by Gender

	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Spring 2016
Female	100%	86%	100%	89%	100%	95%	98%	94%	95%	91%	85%
Male	95%	80%	88%	82%	100%	92%	79%	100%	91%	89%	84%
Not report					100%		100%	100%		100%	100%
Total	97%	83%	95%	86%	100%	94%	90%	96%	94%	90%	85%

Success by Ethnicity

	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Sum 2015	Fall 2015	Spring 2016
Total	97%	83%	95%	86%	100%	94%	90%	96%	94%	90%	100%	89%	85%
Am. Ind. or AK		100%		100%		100%	100%	100%		67%	100%	100%	80%
Asian or PI	100%	87%	100%	86%	100%	95%	94%	100%	100%	89%	100%	100%	90%
Black Non-Hispanic	100%	75%	100%	100%	100%		100%	100%	100%	92%	100%		100%
Hispanic	100%	77%	83%	71%	100%	100%	76%	100%	93%	100%	100%	87%	73%
White, Non-Hispanic	90%	79%	100%	94%	100%	90%	88%	90%	90%	87%	100%	56%	88%
Other	100%	100%	100%	80%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Success by Age

	F 2011	S 2012	F 2012	S 2013	Sum 2013	F 2013	S 2014	Sum 2014	F 2014	S 2015	Sum 2015	F 2015	S 2016
Total	97%	83%	95%	86%	100%	94%	90%	96%	94%	90%	100%	89%	85%
U 17		100%			100%			100%	3%			100%	
18-19	100%	90%	100%	67%	100%	100%	100%	100%	100%	100%	100%	100%	64%
20-24	100%	81%	100%	84%	100%	95%	82%	100%	94%	91%	100%	79%	93%
25-29	100%	89%	80%	89%	100%	100%	100%	100%	86%	95%	100%	86%	82%
30-34	100%	80%	100%	80%	100%	100%	80%	100%	100%	100%	100%	100%	94%
35-39		100%	100%	89%	100%	90%	90%		90%	64%	100%	100%	100%
40-49		67%	100%	100%	100%	75%	100%	50%		92%	100%	100%	83%
50+	80%		100%	67%	100%	100%	100%	100%	100%	80%	100%		50%

Overall the current success and completion rate of the Biotechnology majors is very high. The post graduate success rate at landing and retaining a job likely provides motivation for students completing the program. While the faculty members in biotechnology would like to take full credit for this, the extensive prerequisites required to enter these courses likely plays a major role; the students in these courses have earned their place in them through previous academic achievement in Chemistry. The success rate typically matches the End of Term Retention rate meaning that those students who stick the course out tend to be successful. There do not appear to be statistically significant different success rates between genders, ethnicities, or ages.

3.2 Degrees/Certificates Awarded – Associates of Science in Industrial Biotechnology
 Include the number of degrees and certificates awarded during each semester of the program review cycle. Describe the trends observed and any planned action relevant to the findings.

Certificate of Achievement and Associate in Science Degree

The Certificate of Achievement can be obtained upon completion of the 22-24-unit major with a grade of C (2.0) or better in each course. The Associate in Science Degree can be obtained upon completion of 60 units, including the major, general education requirements and electives. All courses in the major must be completed with a grade of C or better or a P if the course is taken on a Pass/No Pass basis.

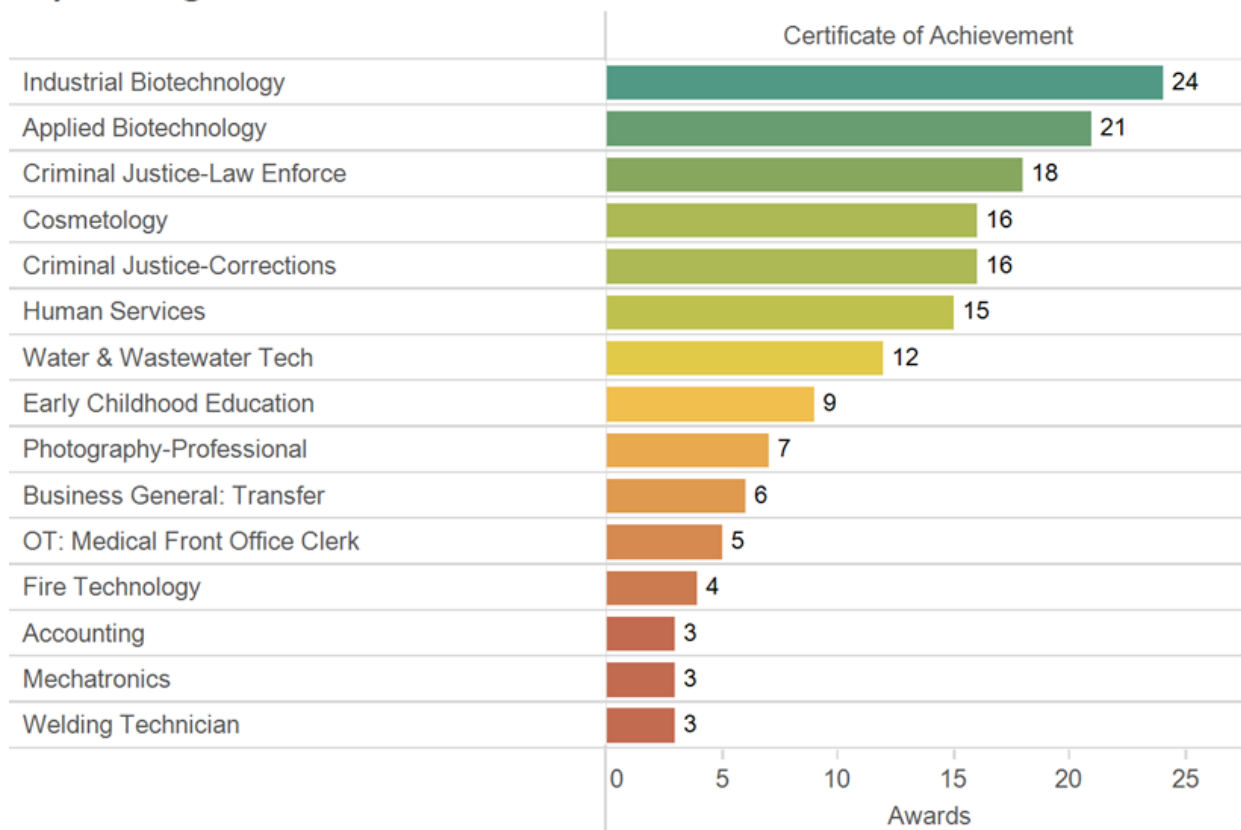
REQUIRED COURSES	Units
BIOT 051 Principles of Biotechnology	3
BIOT 052 Business and Regulatory Practices in Biotechnology	3
BIOT 062 Cell Culture and Protein Recovery.	4
BIOT 063 Biotechnology Instrumentation: Quality Control & Genetic Engineering	4

Prerequisites

BIO 014 Principles of Microbiology	4
OR	
BIO 002 Principles of Cell and Molecular Biology	5
CHEM 010 Intermediate Chemistry	4
OR	
CHEM 001 General Chemistry	5
Total Units	22 – 24

NOTE: Prior knowledge and use of computers is advised, including word processing, spreadsheets, and databases.

Top 15 Degrees - Certificate of Achievement



3.3 Transfer –Describe any data known about students in your program who are transfer eligible/ready (have 60 transferable units with English and math requirements met). Include how your program helps students become aware of transfer opportunities (limit to one or two paragraphs).

Unlike some of the majors on campus, most of the students completing BIO 002 and BIO 003 transfer within a year of completing these classes; our estimate is 90%. As an integral part of the program, and during the 6 hour per week laboratories, our faculty counsel them individually on transfer, what it takes to transfer, and how to succeed after transfer.

We informally track the students after transfer as a way to assess our program. We have a relationship with several of the local universities, especially UC Davis, and they have collected data on the students' success after transfer. Our students succeed at a rate comparable to those native students who have taken their first two years at the transfer institution.

3.4 Career Technical Programs – For career technical programs, describe how graduates are prepared with the professional and technical competencies that meet employment/ licensure standards. State if there are any efforts made to place students in the workforce upon graduation, including any applicable placement data.

The placement rates for biotechnology graduates have been extraordinarily high – sometimes in the 80% to 100% range. A biomanufacturing professional skills report has just been prepared by the Community College Consortium for Bioscience Credentials, a Department of Labor

funded effort. Each course will be re-evaluated using these students during curriculum review.

PROGRAM RESOURCES

4.1 Human Resources – Describe the adequacy of current staffing levels and a rationale for any proposed changes in staffing (FTES, retirements, etc.). Address how current staffing levels impact the program and any future goals related to human resources.

The current staffing levels are entirely inadequate to accomplish all of the goals of the program. The biotechnology department requires at least two additional full-time faculty and multiple adjunct faculty to support the goals of expanding the current program, especially with the Bridge to Biosciences and with the new baccalaureate program.

Also, the Biology department has suffered from the retirement of John Nogue and the loss of Phil Summers (who dropped teaching BIO 003 due to a reduction of load) and this pulled faculty away from biotechnology to teach biology. We will be expanding our BIO 002 offerings in Vacaville and continuing our BIO 003 offerings in the Vallejo center, furthering the biology shortage that affects biotechnology. Again, to expand, and to compensate for these losses, and to increase the expertise of the group, and to implement the baccalaureate degree we should hire two full time Biotechnology instructors.

Lack of available staff meant that we did not offer the biotechnology bootcamp last summer (Summer 2016).

4.2 Current Staff contributions. Highlight the significant contributions since the last program review cycle.

The biotechnology program has undergone tremendous expansion and implemented tremendous innovation during this review cycle. Starting in December 2014, we embarked upon an effort to participate in the California Community Colleges' pioneering of a baccalaureate degree; this has been a major undertaking. The classes and the program have now been approved by the curriculum committee and the Board of Trustees. The substantive change request has been rewritten and submitted to the ACCJC, the accreditation body.

During the last four years, there has been substantial improvement and addition of equipment used in the labs. A National Science Foundation Advanced Technological Education grant is bringing single use bioreactor equipment to the lab. Intramural grant proposals, including those written by Irene Camins, have brought additional equipment to Vallejo. This includes a photobioreactor to grow algae.

The faculty have put many hundreds of hour into working on the new Biotech/ Science building in Vacaville. The faculty helped interview, hire, and work with the criterion architects. Likewise the faculty helped interview, hire, and work with the design-build architects to design the building.

During this time Edward Re and Jim DeKloe were chosen by the American Association of Community Colleges as Finalists for their Innovation Awards. Beside the recent awards, faculty also received the following recognition: : (1) Award of 'Faculty of the Year', 2011 (J.

DeKloe); ((2) Presidential Excellence Awards in 2011 (J. DeKloe and Ed Re).

The faculty helped implement the Department of Labor TAACCCT grant, Design It, Build It, Ship It.

During this time the faculty wrote and submitted three Department of Labor TAACCCT grants for \$ 15 million, \$ 20 million, and \$ 25 million – these were not funded.

The faculty were awarded and are implementing a National Science Foundation Advanced Technological Education grant.

During this time Jim DeKloe served as the Treasurer, then President, then Past President of the Solano College Faculty Association.

During this time the faculty have engaged in a regional and national collaboration with other biotech faculty from around the United States.

During this time the faculty have had many speaking engagements and professional development; see Appendix.

4.3 Equipment. Address the currency of equipment utilized by the program and how it affects student services/success. Make recommendation (if relevant) for technology, equipment, and materials that would improve quality of education for students.

The biotechnology program is always adding equipment. The program will receive a major boost with the new equipment ordered for the new Biotech /Science building going up in Vacaville. This will add several million dollars of equipment.

The faculty spends quite a bit of time soliciting donations and bringing the equipment back.

Irene Camins at the Vallejo Center has accumulated equipment that will help bring the Bridge to Biosciences there.

4.4 Facilities. Describe the facilities utilized by your program. Comment on the adequacy of the facilities to meet program's educational objectives.

The Biotechnology program benefits from a major building boom carried out by Solano College. Currently biotechnology is taught in the well-equipped Room 1852 on the Fairfield campus. Biotech will be able to be offered in the recently remodeled Room 114. Of course a major boost will be the construction and equipping of the new Biotechnology/Science Building on the Vacaville campus.

We would like echo here the concerns expressed in the program review for the Biology majors program and the Allied Health component of Biology. We are very concerned that the entire Cost of Ownership of the new buildings has not been addressed. We can build the new buildings, but we are concerned that no plans have been drawn out for preventative maintenance or for routine maintenance.

Those reports also said the following:

“Because of budget cuts to the maintenance and operations staff, there is currently not routine janitorial services to our labs. Due to the activities that take place in all of our Biology labs, the floors in the lab need to be swept and wet mopped on a regular basis followed by a scheduled yearly steam cleaning, waxing, and buffing of the floors. We would like to support their contention that this is a safety matter rather than a cosmetic need.

The maintenance of the current facilities is inadequate and is not being addressed. We are worried that the same state of neglect might compromise the major investments in new buildings that we are making on behalf of the community that we serve.”

These comments are equally appropriate here.

4.5 Budget/Fiscal Profile. Provide a five year historical budget outlook including general fund, categorical funding, Perkins, grants, etc. Discuss the adequacy of allocations for programmatic needs. This should be a macro rather than micro level analysis.
Programmatic Goals & Planning

Running the biotechnology program is expensive – the equipment and expendable supplies are expensive. We have supplemented the budget with grant funding and with VTEA (Perkins) funds to exist. Budgetary planning has been problematic with uncertainties arising about existing budgets. (The budget in the BANNER system has not consistently been accurate.)

In the 1990’s the budget for the Biotechnology department was \$ 15,000 per year. We have not seen this degree of support since, even though we have expanded.

Sufficient funding for the current biotechnology is a concern. Of greater concern is funding for the new biomanufacturing baccalaureate program. This program will require placing the full additional \$ 84 per unit of student fees into the program.

PROGRAMMATIC GOALS & PLANNING

5.1 Program Strengths and Major Accomplishments. Summarize what you believe are your program’s strengths and major accomplishments in the last 5 years. Next, state the areas that are most in need of improvement.

A. Strengths of the Biotechnology program:

The Biology faculty are proud of the program that exists here and we suggested that it would do well when judged against any program at any college or university in the United States.

Faculty: The great strength of the Biology Majors component of Biology at Solano College is its well-qualified and well-trained faculty members and staff. These faculty members work cooperatively to uphold the academic standards set for the courses. The faculty keep up to date on both scientific and technical advances and on pedagogic innovations in this field with professional development.

Staff: The courses could not achieve their high quality without the technicians who run the

laboratories, especially Jennifer Low. She was chosen as classified employee of the year for 2015 and that honor was well-deserved. She deserves an equal recognition this year. In the last few years she has successfully supported the core program, the summer IBIS bootcamps, developed equipment lists for the new buildings, served on committees for the new buildings, ordered and set-up new equipment, and a host of other duties. In the future we will involve Christine Kucala and Irene Camins. Each has an academic preparation much greater than the minimum required by the job, and each has duties greater than that which would be expected by a comparable technician elsewhere.

The emphasis on laboratory: The strong lab component gives the students extensive time to develop skills in well-equipped laboratories. When students exit the biotechnology program they exit with excellent preparation to enter the field or to transfer with extraordinary cell and molecular biology laboratory skills. All of these mastered techniques can be placed on a resume and used to gain employment or to gain a position in the research laboratory after transfer.

Funding for equipment and expendables: The biotechnology labs tend to be expensive. The college historically has supported a strong laboratory budget, although that support has diminished and the slack has been taken up by VTEA Perkins funds.

The new Biotechnology/Science Building in Vacaville will provide a major boost to the program.

The biotechnology program has emerged as one of only 15 baccalaureate programs in the state. This took a tremendous amount of work to achieve.

B. Weaknesses of the Biotechnology program:

A major weakness of the biotechnology program is the size of the team. There is so much going on. The amount of work piled upon the faculty in the last few years can only be described as cruel, and there is a real risk of burn-out. The addition of new full time biotech faculty is critical. Also, the additional of adjunct faculty members might increase the ability to carry out the many duties required to keep the program going.

Lack of administrative support

We will echo the weakness from the biology program reviews. A major weakness of the campus is the fact that the understaffed maintenance and operations group do not have the resources to clean anywhere. There is inadequate resources to operate Preventative Maintenance. To their comment that there is “absolutely unacceptable poor cleanliness of all labs and most of lecture rooms used for our classes,” let us add to that the rest rooms and the entire main campus lack attention. This is hurting our enrollments; an informal poll of the Vacaville students cited poor rest room maintenance as a major reason that they avoid the main campus. While the routine janitorial services in Vallejo and Vacaville have been better, since there are no maintenance personnel stationed there, and since there is no PM, there have been ongoing problems with maintaining the temperature of the rooms. Again, to quote the Allied Health report: “Faculty feel that it is mandatory to find a solution to this ongoing problem in order to immediately provide a better teaching environment for the [Biology Majors], and in order to immediately improve overall SCC image and in order to maintain in a good condition the new buildings as they are going to be built on our campus. It is sad to see how the “new” building 400 is already showing the effects of a very low level of care, maintenance and cleanliness. It would be very sad to see the same happening to the buildings that are not built

yet.” We view this as a top problem that the campus needs to solve.

Non-Teaching Duties of Faculty: While a major strength of the Biology majors program is the faculty, a major weakness is that the attention and efforts of these faculty continue to be siphoned away by non-teaching duties. This report is a good example of that. While analysis and long range planning are worthy goals, time is finite; the hundreds of faculty person-hours spent on this report were taken from other activities: curriculum planning, reading about scientific innovations, meeting with students, etc. In the not so distant past, a faculty member would teach class and meet with students and grade papers. Now, there is at least an hour of email correspondence every day. SLOs and PLOs and their assessments have been added to grading without additional time to support the effort. New efforts from the State like C-IDs and TMCs take time. Committee assignments seem to have increased. This year there has been additional meetings with architects to help them design the new buildings. We have had several faculty members drawn away with union duties and serving on the Shared Governance Committee. While all of these constitute worthy endeavors, they take time away from teaching and especially from the innovation required to keep our program up-to-date.

5.2 Short-Term and Long-Term Goals

The faculty have the following goals to accomplish:

Fall 2016

- Gain Bridge to Biosciences regional and local approval
- Biotech Program Review Completion
- Baccalaureate Degree approval
- CTE/Biotech Job Description and Faculty Hire
- Baccalaureate Full Time Faculty hire
- Temporary Storage Space to house biotech supplies and equipment for courses taught at the Vacaville center prior to completion of the new biotech/science building
- Develop/Cultivate Biotech group (meet once a month) adjunct pool
- Get Room 114 in Vacaville functioning
- Meeting with High School Biotech teachers
- Elimination of Applied Biotech certificate – wrap into the Industrial Biotech
- Professional development – especially Design of Experiment and Certified Quality Improvement Associate
- High School Dual Enrollment
- Meet with BioMarin Training Manager
- Plan and Prepare for Spring 2017 Bridge to Biosciences
- Continue to work on curriculum details of baccalaureate courses

Spring 2017

- Full Time Faculty Hire – works on course development (all biotech faculty help)
- Planning move to new Biotech building
- Ed/Jim redo their schedules (pick up BIO 014, ½ BIOT 52, ½ BIOT 63)
- Curriculum Review for the Biotech Program; submit CIDs
- Run Bridge to Biotech or at least BIOT 160 (the Bridge requires English and math teachers)
- Foundation grants
- Design Short Courses

Consult with California State University professional masters programs
 Consult with UC Berkeley about collaborating with their new Bioprocessing program

Summer 2017

NSF Single Use Bioreactor Courses (complete course design by 12/2016)

SCORE

Begin the move into the new building

Fall 2017

Move into building

Launch biomanufacturing baccalaureate (BIOT 401, BIOT 407 , ENGL 400)

Spring 2018

BIOT 403, BIOT 404, BIOT 402

Summer 2018

IBIS 2018

SCORE

Fall 2018

BIOT 406, BIOT 405, BIOT 408, PHIL 400 (first cohort)

BIOT 401, BIOT 407 , ENGL 400 (second cohort)

Spring 2019

BIOT 409, BIOT 410, BUS 400 (first cohort)

BIOT 403, BIOT 404, BIOT 402 (second cohort)

Graduation of first baccalaureate cohort

Program Learning Outcome evaluation – program adjustment

Summer 2019

IBIS 2019

SCORE

Based on the self-study analysis, prioritize the program's short (1-2 years) and long term goals (3+ years). Check whether the goal requires fiscal resources to achieve.

Table 8.

Short-Term Goals	Planned Action	Target Date	Person Responsible	Source
1.	The curriculum for all biotech courses, BIOT 160, BIOT 51, BIOT 52, BIOT 62, and BIOT 063 must be changed to match the statewide C-ID curriculum and submitted for review. Review of SLOs, PLOs, and Course Outlines of Record. The CoRs will be altered to comply with statewide C-IDs and submitted for approval.	Fall 2016	Biotech faculty,	Faculty time

2	The Bachelors Degree in Biomanufacturing must undergo final design to be approved by the curriculum committee and the Board of Trustees. The curriculum will also be submitted to the Accreditation Commission	Completed Spring and Fall 2016	Biotech faculty	Faculty release time.
3	Hiring and training of two new full time faculty to teach biotechnology, one for expansion of the lower division program and one for the baccalaureate degree. The application for the Bachelors in Biomanufacturing made this commitment. This is critical and overdue!	Spring 2017	Hiring Committee HR staff Dean Vice President of Academic Affairs	DB NR- Currently finalizing job descriptions to be sent to Deans and Human Resources for Final Approval. Faculty will donate their time to serve on hiring committees and to train new faculty. Explore use of professional development
4	Hiring two to four additional adjunct faculty to teach in the Biomanufacturing program	Spring 2017	Hiring Committee HR staff	NR – Faculty will donate their time to serve on hiring committees. Faculty are recruiting for current Industrial Biotechnology program expansion and for
5	Biotechnology faculty must undergo extensive professional development to acquire additional skills and knowledge in the subjects covered in the new biomanufacturing degree	Spring 2017 – Spring 2018	Biotech faculty	Professional development funds

6	The library holdings must be updated and expanded both at the Main Campus and at the Vacaville Center	Spring 2017	Biotech faculty	Library funds and Baccalaureate implementation funds
7	Implement Bridge to Bioscience program. Take curriculum through the curriculum committee, through the regional BACCC approval process, and through the Chancellors Office approval process.	Fall 2016-Spring 2017	Biotech Faculty	Classroom expendables budget
8	Accommodate Short Term Storage Space	Spring 2017	Dean of Vacaville Center	Temporary storage space until Room 114 becomes available as a permanent storage option
9	Develop electives for Biomanufacturing baccalaureate (Human Genetics, Infectious Disease, Fermentation, Algae)	Fall 2017	Faculty	Faculty time will be required
Long-Term Goals	Planned Action	Target Date	Person Responsible	Source
1.	Build the new Biotech/Science building on the Vacaville campus.	Groundbreaking: July 2016 Completion: May 2017	Biotech faculty and staff	Measure Q funds. Extensive work has already been done.
2.	Increase course offerings at VVC and VJO centers according to student demand.	On going	Faculty	General Fund Instructional Equipment proposal Future SP development
3.	Increase the outreach potential of the Bridge to Biosciences program	January 2018	Faculty	This will require additional faculty resources

4.	Introduce new technologies for additional job skills (stem cells, biomaterials, algae, organ printing, fermentation)	January 2018	Faculty	Extra funding may be needed
----	--	--------------	---------	-----------------------------

Signature page

Please include a signature page with all full-time faculty and as many part-time faculty as you are able. The signature page should include lines with the signatures and then typed names of the faculty members.

The undersigned faculty in the Biotechnology Majors program have read and concur with the finding and recommendations in the attached program review self-study

Date: _____

Faculty Name

Faculty Name

APPENDIX

4.2 Current Staff contributions

December 2016	National Institute for Innovation in Manufacturing Biopharmaceuticals Newark, DE
December 2016	American Society for Cell Biology Poster: "Introducing Single-Use Mammalian Cell Culture Bioreactor Technologies into the Biomanufacturing Classroom" San Francisco, CA
November 2016	Curriculum Summit Solano College Fairfield, CA
November 2016	California Community College League Speaker, "Biomanufacturing Baccalaureate: Biomanufacturing Innovation Framework for Novel Degrees in Emerging Industries" Riverside, CA
November 2016	Keck Graduate Institute Advisory Committee meeting Claremont, CA
October 2016	Biotechnology Pathways Educators Conference - Speaker Skyline College, San Bruno, CA
October 2016	Design of Experiments Biomanufacturing Training and Education Center North Carolina State University, Raleigh, NC
September 2016	Regional Faculty Biotechnology meeting Oakland, CA
September 2016	Baccalaureate Degree Pilot program meeting Sacramento, CA
September 2016	Bay Area Biotechnology Education Consortium Kick-off 2016 Bruce Alberts, speaker, The State of Biology Education
September 2016	Biomanufacturing baccalaureate program Math-Science Division meeting Solano College Fairfield, CA
August 2016	Doing What Matters for Jobs in our Community conference Cordelia, CA
August 2016	Career Technical Education Leadership Summit sponsored by the California Community College League Oakland, CA
July 2016	High Impact Technology Exchange Conference Pittsburgh, PA
July 2016	California Community College Curriculum Institute Orange, CA
July 2016	Baccalaureate Degree Pilot Program Summit – Fullerton, CA
June 2016	International Conference on Algal Biomass, Biofuels, and Bioproducts San Diego, CA
June 2016	Bio-Link Summer Fellows Conference Berkeley, CA
June 2016	Speaker: Introducing Single Use Technologies into the Classroom Biotechnology Industry Organization Community College Day San Francisco, CA Speaker

May 2016	Northeast Biomanufacturing Center and Collaborative Educators Conference – Speaker – Single Use Technology in Biomanufacturing Blue Bell, PA
May 2016	“Implementing and Improving Disposable Systems in BioMarin's Manufacturing Environment to Meet Growing Capacity” American Society for Quality meeting Genentech South San Francisco, CA
May 2016	Solano Business Connections Expo Fairfield, CA
May 2016	NERDtopia University of California, Berkeley Berkeley, CA
April 2016	Laney College Industry Advisory Committee Oakland, CA
April 2016	Presentation to Jesse Bethel High School Biomedical Academy students
April 2016	Chair, National Visiting Committee for the National Science Foundation Funded Northeast Biomanufacturing Center and Collaborative Blue Bell, PA
April 2016	Presentation to Benicia High School Biotechnology students
April 2016	Biotechnology Extravaganza – Keynote Speaker Tulsa, OK
March 2016	Presentation to Vacaville High School Biomedical students
March 2016	Biotechnology Statewide Retreat – Miramar College San Diego, CA - Speaker
March 2016	Rodriguez High School biotechnology class
February 2016	Rodriguez High School biotechnology class
February 2016	American Association for the Advancement of Science Speaker, Washington DC
January 2016	Bay Area Regional Biotechnology Collaboration Berkeley, CA
January 2016	Bachelors Degree Pilot Faculty meeting Sacramento, CA
January 2016	Vallejo Biotech Academy Advisory Committee Vallejo, CA
January 2016	Career Technical Education Curriculum Academy Napa, CA
January 2016	California State University Partnership for Education and Research in Biotechnology (CSUPERB) meeting – Anaheim, CA
December 2015	Biotechnology Pathway Partner Workshop
December 2015	California Academy of Sciences Face Mite Study San Francisco, CA
November 2015	Curriculum Regional Meetings – Academic Senate of the California Community Colleges – Solano College host
November 2015	Armijo High School Tour of Biotechnology facilities Fairfield campus, Solano College

November 2015	Using Programming and Robotics to teach STEM C-STEM program, UC Davis
November 2015	Biotechnology Marketplace – speaker on Introducing Single Use Bioreactors into the Classroom Newark, CA
November 2015	Solano College Biotechnology, Winters Rotary Club – speaker Winters, CA
November 2015	Bioproduction Summit: Advances in Therapeutic Protein Production South San Francisco, CA
October 2015	Regional Discussion of Biomanufacturing Bachelors degree Laney College, Oakland, CA
October 2015	Regional Discussion of a Brewing Program Santa Rosa Junior College’s Petaluma campus
October 2015	National Science Foundation Advanced Technology Education Principal Investigators Conference Washington DC
October 2015	Principals of Solano County meeting – Speaker Vacaville, CA
October 2015	Hands-on Single Use Processing for Biopharmaceuticals short course, Biomanufacturing Training and Education Center North Carolina State University, Raleigh, NC
September 2015	Bioprocessing Using Single Use Bioreactors Berkeley, CA
September 2015	Single Use Manufacturing, CellWorld Conference San Francisco, CA
September 2015	Career Opportunities in Biotechnology Speaker, Fairfield High School
September 2015	Vacaville Site Operations of Manufacturing Facilities International Society of Pharmaceutical Engineers and Design-Build Institute of America Vacaville, CA
September 2015	Festo EduKit Process Control Training East Bay MUD Orinda, CA
August 2015	Baccalaureate Student Services meeting Solano College, Fairfield, CA
August 2015	Solano College 70th Anniversary Gala – Keynote Speaker Vacaville, CA
August 2015	NBC2 Subject Matter Expert Meeting Oceanside, CA
July 2015	High Impact Technology Exchange Conference Portland, OR
July 2015	BIOMAN conference Bloomington, IN
July 2015	Biotechnology Concepts for Professionals – Organizer and Presenter Solano College, Fairfield, CA
June 2015	Bio-Link Summer Fellows – Looking Toward the Future Berkeley, CA
May 2015	Teen Biotech Challenge – Speaker and Presenter UC Davis Davis, CA
May 2015	MESA Annual Dinner – Keynote Speaker
May 2015	Vallejo STEAM Advisory Committee Meeting
May 2015	Design-Build in Pharmaceutical Manufacturing Facilities

	International Society of Pharmaceutical Engineers and Design-Build Institute of America San Francisco, CA
April 2015	American Association of Community Colleges conference San Antonio, TX Innovation Award Finalist
April 2015	Worthington Bioscience Conference Worthington, MN Keynote Speaker
April 2015	Career Day, Liberty High School Benicia, CA speaker
March 2015	Chair, National Visiting Committee for the National Science Foundation Funded Northeast Biomanufacturing Center and Collaborative Blue Bell, PA
March 2015	Best Practices in Teaching training for Water and Wastewater program Orinda, CA
February 2015	Career Technical Education conference for Northern California Solano College host, Fairfield, CA
February 2015	Interest Based Bargaining training Fairfield, CA
February 2015	Guest Speaker, AP Biology Class Will C. Wood High Vacaville, CA
February 2015	American Association for the Advancement of Science meeting Community College Day San Jose, CA
December 2014	STEAM Task Force Vallejo Unified School District Vallejo, CA
December 2014	Life Science and Biotechnology Middle Skills Workforce webinar
October 2014	National Science Foundation Advanced Technology Education Principal Investigators Conference Washington DC
October 2014	21st Century Community Partnerships for Pathways Vacaville, CA
September 2014	Collaboration in Education and Biotech – hosted by Genentech Vacaville, CA - speaker and participant
September 2014	High Impact Pathways Institute, A Design It-Build It-Ship It Community of Practice event Oakland, CA
August 2014	Vacaville High School Biotechnology meeting
July 2014	Solano County Principals and Teachers meeting
June 2014	Society for Advancement of Hispanics/Chicanos and Native Americans in Science Solano College - presenter
June 2014	Biotechnology Industry Organization – Community College Program Biotech Training Goes Global – Moderator and Presenter San Diego, CA
June 2014	Bio-Link Summer Fellows Conference – Encircling the Community Berkeley, CA
May 2014	Haiti Bioscience Initiative Pilot Program Ecole Superier D’Infomatique de Haiti Port Au Prince, Haiti
May 2014	California Advisory Committee – Presenter – Solano College
May 2014	Solano Days – Open House at Solano College Fairfield, CA
April 2014	Bioscience Marketplace meeting Emeryville, CA
March 2014	Berkeley Bioeconomy Conference: Biofuel as Part of a Sustainable Strategy – Berkeley, CA
March 2014	Bay Area Consortium of Water Wastewater Education Retreat

	Orinda, CA
March 2014	MOOC Food, Fuel, and Water in the 21st Century UC San Diego
March 2014	Food and Fuel for the 21st Century UC San Diego, San Diego, CA
March 2014	Chair, National Visiting Committee for the National Science Foundation Funded Northeast Biomanufacturing Center and Collaborative Blue Bell, PA
February 2014	Algae Production National Algae Association Richmond, CA
February 2014	Vacaville Business Alliance hosted by the Vacaville Chamber of Commerce Speaker Vacaville, CA
January 2014	High School Counselor conference. Speaker Solano College, Fairfield, CA
January 2014	Policy Forum, Faculty Association of the California Community Colleges DeAnza College, Cupertino, CA
January 2014	California State University Partnership for Education and Research in Biotechnology (CSUPERB) meeting – Santa Clara, CA
January 2014	Career Ladders Project – Contextualized Teaching and Learning Workshop, Solano College, Fairfield, CA
December 2013	Biotech Marketplace, Hayward, CA
December 2013	Planning, Launching, and Sustaining Industry Sector Partnerships Berkeley, CA
November 2013	Vallejo Biotech Academy Solano County Board of Education Presenter, Fairfield, CA
October 2013	The Biotech Century: How biotechnology will change everything Faculty Lecture Series Vacaville, CA
September 2013	Design It, Build It, Ship It Biotechnology Cluster leadership meeting Oakland, CA
June – July 2013	Industrial Biotechnology Intensive Summer bootcamp Solano College, CA
July 2013	Biomanufacturing Boot Camp Biomanufacturing Training and Education Center Raleigh, North Carolina
June 2013	Bio-Link Summer Fellows Conference – Bio-Link@15; ATE@20 Berkeley, CA
May 2013	Biofuels Workforce Summer Honolulu, HI – Moderator and Participant
April 2013	Solano County School Boards Association Annual Meeting Higher Education in a Global Economy: How Solano College is Transforming to Meet the Challenge
March 2013	Good Manufacturing Practices Teaching and Education Alliance – West Coast Chapter meeting – Bayer, Berkeley, CA - presenter
March 2013	Chair, National Visiting Committee for the National Science Foundation Funded Northeast Biomanufacturing Center and Collaborative Blue Bell, PA
February 2013	Academic Academy: Strong STEM Courses Promote Prosperity

February 2013	San Diego, CA Statewide Biotechnology Initiative “All-Hands” Meeting Davis, CA
January 2013	Statewide Economic and Workforce Biotechnology Initiative Advisory Board Meeting – Sacramento, CA
January 2013	California State University Partnership for Education and Research in Biotechnology (CSUPERB) meeting – Celebrating 25 Years, Anaheim, CA
December 2012	Solano County Career Technical Education Advisory Meeting Vacaville, CA Advisor
December 2012	Solano County Boards of Education Meeting Vacaville, CA Speaker and Panelist
October 2012	Fish in the Classroom – certification program run by the California Department of Fish and Game – Oakland, CA
October 2012	UC Berkeley/British Petroleum Energy Biosciences Institute American Chemical Society Regional Meeting – Berkeley, CA
October 2012	National Council for Workforce Education conference - Riding the Waves of Change: Leading Strategies for a Diverse Economy Long Beach, CA - presenter
October 2012	OSHA Hazardous Materials Awareness Training Safety in the Teaching Laboratory – Fairfield, CA
July 2012	SoCalBio Workforce Summit – Speaker Sponsored by SoCalBio and Los Angeles Chamber of Commerce Los Angeles, CA
June 2012	BioRad Explorer Education Division Advisory Committee Hercules, CA
June 2012	Bio-Link Summer Fellows Conference – Catching the Crest of the Bio Link Wave Berkeley, CA
May 2012	Scanning Electron Microscopy short course Ohlone College, Newark, CA
May 2012	Solano College Career Fair – presenters Fairfield, CA
April 2012	California Association of Sanitation Agencies conference Napa, CA – presenter and panelist
March 2012	Regional Biosciences Conference - speaker Worthington, MN
March 2012	Chair, National Visiting Committee for the National Science Foundation Funded Northeast Biomanufacturing Center and Collaborative Blue Bell, PA
March 2012	California Community College Association for Occupational Education conference - presenter Burlingame, CA
March 2012	Good Manufacturing Practices Teaching and Education Alliance – West Coast Chapter meeting – Bayer, Berkeley, CA
March 2012	CCB FEST (Community College Biology Faculty Enhancement through Scientific Teaching) Spring Workshop – Solano College hosting

March 2012	Best Teaching Practices in Water and Wastewater Richmond, CA Facilitator and Presenter
February 2012	Virtual Enterprise Faculty Development Seminar Solano College, Fairfield, CA
January 2012	Bay Area Consortium of Water Wastewater Education Retreat Orinda, CA
January 2012	Science and Politics of the AquaAdvantage Genetically Engineered Salmon – Alison Van Eenennaam UC Davis
January 2012	Panel Moderator and Participant Incorporating Workforce Development into Your Curricula Miramar College, San Diego, CA
January 2012	California State University Partnership for Education and Research in Biotechnology (CSUPERB) meeting, Santa Clara, CA
December 2011	Bridge to Biotechnology Networking Event – San Francisco, CA
December 2011	Good Manufacturing Practices Teaching and Education Alliance – West Coast Chapter meeting – Novartis Vacaville, CA
October 2011	California Community College Association for Occupational Education conference San Diego, CA
June 2011	Bio-Rad Advisory Committee meeting – Hercules, CA
June 2011	Bio-Link Summer Fellows Conference – Expanding the Impact Berkeley, CA - Presenter
May 2011	Bridge to Biotechnology Networking Event – San Francisco, CA
May 2011	California Career Technical Education Model Curriculum Standards – Reviewer for Health Science Section Folsom, CA
May 2001	Annual Biotechnology Poster Symposium – keynote speaker and judge Salt Lake City UT
May 2011	From Industrial Enzymes to Cancer Therapy - Protein Purification is Essential - webcast presenter BioRad - Hercules, CA
May 2011	Solano College Career Education Fair - presenter
April 2011	SoCalBio Biotechnology Workforce Summit Los Angeles, CA
April 2011	ISPE Vendor Night – Student Poster Competition – Faculty Sponsor South San Francisco, CA
March 2011	Good Manufacturing Practice Training and Education Association Berkeley, CA
February 2011	Bio-Rad Beta Testing DHFR production and characterization
February 2011	Focus Track Amgen Bioprocessing Center; Advisory Committee member Keck Graduate Institute, Claremont, CA
January 2011	Bay Area Consortium of Water Wastewater Education Retreat Orinda, CA
January 2011	Solano County Career Technical Education Summit
January 2011	California State University Partnership for Education and Research in Biotechnology (CSUPERB) meeting, Anaheim, CA