Ohlone College
Program Review Report

- Program Description and Scope:
  1. Program Review Title: Biotechnology
  3. Review Type: Instructional Disciplines
  4. Program/Departments: Biotechnology Program (04004)
  5. Authority Code: -
  6. External Regulations: Yes _ No X
  7. Provide a brief narrative that describes the instructional program/discipline.

    The Biotechnology Certificate Program at Ohlone College is designed to prepare students with practical laboratory skills and the theoretical knowledge needed for entry-level jobs in the local biotechnology industry.

  8. Describe how the program specifically serves students, faculty and staff.

    The Biotechnology Certificate Program at Ohlone College prepares students with practical laboratory skills and the theoretical knowledge needed for entry-level jobs in the local biotechnology industry. The Biotechnology Certificate Program also serves both faculty and staff by offering hands-on training and workshops to those who wish to become familiar with or remain current on specialized instrumentation and laboratory techniques.

  9. Describe how the program addresses current needs and applies current technologies.

    As biotechnology evolves, the Biotechnology Certificate Program at Ohlone College responds by upgrading its curriculum to meet job demands in the industry. Ohlone College's Biotechnology Certificate Program has re-designed the biotechnology curriculum into a shorter (2 semesters versus 3 semesters), modular (topic-specific courses that will permit students to acquire specific skills and knowledge on a need-to-know basis) program that will prepare new students for entry-level jobs, as well as upgrade the skills of incumbent workers in biotechnology.

  10. Discuss the impact of the program on the college and/or other programs.

    The Biotechnology Certificate Program has been able to enhance the quality of instruction in other departments (e.g., Biology, Chemistry, and Physics) via its acquisition of instrumentation through a variety of strategies including faculty-sought donations and grants. The Biotechnology Certificate Program has also enhanced the quality of instruction in other departments by offering hands-on training and workshops to instructors within these departments who wish to become familiar with, and use in their courses, these specialized instruments.

  11. Discuss the impact of the program on the community and the impact of the
community on the program.

The Biotechnology industry, in part centered in the San Francisco Bay Area, has an increasing demand for a skilled workforce. Ohlone College is helping to train this workforce by providing life-long learning opportunities to all members of the community in the laboratory, documentation, and instrumentation skills needed to work in biotechnology. In addition, Ohlone's biotechnology department has developed a partnership with local high schools called the Learning Alliance for Bioscience (LAB) Program. This program, open to all students but specifically targeting underserved populations, creates a pathway into STEM careers for students who might not have considered college, and also provides an opportunity for professional development for participating high school teachers.

• College Mission
  1. Mission Statement
     The mission of Ohlone College is to serve the community by offering instruction for basic skills, career entry, university transfer, economic development, and personal enrichment for all who can benefit from our instruction in an environment where student learning success is highly valued, supported and continually assessed.

  2. Vision Statement
     Ohlone College will be known throughout California for our inclusiveness, innovation and superior rates of student success.

  3. Core Values, Goals & Objectives:

     College Core Values
     • We provide life-long learning opportunities for students, college personnel and the community.
     • We open access to higher education and actively reach out to under-served populations.
     • We promote diversity and inclusiveness.
     • We maintain high standards in our constant pursuit of excellence.
     • We value trust, respect and integrity.
     • We promote team work and open communication.
     • We practice innovation and actively encourage risk-taking and entrepreneurship.
     • We demonstrate stewardship for our human, financial, physical and environmental resources.

     College Goals/Objectives
     1. Through innovative programs and services, improve student learning and achievement.
        1. By 2013, have in place an ongoing system for identifying and assessing student learning outcomes at the program and course levels, which includes faculty dialogue and appropriate improvement plans.
        2. By spring 2013, increase the college average course retention to a rate at or above the statewide average.
        5. By spring 2013, increase to 600 the number of students transferring to
UC and CSU.
6. By spring 2013, the number of students receiving associate degrees to a rate at or above the peer group average.
7. By spring 2013, increase the number of students receiving certificates of accomplishment and certificates of achievement to a rate at or above the peer group average.
2. **Support the economic vitality of the community through educational programs and services that respond to identified employment needs.**
3. **Promote continuous, needs-based, learning and professional development opportunities for all district personnel.**
4. **Use human, fiscal, technological, and physical resources responsibly, effectively, and efficiently to maximize student learning and achievement.**
   1. Annually sustain the fiscal health of the district.
7. **Increase access to higher education of under-served and under-represented demographic groups in the District and local communities.**
   2. Annually increase retention and success rates of under-served demographic groups.

4. **Briefly describe how the program supports the college mission, vision selected college values.**

The Biotechnology Program at Ohlone College offers life-long learning opportunities to all members of the community, including those wishing to acquire the training and knowledge to enter the biotechnology workforce, and incumbent employees who wish to upgrade their skills for job advancement. Through our LAB Program we reach out to underserved populations in local high schools, providing young students opportunities to enter an education and career pathway in the sciences.

5. **Briefly describe how the program supports selected college goals.**

The Biotechnology Program directly benefits the economic environment of Fremont and the South Bay by providing a well-trained workforce that can meet the demands of our local biotechnology industry. This keeps local people employed and makes it easier for local firms to remain local.

The Biotechnology Program has been able to enhance the quality of instruction in other departments (e.g., Biology, Chemistry, and Physics) via its acquisition of instrumentation and activities through a variety of strategies including faculty-sought donations and grants.

Our Learning Alliance for Bioscience high school outreach program encourages local students to study biotechnology and STEM areas, reaching out to underrepresented populations such as Hispanic/Latino and Deaf students.
6. Briefly describe how the program supports selected college objectives.

See above.

• Program SLOs & Assessment

1. Program SLO -

Employ the correct mathematical rules of operation, and be able to apply these to the preparation of reagents, buffers, pH adjustments, etc.

a. Indicate program assessment strategies used.
   i. Performance Assessment
   ii. Skills Assessment

b. Describe the criteria and standards used to appraise student work.

Every exam in Biot105, the introductory course in the certificate program, is largely composed of problems that require students to do the calculations they’d use to prepare reagents, make buffers, perform dilutions, etc. These calculations are also tested in all the other hands-on lab classes in the certificate program, including the Biot110, Biot111, and Biot115 series. In addition, students entering the certificate program are now given a math pre-test in Biot105 to assess their basic math skills. Also, at the end of every semester we interview students for internship positions (internal and external internships). This interview includes questions about reagent preparation.

c. Enter assessment results and analyze student success in achieving this program SLO.

This is one of the major skills that our students must gain in our certificate program, and it is the one that gives students the most trouble. The ability to do the relevant calculations requires some basic math skills, such as being able to solve problems involving fractions and proportions, understand percent, and graph data. Some students entering our program struggle with these basic skills. In a Fall 2011 Biot105 class I gave a pre-test to see if students could perform basic math calculations (using their calculators, solving problems such as "what is 15% of 1000"), and out of 16 students, 6 got half or fewer of the problems correct. Based on my experience, of the students who drop out of Biot105 before the end of the semester, the majority of them do so after being overwhelmed by the calculations; some of these students have very good hands-on skills in the lab. Update: in Spring 2012 I gave a similar pre-test to students and found that 40% of the class got one-third or fewer of the problems correct. These same students are the ones that now - 10 weeks into the semester - are struggling and in danger of failing the class.

We gathered data from our 6 internship interviews with students at the end of the Spring 2012 semester (all had completed at least the Biot110 series):
6 of the 6 correctly calculated the amount of solute needed to make a solution with a particular molarity

3 of the 6 correctly described the procedure for making the solution, including BTV. (2 of the 6 forgot the BTV step; 1 of the 6 seemed to treat the problem as a dilution)

5 of the 6 correctly performed the calculation and described the procedure for making a 1/10 dilution of a stock solution.

d. Describe revisions in curriculum or teaching strategies implemented to promote student success.

During a biotechnology faculty meeting in 2010 we discussed the need to either have a pre-requisite math class, prior to entering the certificate program, or to provide extra assistance to students with the particular types of calculations they'll be encountering in our program. (This second tailored approach is similar to one of the recommendations of the state-wide Student Success task force that came out Oct2011.) One of our faculty tried offering a biotech/math class last spring for Biot105 students who were struggling with calculations, but enrollment was low.

e. Future Action (Improvements)

Describe changes you will make to promote improved student learning

Math issues: It seems that support within the class time and office hours, and referring students for math tutoring may be the most practical approaches to addressing the math deficit that some of our students have. Because of the lack of time that our students have (many of them work), it is difficult to schedule an additional math support class. Strongly counseling students early on in the semester to get extra help (office hours, tutoring) is necessary for those with poor math skills.

2. Program SLO -

Demonstrate the use of instrumentation and techniques common to the biotechnology laboratory.

a. Indicate program assessment strategies used.
   i. Skills Assessment
b. Describe the criteria and standards used to appraise student work.

Laboratory practical exams are the primary method of assessing students' abilities to use instruments and show proper lab technique. As an example, students are assessed in the Biot105, Biot110, and Biot115 courses for their ability to pipet and micropipette liquids accurately.

c. Enter assessment results and analyze student success in achieving this program SLO.

Faculty discussions indicate that as students move through our program they are gaining the desired hands-on abilities.
4. Describe revisions in curriculum or teaching strategies implemented to promote student success.

5. Future Action (Improvements)

3. Program SLO -

Demonstrate the ability to keep a legal scientific notebook compatible with Biotechnology Industry standards.

a. Indicate program assessment strategies used.
   i. Rubrics

b. Describe the criteria and standards used to appraise student work.

A rubric is used in BIOT105 (introductory course) to assess students' ability to keep a legal scientific notebook compatible with Biotechnology Industry standards. A similar rubric is used in Biot110A1, Biot110A2, Biot110A3, Biot115, Biot111A, and Biot111B. This rubric includes having the student signature at the bottom of each page, instructor signature after each lab, signing across the edge of any attachments, voiding blank areas, using a single initialed line through any corrections, having dated entries that are clear and legible, and using continuation notes as necessary. Each lab must include a title, intro/objectives, procedures, data/results, and conclusion.

c. Enter assessment results and analyze student success in achieving this program SLO.

We have observed in Biot105 that students have a steep learning curve for keeping a professional notebook. They often enter the program thinking that the notebook should be a "polished" product, and so want to record the data from their experiments into a separate notebook and later transfer a neat and perfect record into their lab notebooks. They are taught that a lab notebook is not the same as a report, but rather it is a legal record of work done in the lab, with data recorded as it is being acquired, with every page signed and dated.

By the end of Biot105, students have generally acquired good record-keeping habits which are practiced and developed in the subsequent classes. Assessment in the Biot110 A, B, and C series shows a steady improvement of student achievement in notebooks, from an average score of 91% in Biot110A to 94% in 110B to 98% in 110C (Barnby, Spr12).

d. Describe revisions in curriculum or teaching strategies implemented to promote student success.

We have compared our rubrics and implemented consistent standards for notebook keeping in the various core classes in our certificate program.

e. Future Action (Improvements)

Describe changes you will make to promote improved student learning

Based on assessment results in the Biot105 class, more frequent notebook
grading will be implemented, to be sure all students understand and are keeping up with the requirements for lab write-up and data analysis.

4. Program SLO -

**Practice proper laboratory safety.**

a. *Indicate program assessment strategies used.*
   i. Performance Assessment

b. *Describe the criteria and standards used to appraise student work.*

   Students are required to show professional behavior in the laboratory and to wear the appropriate Personal Protective Equipment (PPE), including gloves, lab coat, safety glasses or goggles, and closed-toe shoes.

c. *Enter assessment results and analyze student success in achieving this program SLO.*

   Instructors at all levels of our Biotechnology program have the same requirements for lab safety; they are spelled out in the safety contract students sign at the beginning of each semester. Students are monitored for compliance every day in the lab, and are not allowed to be in the laboratory unless they are wearing the appropriate PPE and demonstrating safe, professional behavior. It has been our observation that after the first few weeks of our introductory class (Biot105), students adopt the habit of wearing the appropriate gear and rarely need additional reminders.

d. *Describe revisions in curriculum or teaching strategies implemented to promote student success.*

   We have created a rubric that assesses lab performance, and this rubric includes demonstrating professional behavior in the lab and wearing appropriate PPE. Scores on this rubric are now part of the grading in the core classes in our program (Biot105, Biot110A1, Biot110A2, Biot110A3, and Biot115). Based on assessment in our Biot105 class, students are adopting the habits of wearing appropriate PPE and practicing safe science.

e. * Future Action (Improvements)*
   Maintain current student learning plan

5. Program SLO -

**Demonstrate an understanding of key theoretical concepts in molecular biology and biotechnology as they relate to the biotechnology industry.**

a. *Indicate program assessment strategies used.*
   i. Skills Assessment

b. *Describe the criteria and standards used to appraise student work.*

   In-class exams and quizzes are used to ensure students are developing an appropriate understanding of concepts in molecular biology and biotechnology.

c. *Enter assessment results and analyze student success in achieving this*
program SLO.

Students in the introductory class (Biot105) gain a preliminary understanding of these concepts, and they are practiced and reinforced in the subsequent classes in the program (especially the Biot110 and Biot111 series). When the biotech faculty have met and discussed student achievement in this area, it was noted that there was a large gain in student understanding during the Biot110 series, as students had the opportunity to apply the concepts to the hands-on labs they were performing.

d. Describe revisions in curriculum or teaching strategies implemented to promote student success.

At faculty meetings it was agreed that review of the basic concepts that students heard for the first time in Biot105 was important in the Biot110 classes, to reinforce and deepen student understanding of these ideas. During 2011-12, the Biot110A class expanded coverage of DNA restriction and mapping, and students showed improved test and quiz scores. Assessment in Biot105 confirmed that students were able to apply basic knowledge of the "Central Dogma" of molecular biology, translating nucleotide sequence into protein sequence.

e. Future Action (Improvements)

Maintain current student learning plan

- **SLO Matrix**

  *Key: I-Introduced, P-Practiced with Feedback, M-Demonstrated at the Mastery Level*

<table>
<thead>
<tr>
<th>Course</th>
<th>SLO-1</th>
<th>SLO-2</th>
<th>SLO-3</th>
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• SLO Matrix Comments

• Course SLO & Assessment

**BIOT 115A Mammalian Cell Culture Techniques**

1. Demonstrate sterile techniques. (Example: students will demonstrate the ability to perform experiments in a cell culture hood using appropriate sterile technique.)
2. Show an understanding of basic cell culture theory.
3. Design culture media.
4. Create cell lines.
5. Measure viable cell counts. (Example: students will be able to use a hemocytometer to quantitate cultured cells for passage and cryopreservation.
6. Utilize basic cell culture theory techniques in the laboratory.
7. Apply routine cell maintenance. (Example: students will demonstrate that they are able to quantitate, feed, and passage cultured cells.)
8. Assess freezing & thawing techniques. (Example: students will quantitate resuscitated cells to assess the effectiveness of their cryopreservation and resuscitation techniques.)
9. Recognize cell culture related equipment/facility design issues.
10. Prepare cell proliferation assays.

<table>
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<tr>
<th>Indicate planned course assessment strategies</th>
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<tbody>
<tr>
<td>Rubrics</td>
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<td>Culminating Project</td>
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<td>Performance Assessment</td>
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<td>Other</td>
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</table>
Describe the criteria and/or performance standards used to appraise student work.

Students are expected to submit a complete, thorough, legal, scientific notebook for instructor grading at the end of the course. A professional, scientific, laboratory notebook is kept by each student during the course of the lab and all experiments and results are entered into this notebook by the students. This notebook is graded at the end of the course and used to assess students on all of the student learning objectives except the demonstration of sterile techniques (SLO 1).

Students are expected to demonstrate proficiency in the use of sterile techniques and in their ability to correctly use a hemocytometer to measure viable cell counts (SLO 1 and SLO 5) and will be assessed on these skills using a laboratory practical portion of the final examination.

The "Soft Skills" rubric, midterm, and final examination are used to assess students on their understanding of basic cell culture theory (SLO 2). Students that pass the course are expected to show a thorough understanding of cell culture theory.

Midterm and final examinations are used to assess students on all Student Learning Objectives. Students able to pass the midterm and final examination will have demonstrated their knowledge in all areas of cell culture.

All skills included in the Student Learning Objectives will be assessed by the instructor during each laboratory session to insure that students are acquiring the knowledge and proper use of techniques to demonstrate sterile techniques, design culture media, measure viable cell counts, utilize basic cell culture theory techniques in the laboratory, apply routine cell maintenance, assess freezing & thawing techniques, recognize cell culture related equipment/facility design issues, and prepare cell proliferation assays. Students are expected to show proficiency in all areas listed above in order to pass the course.

Enter assessment results and analyze student success in achieving course SLOs.

Pre- and post- laboratory assignments were added to the course in the Fall of 2010. Since the addition of the pre- and post- laboratory assignments to the course an increase in student understanding of sterile techniques, media design, viable cell counts, basic cell culture theory techniques in the laboratory, cell maintenance, freezing & thawing techniques, and cell proliferation assays has been observed by the instructor. Students have been more prepared and self-motivated when performing experiments.

Describe revisions in curriculum or teaching strategies implemented to promote student success.
Designed and implemented a "Soft Skills" rubric to assess students skills in areas that the Biotechnology faculty have determined will be important for their future hiring into the biotechnology industry as interns and/or technicians. The rubric is used to assess students on the following skills: self-motivation and independence, teamwork, professionalism, efficiency, accuracy, oral and written communication skills, critical thinking, and math skills.

A modular grading technique, that emphasizes the students performance in both theory and hands-on lab skills, has been implemented. Students are expected to demonstrate proficiency in both of these portions of the course in order to receive a passing grade for the entire course.

A pre-test on basic laboratory math is now being given to students when they first enter the course and again at the end of the course to assess their current level of skill when entering, and whether their math skills have improved during, the course.

Pre- and post-laboratory assignments are given for each laboratory in order to ensure students arrive prepared to begin the laboratory (pre-laboratory assignments) and that the important information from each laboratory is emphasized after the laboratory is completed (post-laboratory assignments).

### Future Action (Improvements)

Maintain current student learning plan

*The current types and level of assessment will continue. The methods and level of assessment will be re-evaluated in the future after the addition of the laboratory math course to the program and when current assessment strategies have been evaluated further to determine their success.*

### BIOT 115A Mammalian Cell Culture Techniques

1. Show an understanding of basic cell culture theory.
2. Demonstrate a basic knowledge of the use and applications of equipment found in cell culture laboratories, including inverted-phase contrast microscopes, hemocytometers, automated cell counters, and biosafety cabinets.
3. Apply, and demonstrate an understanding of, cell culture laboratory techniques and laboratory math including: sterile technique, measurement of viable cell counts, routine cell maintenance, cell culture media preparation, cryopreservation and resuscitation of cells, creation of secondary cell lines, and preparation of cell proliferation assays.
4. Maintain a scientific laboratory notebook in which they demonstrate an understanding of the scientific method, experimental design, and data collection.

### Indicate planned course assessment strategies

<table>
<thead>
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Future Action (Improvements)

Maintain current student learning plan
The current types and level of assessment will continue. The methods and level of assessment will be re-evaluated in the future after the addition of the laboratory math course to the program and when current assessment strategies have been evaluated further to determine their success.

BIOT 105 Introduction to Cell & Molecular Biology

1. Demonstrate the appropriate behaviors, teamwork, and proper safety procedures to work in a laboratory environment. This includes maintaining a professional quality laboratory notebook.
2. Demonstrate an understanding of the scientific method, experimental design, data collection, basic statistics, basic laboratory skills, and procedures, including the preparation of reagents and other materials.
3. Demonstrate basic concepts and applications of chemistry and biochemistry appropriate for a biotechnology laboratory, with the goal of preparing students to work with basic and sophisticated instrumentation in a biotechnology laboratory, e.g., spectrophotometers, electrophoresis apparatus, pH meters, and chromatographic systems.
4. Demonstrate the proper procedures for the aseptic culturing of microorganisms, their preparation for microscopy (e.g., Gram staining), and their use as vectors in recombinant DNA work.
5. Describe the general features of cell structure & function, how cells reproduce (mitosis & meiosis), and basic concepts in Mendelian and chromosomal inheritance.
6. Describe the fundamentals of molecular inheritance, including DNA structure & replication, transcription, translation, introduction of mobile elements, and genomics.

Indicate planned course assessment strategies

Rubrics
Performance Assessment
Skills Assessment

Describe the criteria and/or performance standards used to appraise student work.
SLO1: Performance evaluation of proper use of PPE; Lab notebooks evaluated by rubric
SLO2: Performance evaluation of micropipetting and reading volumes in graduated cylinders; correct interpretation of relative sizes of DNA fragments after agarose gel electrophoresis.
SLO3: Quiz on pH and dilutions
SLO4: Performance evaluation, ability to streak bacteria for isolated colonies
SLO5: Final exam questions: Ability to correctly determine parental genotype based on number of offspring in different phenotypic categories, for monohybrid and dihybrid crosses
SLO6: Final exam questions: correct use of genetic code table to translate from DNA sequence to protein sequence

Enter assessment results and analyze student success in achieving course SLOs.

SLO1: By the end of the semester, 11 out of 11 students were wearing appropriate PPE without needing reminders. 8 out of 11 students had top scores on a rubric of proper keeping of a professional laboratory notebook; 3 out of 11 students had incomplete information or unsatisfactory data analysis.

SLO2: 11 out of 11 students were able to micropipette with high accuracy by the end of the semester. 9 out of 11 got a perfect score on readings of volumes in various graduated cylinders; 2 of 11 made at least 1 error. 10 out of 11 students correctly identified larger and smaller fragments of DNA based on their electrophoretic mobility.

SLO3: 9 out of 10 students scored a B or higher on a quiz that tested understanding of pH, Hydrogen ion concentrations, buffers, and dilutions.

SLO4: 8 out of 12 students were able to reliably get single colonies when streaking E. coli for isolation.

SLO5: 10 out of 11 students were able to correctly determine parental genotypes in a monohybrid cross; 9 out of 11 students could do this in a dihybrid cross.

SLO6: 11 out of 11 students were able to correctly use the genetic code table to translate DNA sequence into protein.

Describe revisions in curriculum or teaching strategies implemented to promote student success.

Future Action (Improvements)

Describe changes you will make to promote improved student learning

SLO1: Instead of collecting notebooks just twice in a semester, I will collect notebooks after every exam. This will give students better warning if their notebooks are not meeting the required standard. SLO4: I will move the aseptic technique lab earlier in the semester. Last semester I had better success with students learning to streak for singles (13/15) and I think that was because they had more chances to practice their
BIOT 105 Introduction to Cell & Molecular Biology
1. Demonstrate the appropriate behaviors, teamwork, and proper safety procedures to work in a laboratory environment.
2. Apply the correct mathematical operations to the preparation of reagents and buffers, dilutions and dilution series, pH calculations, basic statistics, and the creation of standard curves.
3. Demonstrate an understanding of the scientific method, experimental design, data collection, maintaining a professional laboratory notebook, aseptic technique, laboratory skills and procedures, including the preparation of reagents, buffers, and other materials.
4. Demonstrate basic concepts and applications of biology, chemistry and biochemistry appropriate for a biotechnology laboratory, with the goal of working with basic and sophisticated instrumentation in a biotechnology laboratory, e.g., spectrophotometers, conductivity meters, electrophoresis apparatus, pH meters, microscopes, and chromatographic systems.
5. Describe general features of cell structure & function, how cells reproduce (mitosis & meiosis), basic concepts in Mendelian and chromosomal inheritance, the fundamentals of molecular inheritance, including DNA structure & replication, transcription, and translation.

Indicate planned course assessment strategies

Rubrics
Performance Assessment
Skills Assessment

Describe the criteria and/or performance standards used to appraise student work.

SLO1: Performance evaluation of proper use of PPE; Lab notebooks evaluated by rubric
SLO2: Performance evaluation of micropipetting and reading volumes in graduated cylinders; correct interpretation of relative sizes of DNA fragments after agarose gel electrophoresis.
SLO3: Quiz on pH and dilutions
SLO4: Performance evaluation, ability to streak bacteria for isolated colonies
SLO5: Final exam questions: Ability to correctly determine parental genotype based on number of offspring in different phenotypic categories, for monohybrid and dihybrid crosses
SLO6: Final exam questions: correct use of genetic code table to translate from DNA sequence to protein sequence

Enter assessment results and analyze student success in achieving course SLOs.
SLO1: By the end of the semester, 11 out of 11 students were wearing appropriate PPE without needing reminders. 8 out of 11 students had top scores on a rubric of proper keeping of a professional laboratory notebook; 3 out of 11 students had incomplete information or unsatisfactory data analysis.

SLO2: 11 out of 11 students were able to micropipette with high accuracy by the end of the semester. 9 out of 11 got a perfect score on readings of volumes in various graduated cylinders; 2 of 11 made at least 1 error. 10 out of 11 students correctly identified larger and smaller fragments of DNA based on their electrophoretic mobility.

SLO3: 9 out of 10 students scored a B or higher on a quiz that tested understanding of pH, Hydrogen ion concentrations, buffers, and dilutions.

SLO4: 8 out of 12 students were able to reliably get single colonies when streaking E. coli for isolation.

SLO5: 10 out of 11 students were able to correctly determine parental genotypes in a monohybrid cross; 9 out of 11 students could do this in a dihybrid cross.

SLO6: 11 out of 11 students were able to correctly use the genetic code table to translate DNA sequence into protein.

Describe revisions in curriculum or teaching strategies implemented to promote student success.

Future Action (Improvements)

Describe changes you will make to promote improved student learning

SLO1: Instead of collecting notebooks just twice in a semester, I will collect notebooks after every exam. This will give students better warning if their notebooks are not meeting the required standard. SLO4: I will move the aseptic technique lab earlier in the semester. Last semester I had better success with students learning to streak for singles (13/15) and I think that was because they had more chances to practice their skills compared with this semester’s group.

• Student Achievement: A series of measures including course completion, course retention, persistence, program completion, and others.

1. List expected student achievement outcomes:
2. Analyze changes in data, identify trends, and provide possible contextual explanations for each measure used. (Example measures include: course completion, course retention, persistence, program completion).

Currently under review.

3. Analyze program budget trends and expenditures. Comment on how the program can best use budget resources.
4. Analyze the program's current use of staff, equipment, technology, facilities, and/or other resources. Comment on how the program can best use these resources.
5. Describe any additional notable program achievements (optional).

The 2011-2012 school year saw the first graduates from our program with Associates Degrees in Biotechnology. Included in the graduates was a student
from our high school LAB program.

6. **Additional Program Table Data**
7. **Future Action**
   Current levels of student achievement indicators maintained.

- **Program Analysis**
  After assessing student learning outcomes/impacts, student/program achievement, and the status of previous program improvement objectives (PIOs), analyze the data and any identified trends, and summarize your findings. Use these data and trends to prioritize, revise, or develop new PIOs

  1. **Describe program achievements and successes.**

     Ohlone has a thriving biotechnology program, with students making good progress toward certificates and the AS degree in biotechnology. In May 2012 we had our first graduates with the AS in biotech. Many of our students find jobs in the biotechnology industry after graduation, or even while they are still taking classes. Faculty continue to make improvements in the curriculum to make it current and relevant for the local industry, and are responsive to feedback from our Industry Advisory Board. Our Learning Alliance for Bioscience adds new high school partners every year, and in 2012 we started the school year with a LAB Learning Community group of about a dozen students who started out as LAB high school students and are now studying the sciences at Ohlone. In addition, the LAB program had its first graduate with an AS degree in biotechnology in May 2012.

  2. **According to the evidence, what are the areas needing improvement?**

     We are always in need of updated equipment, and (for example) have a need for new bioreactors and a 98-well plate thermal cycler. In addition, helping our students master the math skills they need to succeed is an ongoing issue. We also could benefit from more industry connections, allowing us to offer a greater variety and number of internship opportunities for our students.

- **Program Improvement Objectives:**
  1. **Objective:**

     Strengthen Ohlone's Biotechnology program by updating the curriculum to stay aligned with industry standards, upgrade equipment to meet the needs of an evolving industry, participate in the development of Ohlone's new Science Center, and increase our ties with local biotechnology companies to give students better access to internships and eventual employment.

     a. **Action Plan**

        **Year 1:**

        Feedback from Ohlone's biotechnology industry advisory board will be used to update curriculum. A rubric for giving students feedback about their hard and soft skills will be implemented in biotechnology laboratory courses to improve student success in attaining internships and eventual employment.
Equipment and facilities will be upgraded to maintain alignment with industry standards. Departmental faculty will participate in planning the new Science Center.

Year 2:
Continue to solicit feedback from industry partners to update curriculum. Expand internship opportunities for students, by strengthening ties with biotechnology industry partners. Personnel are needed to coordinate curriculum development and job placement. Upgrade equipment and facilities as needed. Progress continues with new Science Center.

Year 3:
Continue to solicit feedback from industry partners to update curriculum. Upgrade equipment and facilities as needed. Construction begins on new Science Center.

b. **Staffing**

Year 2:
Hire a full-time industry liaison to coordinate job placement, internships, and curriculum development for all STEM programs.

c. **Equipment (Include items that fit under department budget codes)**

Year 1:
2011: Based on feedback from our biotechnology industry partners, we have a need for a classroom set of conductivity meters, to give students experience with quality assessment of solutions and dilutions they have made in the laboratory. In addition, some equipment upgrades are needed, such as ocular and stage micrometers for our compound light microscopes, additional inverted microscopes for cell culture, and 96-well plate centrifuge.

2012: The conductivity meters and 96-well plate centrifuge were received and have made a positive impact on our Biot105 and Biot111B classes. Students in Biot105 are now able to measure the relationship between concentration and conductivity, for quality assessment of buffers made in the lab. In Biot111B the quality of the data has improved (noise has been reduced) in quantitative PCR reactions due to the use of the plate centrifuge.

2012 Requests: The Biot111 class needs a 96-well thermal cycler so that students can properly perform their PCR optimization experiments. New bioreactors are needed for the Biot115B class, as well as upgraded DNA
sequencing equipment for Biot110A. These equipment items would also be used for Biotechnology Center workshops offered to support biotechnology education in our region.

**Year 2:**
Upgrade equipment based on feedback from industry partners.

**Year 3:**
Upgrade equipment based on feedback from industry partners.

d. **Facilities (Include items that fit under the Facilities budget codes)**
   **Year 1:**
   Planning begins for the new Science Center. Planning for a greenhouse at the Newark campus to support Biot114, and could be shared by the ENVS agriculture classes.

   **Year 2:**
   Planning continues for the new Science Center.

   **Year 3:**
   Begin construction on the new Science Center.

e. **Which college goal(s) does this program improvement objective work to achieve? Clearly describe how your PIO will help achieve one or more of the college goals and objectives, has impact beyond the particular department, and contributes to student learning/success.**

   1. Through innovative programs and services, improve student learning and achievement.
   **Rationale:**
   The proposed recommendations - improved connection with industry via a liaison, updated curriculum, upgraded equipment and facilities - will improve our biotechnology students' learning and achievement.

   2. Support the economic vitality of the community through educational programs and services that respond to identified employment needs.
   **Rationale:**
   The proposed recommendations - closer ties with industry via a liaison, updated curriculum, upgraded equipment and facilities - will allow us to
support the local biotechnology industry with graduates who are prepared to find and excel at jobs at local companies.

4. Use human, fiscal, technological, and physical resources responsibly, effectively, and efficiently to maximize student learning and achievement. 
Rationale:

Equipment in our department (such as the DNA sequencer) can also be used for courses covering DNA fingerprinting (administration of justice, anthropology, forensics) and ancestry tracing (anthropology).

5. Lead and educate the community in environmental sustainability. 
Rationale:

Improved greenhouse facilities will allow us to develop curriculum tied into sustainable agriculture, bioremediation, and biofuels (cellulose and algae), in conjunction with faculty in the Environmental Studies department.

7. Increase access to higher education of under-served and under-represented demographic groups in the District and local communities. 
Rationale:

The proposed recommendations will enhance the Learning Alliance for Bioscience pathway program for under-represented students coming from local high schools.

2. PIO Assessment
   a. Enter assessment results with analysis.

In the last year we have upgraded the biotechnology department's equipment by purchasing (via minigrants) a classroom set of conductivity meters and a 96-well plate centrifuge. These items have made a positive impact on our Biot105 and Biot111B classes.

Students in Biot105 are now able to measure the relationship between concentration and conductivity, for quality assessment of buffers made in the lab. This skill was requested by members of our biotechnology advisory board, as something graduates from our program should be familiar with.

In Biot111B the quality of the data students produce has improved (noise has been reduced) in quantitative PCR reactions due to the use of the 96-well plate centrifuge. This allows students to graph meaningful, quality data, and compare experimental data to a standard curve.
b. Describe how PIO achieved one or more of the college goals and objectives, had an impact beyond the particular department, and contributed to student success/learning.

1 Through innovative programs and services, improve student learning and achievement.
   Rationale:
   Our upgraded equipment has improved our biotechnology students' learning and achievement (see above).

2 Support the economic vitality of the community through educational programs and services that respond to identified employment needs.
   Our upgraded equipment allows us to support the local biotechnology industry with graduates who are prepared to find and excel at jobs at local companies.

c. Future Action

1. Objective:

   Strengthen Ohlone's Learning Alliance for Bioscience high school outreach program, to encourage more local students (including those underrepresented in the sciences) to study biotechnology and other STEM areas at Ohlone.

   a. Action Plan
      Year 1:
      Continue to reach out to local high schools, to expand our partnerships. Provide professional development opportunities for teachers, and expanded tutoring for students in the program. Provide a strong Summer Bridge program, building on past successes, to encourage students to study the sciences at Ohlone. Connect with industry to provide further tour and internship opportunities. Explore funding opportunities through grants, to support the LAB and Summer Bridge.

      Year 2:
      Same as year 1, with likely grant writing.

      Year 3:
      Same as year 2.

   b. Other (Include other resources needed)
      Year 1:
      Funds are needed to support the Summer Bridge program, which costs
between $10K and $12K per year.

Year 2:
Summer Bridge funds needed.

Year 3:
Summer Bridge funds needed.

c. Assessment Plan: List Assessment Strategies
Year 1:
Success can be measured in terms of numbers of students passing articulated biotech and biochem classes at local high schools, the number of high school teachers participating in professional development workshops and attending LAB teacher meetings, the number of students participating in the Summer Bridge program, and the number of students entering and continuing in the LAB Learning Community at Ohlone. Ultimately also in the number of students from the LAB program who earn a degree or certificate or successfully transfer in the STEM programs here at Ohlone.

Year 2:
Same.

Year 3:
Same.

d. Which college goal(s) does this program improvement objective work to achieve? Clearly describe how your PIO will help achieve one or more of the college goals and objectives, has impact beyond the particular department, and contributes to student learning/success.

1. Through innovative programs and services, improve student learning and achievement.
   Rationale:

   The LAB program seeks to improve student participation in the STEM fields by interesting high school students in the hands-on science of biotech.

2. Support the economic vitality of the community through educational programs and services that respond to identified employment needs.
   Rationale:
The biotech industry is strong in our area, and the LAB program produces students with skills in this area.

7. Increase access to higher education of under-served and under-represented demographic groups in the District and local communities.
Rationale:
Though the LAB program is open to all students, we particularly encourage students underrepresented in the sciences to participate.

2. PIO Assessment
   a. Future Action

● Outside Review Results
   1. List each team members name and title.
      None.
   2. Discuss key feedback provided by team and how it was incorporated into the report.
      None.

● Attached Files
   1. BLOT115A_Spring_2012_assessment.docx
   2. AssessmentBiot105Spr12.docx
   3. Barnby_Course_Assessment_in_a_Box_Version_II.doc