Department/Program Review

**Self-Study Report Template**

**2007 - 2012**

**Department:** **Biology/Biotechnology**

**Program: Science Mathematics and Engineering (SME) (BIOE.S.AS) in Biology and (BTN.S.AAS) in Biotechnology.**

**Section I: Overview of Department**

1. **Mission of the department and its programs(s)**

*What is the purpose of the department and its programs? What publics does the department serve through its instructional programs? What positive changes in students, the community and/or disciplines/professions is the department striving to effect?*

The purpose of the Biology Department is to improve biological science literacy among students. Students in biology and biotechnology are exposed to both historical and current issues in science. They explore modern problems that affect themselves, local, and global populations. In the lecture class environment, students have an opportunity to interact with their instructors and fellow students as these issues are addressed. Students also experience hands-on work in laboratories where they develop skills using biological supplies and equipment, study biological models, observe and dissect biological specimens, design and run experiments, learn aseptic techniques, practice weighing and measuring, collect and analyze data, and write laboratory reports and notebooks. Through these experiences, students gain understanding and appreciation for the scientific method that is central to all of the sciences.

The Biology Department offers courses that support transfer to universities, achievement of an SME A.A. or A.A.S. degree with emphasis in Biology and achievement of degrees and/or certificates from other divisions. The Biology Department offers the A.A.S. degree in Biotechnology (under the quarter system) and BIOE.S.AS and BTN.S.AAS (under the semester system).

1. **Description of the self-study process**

*Briefly describe the process the department followed to examine its status and prepare for this review. What were the strengths of the process, and what would the department do differently in its next five-year review?*

The self-study process began in fall 2012 with a meeting between Jared Cutler, PhD. and the chair to develop the Environmental Scan. During the fall term, the chair attended an orientation and the biology department met with Jared Cutler, who described the year process and answered our questions. Each full-time faculty member then selected one or more sections of the review template and collected information or analyzed the data related to that section. The individual sections were compiled by the chair and multiple drafts were circulated for feedback and editing. The faculty discussed the review before submitting the final version.

One of the strengths of this self-study was the involvement of the department’s entire faculty and staff. This involvement served to promote awareness in our faculty and staff of the overall mission of the department, as well as issues that might be outside of their individual teaching responsibilities.

Because this has probably been the most comprehensive review of the Biology Department to date and is the last program review prior to quarter to semester conversion, it will serve as an important benchmark when assessing our progress in subsequent department reviews within the semester system.

**Section II: Overview of Program**

1. **Analysis of Environmental Factors**

*This analysis, initially developed in a collaborative meeting between IPR and the department chairperson, provides important background on the environmental factors surrounding the program. Department chairpersons and faculty members have an opportunity to revise and refine the analysis as part of the self-study process.*

The Biology Department supports a variety of degree and certificate programs from several academic divisions at Sinclair: In addition, the department has offered a career degree, the A.A.S. in Biotechnology, since fall, 2001. Outside of Sinclair, the department has associations with local universities, with several Tech Prep high schools, and with biotechnology employers in the region.

The department offers two general biology sequences with laboratories/or integrated laboratories, one for non-science majors (BIO 111, 112, & 113 General Biology I, II, III) (**BIO 1111 and 1212**) and the other for science majors (BIO 171, 172, & 173 Principles of Biology I, II, III) (**BIO 1171 and 1272**). The major’s sequence (171, 172, & 173) (**BIO 1171 and 1272**) was submitted to the Ohio Board of Regents for the Biology Transfer Assurance Guide (TAG) and approved. Later this class integrated the laboratories into the lecture sequences for pedagogical reasons.

The department offers the following anatomy and physiology courses and/or sequences that support a variety of degrees and certificates:

Quarters **(semester version)**

 BIO 107 **(1107)** Human Biology

* + Biotechnology
	+ Emergency Medical Services/Fire Science
	+ Paramedic Program
	+ Mental Health Technology and MHT/CD
	+ Occupational Therapy Assistant
	+ Respiratory Care
	+ Specimen Processing
	+ Tissue Banking Technology
	+ Pharmacy Technology

 BIO 121-122 **(1121-1222)** Human Anatomy & Physiology

* Exercise Specialists
* Exercise Science
* Health Information Management
* Health Information Technology
* Medical Assistant Technology
* Medical Coding &Billing Specialist
* Physical Therapist Assistant
* Radiologic Technology
* Surgical Technology
* Pharmacy Technology

 BIO 141-143 **(1141-1242)** Principles of Anatomy & Physiology

* Dental Hygiene
* Nursing

 BIO 211**(2211)** Human Physiology

* LPN entering nursing

The department operates B.I.O.S.I.S. (a self-study and tutorial laboratory service) that is available to all students. B.I.O.S.I.S. employs student tutors and provides a place where students congregate to study and review utilizing the same models, slides, specimens, and other materials that are found in the biology labs. Peer to peer interactions promote significant academic gains.

# B (1). Statement of program learning outcomes and linkage to courses

*Complete attached Program Learning Outcomes Form, identifying where in the curriculum each program learning outcomes is addressed.*

The program learning outcomes used for the biology emphasis program are the same ones adopted by the Division of Liberal Arts and Sciences and continued when the department joined in with the Science Mathematics and Engineering Division. The following table outlines these learning outcomes, and the required courses in the biotechnology program through which these outcome goals are met.

|  |
| --- |
| **Program Outcomes and Program Linkages** |

|  |  |  |
| --- | --- | --- |
| **Outcome Name** | **Description of Outcome** | **Courses** |
| Critical Thinking and Problem Solving | Demonstrate the ability to think logically and demonstrate problem solving using analysis, synthesis and evaluation. | BIO 1171, BIO1272, CHE 2111, CHE 2121,MET 1131, MAT 2270, OTM Elective |
| Laboratory Foundation | Demonstrate a strong foundation in the natural sciences and the reasoning skills needed for successfully executing laboratory protocols. | BIO 1171, BIO 1272, CHE 1211, CHE 1221 |
| Communication | Communicate effectively in a variety of ways with varied audiences through: writing skills, oral communication skills, listening skills, reading skills, and computer literacy. | BIO 1171, BIO 1272, SCC 1101, ENG 1101, ENG 1201, COM 2111 |

#### B (2). Statement of program learning outcomes and linkage to courses

###### A.A.S. in Biotechnology

The program learning outcomes used for the biotechnology program are the same ones adopted by the Division of Liberal Arts and Sciences and continued when the department joined in with the Science Mathematics and Engineering Division. The following table outlines these learning outcomes, and the required courses in the biotechnology program through which these outcome goals are met.

|  |
| --- |
| **Program Outcomes and Program Linkages** |

|  |  |  |
| --- | --- | --- |
| **Outcome Name** | **Description of Outcome** | **Courses** |
| Critical Thinking and Problem Solving | Demonstrate the ability to think logically and solve problems using analysis, synthesis and evaluation. | BTN 1110, BTN 1120, CHEM 1011, BIO 1111, BIO 1211, BIO 1107, and MAT 1470 |
| Laboratory Foundation | Demonstrate a strong foundation in the natural sciences and the reasoning skills needed for successfully executing laboratory protocols. | BTN 1120, BTN 1201, and BTN 1130 |
| Biotechnology Techniques | Demonstrate knowledge of various experimental systems, including bacterial cultures, mammalian cell cultures and recombinant DNA technology. | BTN 1140, BTN 2210, BTN 2220, and BTN 2230 |
| Global Awareness | Recognize and articulate an understanding of the increasing interdependence of world cultures and their consequences. | HUM OTM and SOC OTM |
| Communication | Communicate effectively in a variety of ways with varied audiences through: writing skills, oral communication skills, listening skills, reading skills and computer literacy. | SCC 1101, ENG 1101, ENG 1201,BIS 1120,and COM 2111 |

**Admission requirements**

*List any admission requirements specific to the department/program. How well have these requirements served the goals of the department/program? Are any changes in these requirements anticipated? If so, what is the rationale for these changes?*

Many biology courses have prerequisites. All 100-level courses that begin a sequence require DEV 0012, 0030, and 0022.Students must complete sequences in order. The technical courses in the A.A.S. in Biotechnology degree are restricted to majors and must be taken in sequence.

 \*Please note below that the department offers the requirement for both the quarter and semester versions.\*

The biotechnology degree has been in existence since 2001. Students who enter the program have a wide range of basic science abilities and aptitudes, from no skills to good skills. Students who complete two years in the Tech Prep Biotechnology Pathway enter the program with credit for BTN 110(1110) Introduction to Biotechnology and BTN 120(1120) Laboratory Safety and Regulatory Compliance.

**Biology Course Prerequisites and Co-requisites**

**\*Quarter Version**

|  |  |  |
| --- | --- | --- |
| **Course** | **Prerequisite** | **Co-requisite** |
| BIO 107/108 | DEV 065, 075, 085 |  |
| BIO 111/117 | DEV 065, 075, 085 |  |
| BIO 112/118 | BIO 111 |  |
| BIO 113/119 | BIO 112 |  |
| BIO 121/127 | DEV 065, 075, 085 |  |
| BIO 122/128 | BIO 121 |  |
| BIO 125 | BIO 107 |  |
| BIO 141/147 | DEV 065, 075, 085 and CHE 117 or 120 |  |
| BIO 142/148 | BIO 141 |  |
| BIO 143/149 | BIO 142 |  |
| BIO 171/177 | DEV 065, 075, MAT 101 |  |
| BIO 172/178 | BIO 171 |  |
| BIO 173/179 | BIO 172 |  |
| BIO 205 | BIO 107, 111, 115, 121, 131, 161, 211, CHE 117, or 122 |  |
| BIO 211/212 | BIO 107 or 112, or 121, or 141 or LPN Certification |  |
| BIO 235/236 | BIO 113 or 173 or 143 and MAT 116 |  |
| BIO 245 | MAT 110 and ASE 145 |  |
| BTN 120 | CHE 131 or 120 | CHE 131 or 120 |
| BTN 130/131 | BTN 120  |  |
| BTN 140/141 | BIO 111 and BTN 130 |  |
| BTN 210/211 | BIO 112, CHE 122, and BTN 130 |  |
| BTN 220/221 | BIO 112, CHE 122, and BTN 130 |  |
| BTN 230/231 | BIO 112, CHE 122, and BTN 130 |  |
| BTN 235 | BTN 210 |  |
| BTN 240/241 | BIO 113, BTN 210, and BTN 230 |  |
|  |  |  |
|  |  |  |

**\*Semester Version**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course** | **Course Title** | **Prerequisite** | **Co-requisite** |
| BIO 1101 |  Body Structure and Function |  |  |
| BIO 1104 |  HIV/AIDS |  |  |
|  |  |  |  |
| BIO 1107/1108 |  Human Biology | DEV 0022 |  |
|  |  |  |  |
| BIO 1111/1117 |  General Biology I | DEV 0012, 0026, 0030 |  |
| BIO 1211/1217 |  General Biology II | BIO 1111 |  |
|  |  |  |  |
| BIO 1121 |  Human Anatomy & Physiology I | DEV 0012, 0022, 0030 |  |
| BIO 1122 |  Human Anatomy & Physiology II | BIO 1121 |  |
|  |  |  |  |
| BIO 1141/1147 |  Principles of Anatomy & Physiology I | DEV 0012, 0026, 0030 |  |
| BIO 1242/1248 |  Principles of Anatomy & Physiology II | BIO 1141 |  |
|  |  |  |  |
| BIO 1171 |  Principles of Biology I | DEV 0012, 0026, 0030 |  |
| BIO 1272 |  Principles of Biology II | BIO 1171 |  |
|  |  |  |  |
| BIO 2205 |  Microbiology | BIO 1107 or BIO 1111 or BIO 1141 |  |
| BIO 2211/2212 |  Human Physiology | BIO 1107 or BIO 1111 or BIO 1141 or CHE 1111 or LPN Diploma |  |
| BIO 2222 |  Evolution |  |  |
| BIO 2225 |  Ecology |  |  |
| BIO 2235 |  Genetics | BIO 1111 |  |
|  |  |  |  |
| BTN 1110 |  Biotechnology & Bioethics | Restricted to Majors |  |
| BTN 1120 |  Laboratory Safety & Reg. Compliance | Restricted to Majors |  |
| BTN 1130/1131 |  Biological Reagents Preparation | CHE 1111 or CHE 1211 and Restricted to Majors. BTN 1120 |  |
| BTN 1140/141 |  Cell Cultures | BIO 1111, CHE 1111 and BTN 1130 and Restricted to Majors |  |
| BTN 1201 |  Biotechnology Careers | BTN 1110 and Restricted to Majors  |  |
| BTN 2210/2211 |  Protein Purification & Analysis | BIO 1111, CHE 1111 and BTN 1130 and Restricted to Majors |  |
| BTN 2220/2221 |  Microbiology & Fermentation Methods | BIO 1111, CHE 1111 and BTN 1130 and Restricted to Majors |  |
| BTN 2230/2231 |  Molecular Biology Techniques | BIO 1111, CHE 1111 and BTN 1130 and Restricted to Majors |  |

**Section III: Student Learning**

1. **Evidence of student mastery of general education competencies:***What evidence does the department/program have regarding students’ proficiency in general education competencies? Based on this evidence, how well are students mastering and applying general education competencies in the program?*

The Biology department enhances the students’ proficiency in the General Education Competencies by:

Biology students demonstrate proficiency in the **Computer literacy** competency by:

* Using email to communicate and send/receive attachments
* Using computers to access SCC network drives from files provided by the course instructors.
* Using my.sinclair web portal for access to test grades, classroom and power point presentations and other instructor communication.
* Using publishers assisted activities, such as Learn Smart from McGraw-Hill or Mastering Biology (Pearson) to answer online questions.
* Using computers to research lab and lecture topics and write papers based on such research
* Using online activities developed by faculty of Biology Department and supported by on campus IT.
* Online lecture students need to send and respond to emails, post and reply to discussion forums, navigate within the online material, and take online assessments. Students are required to explore web resources for additional information.

Biology students demonstrate proficiency in the **Critical Thinking** competency by:

* The emphasis of all courses centers around scientific method; observation, hypothesis formation, predictions, experimentation, evaluation of results and conclusions.
* The foundation of all of the courses offered within the department is evolution, to which the student must critically analyze information and observations about the past, present, and future.
* Courses offered within the department encourage the student to closely examine the three functional domains of learning; cognitive (knowledge based), affective (attitudinal areas of growth), and psychomotor (physical skills).
* Courses offered focus on many avenues of critical thinking and are addressed by the following; analyzing complicated lecture and lab exam questions, collaborative quizzes in face to face settings, collaborative learning activities involving problem solving using experimental methods in classroom settings.

Biology students demonstrate proficiency in the **Information Literacy** competency by:

* The department uses textbooks that meet the collegiate level of expectations with regards to content and presentation.
* Students work in collaborative groups for in class activities and are encouraged to develop study groups to aid in their evaluation and use of knowledge.
* Honors and non-honors students are expected and required to gather information from a variety of external sources such as websites, peer-reviewed journals, etc. in order to write reports and present in class information.
* Students learn tools to evaluate information sources for validity.
* Biology Department material for online content exceeds collegiate standards. This statement is backed by the multiple accolades received with online development. (Please reference awards won)

Biology students demonstrate proficiency in the **Written Communication** competency by:

* Students are required to write laboratory reports.
* Students are required to answer lecture and laboratory exams questions in essay form when applicable.
* Students are exposed to writing research papers in MLA format
* Students write review questions for in class exam reviews.
* Online lecture students are required to participate in online discussion forums

Biology students demonstrate proficiency in the **Oral Communication** competency by:

* Students are expected to ask and respond to questions during lecture and laboratory meetings
* Students are encouraged to work and collaborate in small groups during certain lecture and laboratory circumstances and report results to the class.
* Certain courses require students to give 20 minute presentations within the lecture.
* Honors students are required to give a substantial oral presentation at the end of the quarter to fulfill the requirement of the project.

Biology students demonstrate proficiency in the **Values/Citizenship/Community** competency by:

* Biology teaches students about the unity of all life on our planet and our responsibility to be proper stewards of this planet. The future of our species depends on hard decisions we make today about our environment. These issues are assessed in numerous ways; mainly in written responses to such discussions.
* Many of the classes expose our students to; deeper scientific knowledge, thinking independently, responsibility and authority, curiosity, integrity, and humility.
* Many of the classes offered expect students to confront problems and issues surrounding socioeconomics and cultural differences.
* The students are held accountable for the values expressed in the Sinclair Community College Honor code.
* Some courses require participation in Service Learning activities.
1. **Evidence of student mastery of general education competencies:**

**A.A.S. in Biotechnology**

The four primary general education competencies that we strive to instill in our students are: **oral and written** **communication, critical thinking, and values/citizenship/community.**

**\*Indicated below are the quarter system classes, but is also noted for the semester versions.\***

**Written and oral communication** **skills** are both assessed in all of the biotechnology courses.

* BTN 110 (1110) and BTN 140 (1140) and BTN 270 (2270) require library research, a written report, and an oral presentation on a current topic in biotechnology.
* In BTN 270 (2270), each student gives a 30-minute seminar, which is critiqued by peer-evaluations and via an oral presentation rubric used by the instructor.
* All biotechnology courses with a laboratory component (BTN 130, 140, 210, 230, and 240) require the student to maintain a laboratory notebook in accordance with Good Laboratory Practices (GLPs), an industry standard in laboratory documentation.
* BTN 210(2210) has students present a relevant journal article to the class.

**Critical thinking skills** are assessed in the following ways:

* BTN 110(1110) requires students to discuss ethical implications and controversies of biotechnology such as stem cell research, gene therapy, genetically modified foods, and cloning.
* Biotechnology laboratory courses require students to follow SOPs (Standard Operating Procedures), interpret and follow written laboratory protocols, set-up of one’s own work station by thinking through the procedures to decide on the supplies and equipment needed, operate instruments, observe safety regulations, etc.

Several activities have been incorporated into the biotechnology program to assess **values/citizenship/community** as well.

* Students work in teams in BTN 110 (1110) researching on a topic in biotechnology and preparing a written report. They discuss topics with global interest such as stem cell research and human cloning, where the instructor acts as a moderator. This exercise gives the students exposure to differing viewpoints on controversial topics, and the opportunity to develop sensitivity to others’ ideas and beliefs.
* All the laboratory courses are designed to simulate the work site, by requiring students to prepare the laboratory for the procedure they have to execute, as well as clean up after themselves. This provides the students with a sense of ownership for their actions, and creates awareness that everyone has to pitch in for the laboratory (or the work place) to run smoothly.
1. **Evidence of student achievement in the learning outcomes for the program**

*What evidence does the department/program have regarding students’ proficiency in the learning outcomes for the program? Based on this evidence, how well are students mastering and applying the learning outcomes? Based on the department’s self-study, are there any planned changes in the program learning outcomes?*

* As the students progress through the program they are given more freedom to solve problems in the lab. In first year classes students focus on safety and following directions. In the second year they shown techniques and given problems they are to solve. The instructor gives guidance to groups and individuals and there are often several right answers and techniques being used in the classroom at one time. The students share their results and their methods to learn other problem solving techniques.
* Students are tested in many classes by giving problems to which they are to design an experiment or solution to answer.
* Students are asked to read and respond to online news articles and videos which focus on more current and controversial topics in biotechnology (such as use of embryonic stem cells, genetically modified foods, cloning and other related topics). The students respond on a personal, scientific and community level to these problems and how they might impact them on several levels.
* Students give several presentations and term papers throughout the program, some done as team collaboration and some done independently.
* Students are divided into small groups in the classroom for active learning activities. A representative reports findings to the class.
* Each student must keep a detailed laboratory notebook in classes with lab components. This is graded with feedback several times during the semester/quarter.
* Some class content, discussion forums and some testing are performed online.
* Students have several opportunities to review and present peer-reviewed journal articles during the program.
* Students are introduced to microbiology, microbiological fermentation, recombinant DNA and mammalian cell culture during the program. These have detailed labs and protocols the students must become proficient in for passing lab grades.
* Students learn and are assessed on aseptic technique as it applies to DNA handling, mammalian and bacterial cell cultures.
* General biology classes and labs are prerequisites to courses in the biotech program. The scientific method is shown not in theory but is practiced out nearly daily. Complex biological information must be mastered to understand what is happening in the lab which students are assessed on their ability to describe.

Success rates in advanced BTN classes increases as the students’ progress in the program. This is due to increased master of the scientific method, more familiarity with the equipment and the lab, and the departure of students who are not strongly interested in the program (meaning that they decide BTN isn’t what they “thought it was”). The following is a charter showing the success rates (Those with a C or better) in all BTN classes. A nonsuccess is considered a grade of D or F, U, N or W.

1. **Evidence of student demand for the program**

*How has/is student demand for the program changing? Why? Should the department take steps to increase the demand? Decrease the demand? Eliminate the program? What is the likely future demand for this program and why?*

Demand has increased for this major in part due to economic decline and increased student enrollment. In the past that has only been one lab and lecture section for each biotech class (that has a lab component), lab sections have been added to each course in the program to accommodate increased enrollment. The maximum in each lab is set at the amount of equipment currently available and in good working order. Student groups are limited to a maximum of 4 students per group (increased from 2 per group).

The following graph shows the total seat counts for all biotechnology classes over the last five years.

The Biology Department has experienced steady enrollment growth over the last few years, especially in courses that support the health professions.

**General Biology**

* + Many courses are closed early in the registration process, especially the first course in sequences, and many lecture sections are over-enrolled by the first day of classes.
	+ Enrollment has grown steadily over the last five years.

**Anatomy & Physiology Courses:**

Enrollment for BIO 107(1107) Human Biology

* Has increased over the past five years
* Classes are usually closed early during the registration process preventing an unknown number of students from registering
* The number of sections offered by the department has steadily increased over the past five years until lab capacity was met.

Enrollment for BIO 121(1121) Human Anatomy &Physiology I

* Has increased over the past three years

Enrollment for BIO 141(1141) Principles of Anatomy & Physiology I

* Has rapidly increased over the past five years
* Classes usually close early during the registration process preventing an unknown number of students from registering. This has been a problem until the addition of a new lab (4012) which increased capacity 4 per lab section.
* The number of sections offered by the department has steadily increased over the past five years. Capacity can increase until lab capacity is met.

The need for health care professionals is increasing which is reflected by the increase in enrollment of the above courses that support these programs at Sinclair Community College. One frustration that is consistently expressed by students in A&P courses is the waiting lists for these programs. If successful students continue to have to wait 2-3 years to enter their programs, a negative effect on enrollment in these courses may arise.

The department should see an increase in future demand for all courses. This assumption is based upon the need for qualified students to fill job market demand, as evidenced by:

* + The fastest growing occupations in America in relation to a general biology background are medical assistants, physician’s assistants, home health aides, health information technicians, physical therapy aids and assistants. (Source: Bureau of Labor Statistics)
	+ Biology related high paying jobs include surgeons, anesthesiologists, pediatricians, dentists, and general practitioners. (Source: Bureau of Labor Statistics)
	+ Biology is a generalized requirement for many med schools and graduate schools, health-related and otherwise.
	+ Enrollment in the Biotechnology program has increased over the past five years.

Classes eliminated since last program review under quarter system. Both of the following classes were eliminated and content became delivered as **Biology 121/122 (1121/1222) Human Anatomy & Physiology**

* **Biology 131/132 Radiologic Anatomy & Physiology**
* **Biology 161/162 Human Anatomy & Physiology (formerly Surgical A & P)**

Classes eliminated since last program review under semester system

* **Biotechnology 235 HPLC.** Content delivered in Protein Purification class under semester conversion
* **Biotechnology 240 Bioinformatics**. Content delivered in Molecular Biology class under semester conversion
* **Biology 125 Respiratory Anatomy & Physiology.** Respiratory department absorbed class.
1. **Evidence of program quality from external sources (e.g., advisory committees, accrediting agencies, etc.)**

*What evidence does the department have about evaluations or perceptions of department/program quality from sources outside the department? In addition to off-campus sources, include perceptions of quality by other departments/programs on campus where those departments are consumers of the instruction offered by the department.*

**Evidence from partnering SCC departments:**

**Excellent performance on state/national certifying/licensing exams**

* **Dental Hygiene**: Almost always 100% pass rate for Sinclair students.
* **Nursing**: 94% pass rate averaged over the self-study time frame. Below are the NCLEX rates.



* **Physical Therapy Assistant**: 80 – 100% pass rate for Sinclair students (versus 75% for students nationally).
* **Radiologic Technology**: 98% pass rate averaged over self-study time frame.
* **Health Information Management**: 100% pass rate averaged over self-study time frame.

**Evidence from Biotechnology:**

* A Biotechnology Advisory Board was formed soon after launching the degree program in biotechnology. Board members include representatives from the biomedical/pharmaceutical industry (Eli Lilly, The Rogosin Institute, Orchid GeneScreen, Anderson Consulting, OMERIS) as well as academia (WSU, Univ. of Dayton, SCC). The Board has been invaluable in providing endorsement of our curriculum design for the lecture and laboratory courses. It also provides valuable input regarding curriculum, current training needs, and employment demands of the biotechnology industry. Typically, the Board convenes twice a year.
1. **Evidence of the placement/transfer of graduates**

*What evidence does the department/program have regarding the extent to which its students transfer to other institutions? How well do students from the department/program perform once they have transferred? What evidence does the department have regarding the rate of employment of its graduates? How well do the graduates perform once employed?*

* **Success after transferring to other institutions**

 **Nursing:** Graduates enrolled in BSN completion programs in

area universities are given credit for all Sinclair biology courses and are highly successful in the programs. An example of that success is that all Sinclair nursing graduates at Wright State do very well in the pathophysiology course (according to the Dean of the College of Nursing and Health at WSU).

**Biology:** By “word of mouth”, many of our biology students have been quite successful when continuing their biology degrees. Many of the faculty continues the strong bond between student/instructor, keeping such faculty up to date as to the students’ progress.

* **Excellent employment evaluations**

**Respiratory Care:** Graduates are evaluated every year as employees with an extensive survey.  Overall, Sinclair graduates score very high on such a survey

**Health Information Management:** 100% employer satisfaction during self-study.

**Biotechnology:** Many of our advisory board members (whom hire our graduates) communicate directly with our faculty, often commenting on the success of our graduates from the biotechnology program within their companies. As of Summer 2012, the biology department hired a biotechnology graduate to act as a part time laboratory technician. Communication is maintained with prior students through email and a biotechnology Facebook website to post job opportunities, and to allow students to network with past graduates who are employed.

1. **Evidence of the cost-effectiveness of the department/program**

*How does the department/program characterize its cost-effectiveness? What would enhance the cost-effectiveness of the department/program? Are there considerations in the cost-effectiveness of the department/program that are unique to the discipline or its methods of instruction?*

“According to a Contribution Margin Analysis report FY08 to FY12, the biology department is a high revenue contributing department per FTE, with Contribution Margins per FTE (full-time equivalent) of $4,073 (2008), $3,758 (2009), $3,563 (2010), $3,834 (2011), and $3,689 (2012).

Other data show that our average contribution margin *per FTE* over the five-year period FY07–FY12 was $3,711.”

It is remarkable that the cost of educating biology students has decreased while enrollments in biology and costs of goods and services have increased. Some of this success in holding down costs might be attributed to departmental practices. First, our lab manager comparison shops before placing an order for lab supplies and equipment. Second, we do not hire student workers to assist with lab setups. Third, we have a high average class sizes (ACS).

**Section IV: Department/Program Status and Goals**

1. **List the department’s/program’s strengths, weaknesses and opportunities**

**Strengths**

* Diverse collection of full-time faculty with strong academic preparation, industry experience, and who continue to maintain professional associations and advance their knowledge in their subject areas.
* An atmosphere of respect and collegiality exists between the faculty of our department and the departments of the programs that our courses support.
* Outstanding mentoring program that prepares new faculty to succeed when transitioning to full time status.
* In the past five years the department has added or replaced various ACF positions, replaced a full time lab manager with a lab technician, began the mentoring of a Grow Our Own faculty member, and has hired a full time administrative assistant.
* Faculty and staff continue to attend multiple seminars and college wide training sessions in order to be current within the job description.
* Faculty foster an atmosphere of respect and remain approachable so that students may receive one on one assistance in achieving their academic goals.
* Faculty collectively feels that maintaining academic standards is an important aspect of supporting both the SME and LHS division.
* Provide support for off Dayton campus classes at Huber Heights, Englewood, and Mason (CVC)
* Support high school dual enrollment classes
* Faculty with a clinical background maintains their State License of Certification and contributes that knowledge to their courses.
* Continue to offer 7 am, 8 pm, and Saturday classes to meet the needs of the student population.
* Offer hybrid courses in BIO 121/122 (1121/1222)
* Multiple lab lecture integration (General Biology for Majors and Human Anatomy & Physiology)
* Highly involved in WiSTEM, Project Lead the Way, Achieving the Dream, Completion by Design, Biotech student club, and multiple county/state science and science career fairs.
* Awards won:
	+ Marigrace Ryan won Bellwether Award from the Future Assembly and Innovator of the Year.
	+ Susan Luken won the SOCHE Award
	+ Dr. Erica Mersfelder and Pam Pendry won adjunct of the year awards from the SME division.
	+ Donna Jennings and Carey Brown won SME staff of the year awards.

**Weaknesses**

* Large student to faculty ratio in general biology classroom settings
* Rooms are overcrowded due to large enrollment.
* The shortage of qualified part-time instructors limits the number of sections that we can offer. Upon recent inspection, the numbers of applicants were high, yet the qualifications were not up to standards sought within the department. Furthermore, many of these applicants wish for a full time position, not realizing they have applied for part time employment. Rest assured we have hired the “cream of the crop”.
* The shortage of laboratory space limits the number of lecture sections that we can offer, especially high-demand courses. This is most noticeable in classes such as microbiology.
* Some older labs (ex. rooms 3013 and 3023) need to be renovated to meet the standards established in our other labs.
* The need to counsel more of our students into the BIO 107(1107) course before they attempt the BIO 141-143 (1141/1242) sequence.
* An unnecessary struggle as a department to replace FT tenure track faculty, ACF, lab managers, and administration assistants.
* Student worker issues in BIOSIS. These include student workers missing assigned times or being tardy to assigned times of work.

**Opportunities**

* Diverse course offerings.
* Faculty “in-touch” with job market.

Biotechnology

The department has been fortunate to expand the pool of qualified full-time instructors available to teach some of the highly technical laboratory courses in biotechnology. All of the instructors who teach the biotechnology courses also teach several of the biology courses offered by the department, and it is essential that they continue to do so, since enrollment in all the biology courses has been growing at a phenomenal rate. However, since most biotechnology lab courses are a high number of credits, instructors who teach biotechnology courses are unable to carry much overload hours. This has a negative impact on the department in staffing the critical courses, and also adversely affects faculty morale, as they are not able to count on much overload pay, in addition to having to contend with 0.75 pay hours for each hour spent in lab. The laboratory courses in biotechnology involve a tremendous work load for the instructor in ensuring student safety, thorough training of each student with intricate procedures, as well as assessment of laboratory notebooks on a regular basis.

As the program continues to grow, we may need to consider offering additional sections of some or all of the biotechnology courses as evening classes, necessitating the recruitment of qualified part-time instructors. However, we have not been able to generate much interest among the pool of qualified part-time instructors who fear the work load to compensation discrepancy.

The program continues to grow and the growth experienced is not due to any concerted recruiting efforts on the part of the college or the division. In other words, we have not enjoyed the privilege of any type of mass-marketing of the program other than brief mentions in the quarterly course bulletin. It is important to further boost the positive trend in enrollment by allocating marketing funds.

**Strengths**

* The extensive course offerings in the biotechnology program exposes students to the many techniques and biological concepts currently used in the field of Biotechnology.
* Students acquire skills in the biotech program not normally obtained in a four-year academic institution. This provides that students with a professional advantage during job searches
* The expansive list of techniques learned in the program is attractive to the employers of area Biotech companies
* Advisory Board provides useful suggestions that improve the curriculum
* Our biotechnology program has served as a focus for building important Tech Prep relationships between Sinclair and local high schools.

**Weaknesses**

* Lack of biotech companies offering internship opportunities to biotech students.
* Lack of a “2 + 2” possibility with neighboring universities.
* Lack of evening/weekend course offerings, in part due to student enrollment and lack of qualified faculty.
* Equipment becoming out-of-date and are costly to replace.

**Opportunities**

* Highlight the success of the program
	+ Number of degrees obtained
	+ Percentage of graduates that found employment in the biotech field. The biology department hired a part time lab technician, who was a biotechnology program graduate in 2012.
	+ Internships available, but limited
	+ Growth of the program over the years (increase in student number)
* Expected growth of the Biotech Industry in Ohio and nationwide
	+ Provides additional job opportunities for the biotech graduates
	+ Students can obtain jobs in academic and medical research labs, private industry (pharmaceutical and biotech companies)
1. **Describe the status of the department’s/program’s work on any issues or recommendations that surfaced in the last department review. *Answered in Italics.***
* Ensure appropriate DEV classes are in place as prerequisites. *Reinvestigated as quarters to semester conversion occurred.*
* Continue collaboration with various departments within and outside of the division. *High levels of communications with our neighboring departments who use our classes.*
* Work with the grant office to develop additional resources for labs.
	+ *Ohio Board of Reagents College Ready STEM Demonstration grant – “Ohio Project Lead The Way Biomedical Sciences Expansion”; conditionally awarded to Sinclair Community College contingent on budget revisions (reduce budget from $300K to $246K).*
	+ *PI for National Science Foundation – Advance Technological Education grant (0802428) entitled: “Dayton Urban STEM Academy,” three year, $642,863; in collaboration with Dayton Public Schools with sub awards to Wright State University, University of Dayton, Miami University and EDvention.*
	+ *NSF-ATE Grant Proposal entitled “The High School STEM Teacher Synergistic Institute” three years $881,783 submitted by Sinclair Community College including partners from Warren County Educational Services Center, Mason High School, and Miami University; funding for 2011-2013*
	+ *Senior Personnel for National Science Foundation - STEM Talent Expansion Program grant (0622466) entitled “STEP: Gateway into first-year STEM curricula: a community college/university collaboration promoting retention and articulation,” four-year, $1,786,559 grant awarded to Wright State University with sub award ($451,553) to Sinclair Community College. 2006-2010*
	+ *Participated in the submission of a USDOL Ohio Bioscience Industry Workforce Preparedness Grant Proposal; approved for funding in May 2010.*
* Monitor and adjust to enrollment demands. *Demands continue to be met*
* Monitor best learning practices in distance learning lecture and lab settings. *Award bestowed upon Marigrace Ryan for such practices.*
* Determine viable options for online class delivery. *Developed and maintain BIO 101 (1101), 104(1104), 107/108 (1107/1108), 111/117 (1111/1117), and 121/122 (1121/1222). BIO 1211 is in current development as self-study is finalized and to be delivered Fall 2013.*
* Research and develop alternative hybrid delivery modes and methods. *Semester conversion allowed for hybrid offerings of BIO 1121/1222 at satellite campuses, saving the college $60,000 dollars at each campus.*

1. **Based on feedback from environmental scans, community needs assessment, advisory committees, accrediting agencies, Student Services, and other sources external to the department, how well is the department responding to the (1) current and (2) emerging needs of the community? The college?**

* + The Biology Dept. is offering more sections of high demand courses especially BIO 107(1107), BIO 121(1211), and BIO 141(1411).
	+ The A.A.S. in Biotechnology was created in 2001 to meet the needs of the biotech industry in Ohio for laboratory technicians and continues to be a viable option for many of our students, as indicated by enrollment increase.
	+ The biology department is following class scheduling guidelines (the block scheduling demand) to the extent possible in order to alleviate the shortage of classrooms. Hybrid offering of various classes assists in this issue.
	+ The biology department maintains high average class sizes in order to accommodate student demand and alleviate the shortage of classrooms.
1. **List noteworthy innovations in instruction, curriculum and student learning over the last five years**

**Awards won**:

* + Marigrace Ryan won Bellwether Award from the Future Assembly and Innovator of the year.
	+ Susan Luken won the SOCHE Award
	+ Dr. Erica Mersfelder, Pam Pendry, and Stephanie Kidd won adjunct of the year awards from the SME division.
	+ Donna Jennings and Carey Brown won SME staff of the year awards.

**Student Success Initiative**:

* Achieving the Dream coaching of Bio 141(1141).
* Integration of BIO 121 (1121), 122 (1222), and BIO 171-173(1171 and 1272) (Integrated for Majors).
* “Early math intervention system” for BTN 130/131(1130/1131) has raised success rates 39%
* All full-time faculty have been online teaching certified through SCC.
* As online courses are developed, enhancement shells with many of the additional online resources are made available to on campus students.

**Collaborative Success:**

With the mentioned student success initiative, the department has seen a steady rise in student success across the board. Many of the initiatives started within the Bio 141 class had “trickle down effects” to other classes. Along with these new initiatives, new technologies and educational pedagogies designed by distance learning, in collaboration with our department, allows for highly evolved means of delivering new and exciting, yet complex topics to the students in a multi-functional way. Success rates shown below:

1. **What are the department’s/program’s goals and rationale for expanding and improving student learning, including new courses, programs, delivery formats and locations?**

As our administration continues to define the goals for Sinclair at the YMCA and Warren County sites, the Biology department is committed to providing course offerings that support these efforts. The ability to offer hybrid classes at these YMCA/Warren county sites has saved the college $60,000 per location.

At this time, our primary goal is to meet the established enrollment demand for Top 45 biology courses (and the semester versions), namely BIO 107 (1107)Human Biology, BIO 141-143 (1141/1242)Human Anatomy and Physiology I- III, BIO 111-113 (1111/1211) General Biology I-III (for non-majors). No new courses are planned at this time, as some were removed from the “books” in semester conversion.

1. **What are the department’s goals and rationale for reallocating resources? Discontinuing courses?**

Classes eliminated since last program review under quarter system. Both of the following classes were eliminated and content became delivered as **Biology 121/122(1121/1122)** **Human Anatomy & Physiology**

* **Biology 131/132 Radiologic Anatomy & Physiology**
* **Biology 161/162 Human Anatomy & Physiology** (formerly Surgical A & P)

Classes eliminated since last program review under semester system

* **Biotechnology 235 HPLC**. Content delivered in Protein Purification class under semester conversion
* **Biotechnology 240 Bioinformatics**. Content delivered in Molecular Biology class under semester conversion
* **Biology 125 Respiratory Anatomy & Physiology**. Respiratory department absorbed class.
1. **What resources and other assistance are needed to accomplish the department’s/program’s goals?**
* Laboratories for some high-demand courses are booked to capacity, preventing us from offering enough sections to meet the demand. This problem is evident in classes such as microbiology lab BIO 206(2206).
* As enrollments grow, additional funding for classroom and lab supplies and equipment is essential. Biology uses expendable supplies in all courses such as Scantron testing forms, microbial growth media, dissection specimens, chemical reagents, and other disposables such as gloves, slides, pipettes, pipette tips, paper towels, Petri dishes, and test tubes.
* Many of the laboratories are functionally outdated and are not conducive to collaborative learning.
* Much of the equipment in our biotechnology curriculum is nearing the end of their lifecycle usage. Repeatedly the department has asked advisory committee members for potential donations to the department to save college money, only to be declined. Another option for the department is capital requests, but in the past five years the biology department has been awarded a high number of “dollars” to be used in A&P labs (justified by the high enrollment in A&P), at the expense of biotechnology (12-16 graduates per year).

**Section V: Appendices: Supporting Documentation**

**Biology career information**

**Career Outlook**

* Employment for biologists is expected to grow *much* *faster than the average* compared to all other occupations for the 2008-2018 decade.  Employment of biologists is projected to increase by 21% partly due to the growth in the biotechnology industry. (*2010-2011 Occupational Outlook Handbook, Bureau of Labor Statistics).*

**What kind of work can you do with a degree in biology?**

* Basic and Applied Research and Development
* Environmental Management and Conservation
* Health Care
* Organism Biology *(Botany, Zoology, Marine Biology, Wildlife Biology, Entomology)*
* Quality Control and Testing
* Teaching
* Technical and Pharmaceutical Sales
* Technical Writing

**Education - Where will your degree take you?**

|  |  |  |
| --- | --- | --- |
| Bachelor Degree (BA/BS) | Master’s Degree (MS) | Doctoral Degree (PhD) |
| Entry level research technicians and assistants in product development and inspection, secondary school science teachers, preparation for admission to professional schools such as medicine, dentistry, veterinary or analytical testing,  technical sales | Positions in industry, government, and non-profits related to applied research and development and teachers at high school and community colleges | Positions in basic and independent research in universities and government, university faculty,  and advancement to managerial positions |

**Where do Biology majors find jobs?**

Many biology graduates pursue careers that make direct use of their biology training. Other biology graduates pursue careers that make use of their analytical and technical skills. A degree in biology can also provide an educational foundation for admissions to professional schools or to advanced degrees in fields such as medicine, dentistry, pharmacy, law, business, engineering, etc.

* Colleges and Universities
* Education and Scientific Software Companies
* Government Agencies and Laboratories *(including Food and Drug Administration, Environmental Protection Agency, National Institute of Health)*
* High Schools
* Hospitals and Other Health Care Facilities
* Industry and Laboratories *(including, agricultural, animal pharmaceuticals, environmental, food processing and safety, health care, pharmaceutical, and textiles)*
* Law Firms
* Military
* Private Research Institutions
* Publishing Companies *(including scientific journals, magazines, textbooks)*
* State and Local Public Health Departments
* Veterinary Hospitals
* Zoos, aquariums, wildlife preserves, botanical gardens, museums, fish hatcheries

**What is the average annual salary for biology graduates?**

* Salaries earned by biologists are dependent on degree level and whether they are employed by industry, government, or academia.  According to the most recent data from the United States Bureau of Labor Statistics, average salaries for biologists were $70,000.

**Career Outlook**

Employment for Biotechnologists is projected to keep increasing higher than average in the 2010-2020 decade. Employment of biotechnologists is projected to increase by 14% - 24% depending on the field partly due to the growth in the biotechnology industry. (*2012-2013 Occupational Outlook Handbook, Bureau of Labor Statistics).*

**What kind of work can you do with a degree in biotechnology?**

* Pharmaceutical research, manufacturing or sales
* Forensic testing and analysis
* Quality control/Quality assurance
* Genetic and medical testing
* Environmental monitoring and regulation
* Agricultural and food testing and development
* Medical device development and production
* Medical and clinical laboratory testing and analysis
* Bioremediation application, testing and development
* Technical writing
* Bioinformatics data analysis
* Biomedical engineering
* Industry research and development

**Education - Where will your degree take you?**

|  |  |  |
| --- | --- | --- |
| Bachelor Degree (BA/BS) | Master’s Degree (MS) | Doctoral Degree (PhD) |
| Entry level research technicians and assistants in product development and inspection, microbiology and clinical diagnostics. Field sample collection and analysis.  | Mid-level lab positions in industry and government related to product and process development, analysis and quality control.  | Positions in product development in industry and government. Medical and pharmaceutical research and drug development. Biomedical engineering and medical device development.  |

**Where do Biotechnology majors find jobs?**

Many biotechnology graduates pursue careers that make direct use of their biotech training. Other biotechnology graduates pursue careers that make use of their analytical and technical skills. A degree in biotechnology can also provide an educational foundation for admissions to professional schools or to advanced degrees in fields such as medicine, dentistry, pharmacy, law, business, engineering, etc.

* Pharmaceutical research and manufacturing companies
* Crime laboratories
* Hospital laboratories and other health care facilities
* Specimen and diagnostic laboratories
* Medical device manufacture and sales
* R & D departments of industry, medical or government companies *(including, agricultural, animal, pharmaceuticals, environmental, food processing and safety, health care, pharmaceutical, and textiles)*
* Government Agencies and Laboratories *(including Food and Drug Administration, Environmental Protection Agency, National Institute of Health)*
* Quality Control/Quality Assurance departments
* Water Quality departments *(city or regional)*

**What is the average annual salary for biotechnology graduates?**

Salaries earned in biotechnology fields are dependent on degree level, area of the country, type of field and whether they are employed by industry, government, or academia.  According to the United States Bureau of Labor Statistics, average salaries for biotechnology fields *(including environmental science technician, agricultural and food scientists, microbiologist, medical technician, forensic science technician, biomedical engineer and biological technician)* ranged from $32,000-$110,000 a year.