ACADEMIC AUDIT

BIOTECHNOLOGY TECHNICIAN PROGRAM

SELF STUDY REPORT

Submitted to the Tennessee Board of Regents
For an Academic Audit Review

Department of Natural Sciences
Southwest Tennessee Community College
737 Union Avenue
Memphis, TN 38103

January 30, 2009
I. INTRODUCTION

The Biotechnology Technician Program is a two year degree program that results in an Associate of Applied Science Degree. Preparations for initiating the program were begun in 2003 and classes were officially started in the spring semester of 2006. Currently 30 students are enrolled in the program with the first two graduates of the program receiving their awards in the spring semester of 2008. As of September 2007, all four biotechnology classes and the Internship class have been offered to students. The original motivation for development of the program was market driven. Dr. Martha Howe, president of the American Society of Microbiology and Van Vleet Professor of Microbiology at the University of Tennessee Health Science Center, contacted Southwest Tennessee Community College with a request to pursue the development of a training program for entry level research technicians. In addition, a study conducted by the Chamber of Commerce indicated a strong need for a workforce in entry level research positions.

The program is currently housed in the M Building on the Union Campus of Southwest Tennessee Community College. One Biotechnology lab contains all the equipment needed for teaching the biotechnology classes. Courses are currently taught by one full-time faculty member who serves as coordinator for the program and one additional full-time professor.

At the onset of the program, an individual curriculum plan was designed for each student. In the fall semester of 2008, a new practice of special admission status for students was initiated. Entering students now remain with a cohort group for their classes throughout the program. Currently, all classes are taught during the day. As the program grows, it is hoped that there will also be night offerings for the Biotechnology classes which should allow greater flexibility in scheduling for students.

II. OVERALL PERFORMANCE

The Biotechnology Technician Program is designed to train entry level laboratory technicians for their jobs in either basic or medical research. At the present time, there is one full-time faculty member teaching one course in the program and another full-time
faculty member teaching exclusively in the program. This self review was jointly conducted by the Biotechnology and Natural Sciences faculty.

The physical development of the program has been aided by a grant awarded to Southwest in November 2005 by the Department of Labor. This grant provided funds to help purchase state-of-the-art equipment for students to use. In addition, the grant helped with community outreach and student recruitment.

Although recruitment is one of the areas covered by the grant, the program has had relatively low enrollment. However, those low enrollment numbers are comparable to enrollment and graduation statistics from similar programs in the country. Low enrollment seems to be a problem of Biotechnology focused programs in general. Recruitment efforts have included selective mailings, visits to local high schools, radio and print advertisements, and a spot on the Southwest Now television program. New avenues for recruiting students for the program are continually explored.

At the present time, the Biotechnology laboratory is housed in the M building on the Union Campus. Before designing the lab, sites visits by members of the Biotechnology and Natural Sciences faculty were made to Massachusetts Bay Community College, Piedmont Virginia Community College and Austin Community College. Information obtained on these visits and additional advice provided by local researchers played a major role in the design of the lab space. The laboratory manual chosen for the biotechnology courses was also consulted to ensure that all the necessary equipment to complete the prescribed lab projects was purchased.
Since the beginning of the program in 2006, an open enrollment policy has existed. General Biology, which is a pre/co-requisite for Introduction to Biotechnology, was the only class required for a student to take before entrance to the program. This practice officially changed in the fall semester of 2008. The curriculum committee and TBR accepted a proposal for implementation of a formal admissions procedure. Students now apply to the program before entering and beginning upper level Biotechnology courses. This policy will regulate enrollment and further ensure an adequate background for students who enter the program.

The Biotechnology Technician Program has drawn upon many information resources. Consultations with researchers from academia, medical research, and industry have helped to shape the curriculum of the program. To date, guidance has been received from scientists at the University of Tennessee Health Sciences Research Center, St. Jude Children’s Research Hospital, Transnetyx Corporation, and InMotion Musculoskeletal Research Institute. In addition, consultation with other established programs has been made to determine if the curriculum of the Southwest Biotechnology program is comparable. This input has been invaluable during the development of the program.

Because the Biotechnology Technician Program is relatively new, the opportunity to review and revise processes and procedures is welcomed. It is hoped that this self-study will bring weaknesses as well as strengths to light which will lead to ultimate improvement of the program.

III. PERFORMANCE BY FOCAL AREA

Focal Area I. Learning Objectives

1.1 Process for Developing Program Learning Objectives

Course learning objectives are listed in all syllabi and are distributed to students in the program. The objectives clearly state the skills that should be mastered by students by the conclusion of the course. Objectives were developed with the help of program faculty and faculty in the Department of Natural Sciences. In addition, scientists from St. Jude Children’s Research Hospital and University of Tennessee Health Sciences Center
were consulted about essential skills needed by a new technician in an entry level position. These insights were incorporated in learning outcomes in every class.

Course objectives which are deemed as most important for a student’s later success in the field make up the program objectives. In choosing the program objectives, what is a student should think, know, or be able to do as a result of completion of the program is considered. Each student learning objective is written in such as way as to be specific, time-based and measurable. Program learning objectives and the corresponding assessment plan are included in Appendix 6.

1.2 Evidence-Based Learning Objectives

The learning objectives for the program are evidenced-based. The department collects data to find out what students need. In the process of designing the curriculum for the Biotechnology Technician Program, a first step was the administration of surveys to local businesses and other research institutions to assess which skills and knowledge would be most needed by students in the biotechnology field. There is not currently a national standard curriculum for the program, but other similar programs were reviewed for information regarding appropriate program learning objectives. Scientists from UTHSC, St. Jude Children’s Research Hospital, and local businesses shared insight regarding learning outcomes that should be demonstrated by a student in the program.

Students photographing a gel stained for DNA

In further program development and as an ongoing source of information regarding which skills should be taught in the program, students are given an examination on entry into the program to determine their competencies in mathematics and to assess
other individual skill levels. In addition, the administrator of the Internship meets individually with the student’s mentors for establishing learning needs of students.

Three of the Biotechnology courses (BIOT2410, BIOT2420, and BIOT2430) are lab-based. In each of these three classes, the practice of ongoing skills assessments throughout the semester is adopted. The basic skills that are used in all Biotechnology classes are monitored in each class period, and then more formally assessed at the end of the semester. In both program development and program improvement, decisions are based on realistic and appropriate evidence.

1.3 Best Practices for Learning Objectives

Faculty members in the program have sought out promising practices for defining learning outcomes and adapted these practices for use in the Southwest program. Promising practices in the Biotechnology Technician Program come from researchers in the field. As noted previously, scientists from UTHSC, St. Jude Children’s Research Hospital, and local businesses provided original topics to be included in the program’s curriculum. In addition, each semester the student participation in internships provides continual opportunity to incorporate promising practices from the field into the program.

Individualized training in specific techniques was received by the program coordinator from several specialists in different fields. These specialists include Mr. Glen Germain at St. Jude Children’s Research Hospital, Mr. Michael Jones from the Dionex Corporation, and Dr. Mark Hubbard from the College of the Ozarks. This individualized training for the program coordinator was done to further ensure that best practices are used in instructing students.

Improvements need for Focal Area 1

- The formation of an ongoing formal Advisory Board which would provide guidance and direction on the updating of curriculum and learning objectives would be invaluable for the program. An advisory board was in place for the purpose of initial program development. Some of the researchers and educators that provided that initial input continue to give guidance and advice regarding
program improvement. The initial external contacts with program professionals helped to shape and build the program up to this point. However, regular ongoing contact with field professionals through the formation of a permanent ongoing advisory board would aid in the promotion of continuous program improvement.

**Focal Area 2: Curriculum and Co-Curriculum**

### 2.1 Faculty Collaboration on Curriculum Design and Improvement

The curriculum choice is directly related to the program’s learning outcomes. Direction on courses/topics to include in the original curriculum for the Biotechnology Technician Program was obtained primarily from information provided through surveying professionals in the field. Further, faculty members in the Department of Natural Sciences at Southwest were instrumental in helping to design the curriculum. Planned improvements in the curriculum design are implemented as needed. Before classes were initiated, changes were made to the original curriculum. One change was replacing the Instrumentation class with Biotechniques III. After talking to the Chemistry faculty member who had responsibility for developing and teaching the Instrumentation class, it was decided that most of the techniques in the class were either covered in other classes or were outdated. Therefore, the biochemistry driven Biotechniques III was created and replaced the Instrumentation class.

In further design and improvement of the curriculum, the program’s coordinator was informed that the College did not at that time have anyone qualified to develop and teach the General Microbiology class originally planned for the Biotechnology Program. The program requirement was then modified to include the more specialized *Microbiology for Allied Health* class and a new Microbiology/Biotechnology faculty member was hired for the program in the fall semester of 2008.

### 2.2 Course Content and Sequencing to Achieve Learning Objectives

The sequencing of courses in the program is designed with the goal of enabling students to successfully achieve the program learning objectives. The Biotechnology Technician Program has 15 core classes and 8 hours of electives. The recommended
sequencing of classes assures that students are provided a secure foundation in science upon which to build.

The curriculum committee and TBR accepted a proposal for institution of a formal admissions procedure for the Biotechnology Technician Program and beginning in the fall semester of 2008, students were required to apply to the program. Before applying to the program, a student must have completed General Biology and Introduction to Biotechnology. These admission requirements will regulate enrollment in the program and will further ensure that students have completed introductory courses before attempting the upper level biotechnology courses. Faculty members regularly communicate the reasoning behind the sequencing requirements to students in advising sessions.

The students have opportunities to participate in out-of-classroom activities that can enhance their learning experiences. Each semester the Introduction to Biotechnology class takes a field trip to see a working laboratory. The classes have made several trips to the Hartwell Center, which is the core facility at St Jude Children’s Research Hospital, and have toured each of the labs in the department. In addition to viewing the impressive laboratories, students have had the opportunity to speak with the Assistant Director of the St. Jude facility and ask questions about the labs and the work done by laboratory technicians. An additional out-of-classroom activity for students is participation in the student-led Biotechnology Club which helps to stimulate interest in the field and to enhance their learning experiences.

2.3 Soundness of Curriculum, Including Best Practices

Review of best practices found in other successful biotechnology programs are made by the program coordinator when appropriate. The curriculum for the Biotechnology Technician Program has been modeled after other programs, including the former program offered at Nashville State Community College and the ongoing program offered at Austin Community College. This type of Biotechnology Technician program is relatively new, so all aspects of the curriculum are constantly being revisited and reviewed. Researchers at the University of Tennessee Health Sciences Center, Transnetyx Corporation, and the Bioworks Foundation have reviewed the Southwest
In addition to outside consultations, faculty members review the curriculum for each class at the end of each semester. In the last two and a half years the courses have undergone many changes, with new material and resources being added each semester as the need indicates.

**Improvement Needs for Focal Area 2**

- A formal textbook had not previously been adopted for Biotechniques I and II. A textbook for Biotechniques II was adopted in the fall semester of 2008. An improvement need for this area is consolidation of the material being used in Biotechniques I to better reflect topics of interest. Some of the material being used currently is at a higher level of difficulty than is required for the technical program.

- Southwest should get input from a broader segment of the research population concerning the curriculum for the program. For example, it would be beneficial for the program to contact agricultural researchers or those in the field of biofuels to get their perspectives on valuable additions to the curriculum.

**Focal Area 3: Teaching and Learning**

**3.1 Focus on Teaching and Learning**

Teaching and learning are organized to promote student achievement of the learning outcomes. Most of the Biotechnology classes focus on laboratory exercises. Cooperative learning is used as a method of instruction. Within the labs, students are organized into groups. While one person is performing a task, the other student is encouraged to guide his partner through the exercise. This practice is truly a hands-on cooperative learning experience. In consideration of varied learning styles, “smart board technology” is currently being installed in the laboratory space. This will allow
presentations using the latest technology available and should prove a beneficial teaching tool for visual learners.

Student checking for starch metabolism

The equipment in the laboratory is state of the art. Students learn necessary skills with the same types of equipment they will encounter in real world employment situations. The students also have the opportunity to do an Internship in a working lab setting. This gives them a learning experience that is directly applicable to the jobs they will hold in the future and further stimulates student involvement with the material. Currently, Southwest Tennessee Community College is raising funds to construct a new Biotechnology/Nursing building. This facility will house several labs containing the latest equipment and further will allow for further expansion of the program.

Biotechnology Lab in M Building, Union Campus

3.2 Use of Instructional Methods and Materials for Mastery

The Biotechnology classes employ several methods of instruction. These include lecture, web presentations, individual writing assignments, mathematical assignments,
group assignments, Power Point presentations, use of graphing software, hands-on experiments, video presentation, and oral presentations. Most topics covered in these classes are presented using multiple modes of instruction. Faculty members constantly review instructional methods being employed and add new resources as needed. The instructional methods used are designed to promote competency in the skills needed for a basic science laboratory technician.

One teaching tool that has proven to be successful is the use of GraphPad Prism. Through utilization of this tool, a student can produce more than seven kinds of graphs using the same data. Students can also use the tool to run statistical tests and manage data sets.

3.3 Collaboration in Design and Delivery of Teaching-Learning Process

The original class designs for the Biotechnology courses were developed through a cooperative effort between Biotechnology faculty and faculty in the Department of Natural Sciences. At this time, there is only one faculty member serving full-time in the Biotechnology Program and one faculty member devoting part of her teaching time to the program. The continual development of teaching and learning is primarily carried out by the lead faculty member. Formal departmental meetings for the purpose of discussing teaching methods are not currently in place, but members of the Department of Natural Sciences are regularly consulted for their input regarding effective design and delivery of teaching. In addition, adjunct faculty members bring new ideas to the courses they teach. These ideas are routinely adopted into the formal design and delivery of the courses. For example, in order to demonstrate the safety lab review process, students conducted safety reviews of the Biology and Chemistry laboratories located in the M Building. This type of hands-on activity has proven to be a very valuable teaching tool.

Improvement Needs for Focal Area 3:

- Expanded class offerings are desired by students. Both night and on-line courses should be offered in the future as the program grows. The implementation of the alternative class offerings will be dictated by demand.
Focal Area 4: Student Learning Assessment

4.1 Key Quality Indicators for Learning Objectives

Multiple methods are used in assessing student learning in the Biotechnology Technician Program. The assessment plan for the program outcomes found in Appendix 6 identifies in which courses the program objectives are being achieved and indicates which assessment tools are used to measure those outcomes. At the course level, the higher level courses employ written tests including short answer questions and essay. In addition, students write several short papers and do oral reports and are assessed on their performance on these assignments. In the Internship, students are assessed during a site visit by Biotechnology faculty and by information provided on a skills survey completed by the student’s mentor. Students are also required to keep lab notebooks that are turned in and graded at the end of the semester. Successful completion of the lab notebooks demonstrates a student’s ability to organize and critically review data. Students also perform basic lab skills throughout the semester and are evaluated by the instructor on their successful accomplishment of these basic skills. With each assessment measure, results are documented and are used for enhancing student learning.

4.2 Best Practices for Assessing Student Learning

Assessments within the courses and evaluations from internships are used for the assessment of student learning. A formal questionnaire is administered to the mentors regarding individual student performance. This instrument is used for assessing student attainment of skills used in scientific research. Further, a graduating student survey is administered as an indirect assessment of program quality and student achievement of the learning outcomes. One improvement need is additional communication with existing biotechnology programs to gather data on what is considered “best practices” in this area of assessing student learning in similar programs. At this time, a standardized program field exit exam for assessing value added is not available. The establishment and validation of a locally developed formal exit exam is currently in progress.
4.3 Continuous Assessment-Based Program Improvements

Currently, faculty members are primarily responsible for student assessment. Assessment is also done by mentors for the student internships. There is informal collaboration between program faculty members concerning methods of assessment. Student achievement of the learning outcomes is assessed and documented using the college’s online planning system and four column model. The fourth column lists “use of results” of assessments in making continuous improvements in the program. Assessment methods are periodically reviewed and changed as needed. Improvements are made at the course level as the need is indicated by assessment results. As courses within the program are improved, the overall program is improved.

4.4 Multiple Measures in Assessing Learning and Program Effectiveness

The program plan for improvement uses multiple measures to assess student learning and program effectiveness. Multiple methods used for assessing student learning by the Biotechnology Technician Program are outlined in section 4.1. These methods include student performance on chapter tests, clinical/lab activities, and goal related questions on the final exams. Assessment of teaching methods is done using the student evaluation of teaching surveys and the Department Chair’s Evaluation. This allows the chair of the Department and the Coordinator of the Program to evaluate the methods of instruction and performance of instructors. Program effectiveness is assessed indirectly by results of graduating student surveys and by feedback from student mentors.

Improvement Needs for Focal Area 4

- One improvement need is for more formal communication with existing biotech programs regarding best practices and innovative tools for assessment of the learning outcomes.
Focal Area 5: Systematic Quality Assurance

5.1 Commitment to Continuous Quality Improvements

Program administrators are committed to making improvements in the program a priority. Steps such as surveying mentors about course curriculum and student performance have been undertaken toward making quality improvements to the program. Curriculum changes in 2005-2006 were made that reflect an enhancement in program quality.

The pursuit of articulation agreements with LeMoyne-Owen College and Christian Brothers University is currently underway. The MLT program at UTHSC has agreed to accept the Biotechnology Classes for credit toward their degree. Additionally, investigation regarding the implementation of a certificate program for students in the possession of another degree has begun and is proposed as an improvement initiative. In the fall semester of 2008, the status for the Biotechnology Technician program as a special admissions program was officially begun. All students are now required to apply to the program prior to taking upper level classes which helps to ensure adequate backgrounds and improvements in course sequencing for the students in the program.

The Biotechnology program is relatively new and the program administrators are committed to researching best practices, using results of assessments, and actively working with other institutions regarding needs for transfer students in assuring that continuous quality improvements are made in the program.

5.2 Systematic Quality Assurance

Quality assurance is addressed systematically across the Biotechnology courses. The Curriculum Committee has oversight for the review of curriculum and the management of all course change recommendation in ensuring that the guidelines of the college are met. The IE planning cycle is a formal internal process for quality assurance. This process requires that all departments establish annual objectives, conduct assessments of accomplishments, and use assessment results to make continuous improvements in the programs. Other forms of quality assurance are conducted systematically. Feedback and recognition to faculty regarding how effectively they are
performing work related to the curriculum, teaching and learning, assessment, and other practices affecting students is carried out through results of the students’ evaluation of teaching and the department chair’s evaluation scheduled each spring semester. An effort in assuring program quality through the documentation of the assessment of program outcomes was undertaken in October, 2008 with a college-wide faculty training effort conducted by the Assessment Office. All program data provided by the Institutional Research office is carefully reviewed and used where applicable for the purpose of making continuous improvement in the program.

One improvement need is for the establishment of a formal Advisory Board to provide oversight and support to the program through collaboration, review and program recommendations. A short-term Advisory Board was initially in place and this group of assembled professionals in the field provided invaluable advice to Southwest during the critical program development period. A long-term Advisory Board is needed for the program to provide continual advice and guidance regarding program updates and curriculum improvements. One additional program need is for an increase in the level of faculty professional development. Faculty would benefit greatly from involvement with field experts and industry professionals at program seminars and conferences particularly in the early stages of this program as it is being developed and improved.

**Improvement Needs for Focal Area 5**

- Form a formal ongoing Advisory Board for the Biotechnology Technician Program for the purpose of assistance with curriculum development and quality assurance.

- Increase program faculty attendance at professional seminars and conferences.
IV. POTENTIAL RECOMMENDATIONS & ASSOCIATED INITIATIVES

Having assessed the overall educational quality of the Biotechnology Technician Program in the self-study, the purpose of this section will be to present some specific initiatives for improvement. The program’s faculty members are committed to working intensively on the following quality improvement initiatives.

Initiative 1. Expand class offerings – Implement an offering of night classes and multiple sections of the Introduction to Biotechnology class.

*Key Activities and Related Focus Area:* Increase recruitment activities and stimulate interest in the program for the purpose of increasing enrollment. This would allow the offering of more sections. *Supports:* 3.1 Focus on Teaching and Learning

Initiative 2. Form an Advisory Board – An advisory board was in place for the purpose of initial program development. Many of the researchers and educators that provided that initial input continue to give guidance and advice regarding program improvement. These individuals and other field experts should be asked to join a formal ongoing Advisory Board for the Biotechnology Technician program. Further, committee members in research fields outside of biomedical research who might provide valuable insight might be invited to participate.

*Key Activities and Related Focus Area:* Select and approach potential committee members. *Supports:* Multiple areas including 1.1, 1.3, 2.3, 3.3, and 5.2.

Initiative 3. Start a Certificate Program – There has been interest in the Biotechnology Technician program from students who currently hold Bachelor’s degrees but are interested in additional training. An official certificate program for students such as these would be beneficial.

*Key Activities and Related Focus Area:* Prepare documents for the Curriculum Committee and TBR to initiate such a program. *Supports:* 5.1 Commitment to Continuous Quality Improvements
### V. MATRIX OF IMPROVEMENT INITIATIVES

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Participants</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Expand class offerings</td>
<td><em>Coordination:</em> Department Chair</td>
<td>January 2009</td>
<td>On-going</td>
</tr>
<tr>
<td>Offer night classes</td>
<td><em>Participants:</em> Biotechnology Faculty</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supports Focal Area: 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Form Advisory Board</td>
<td><em>Coordination:</em> Biotechnology Coordinator</td>
<td>January 2009</td>
<td>September 2009</td>
</tr>
<tr>
<td>Identify and recruit advisory board members</td>
<td><em>Participants:</em> Natural Sciences Faculty, Southwest Administrators, Specialists in the field, former Advisory Committee members</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supports Focal Area: 1,2,3,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiate paperwork</td>
<td><em>Participants:</em> Department Chair and Dean</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supports Focal Area: 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDICES

Appendix 1  Program Description
Appendix 2  Program Requirements
Appendix 3  Course Descriptions
Appendix 4  Enrollment Data
Appendix 5  Faculty Credentials
Appendix 6  Assessment Plan
Appendix 7  Graduating Senior Survey
Appendix 1 – Program Description

**BIOTECHNOLOGY TECHNICIAN**  
Associate of Applied Science Degree  
Amy Beth Waddell

The Biotechnology Technician is an important part of the team involved in basic and clinical research. Students completing the program will be employed in medical, research, and industrial laboratories. This program is designed to give practical hands on as well as theoretical knowledge in a variety of laboratory procedures. Students must be accepted into the program prior to enrolling in second BIOT semester courses. The final semester of the second year will be spent working in a laboratory at a local institution, hospital, or business, in addition to other course work. During this period, the students' schedule may differ from the academic calendar. Students accepted into the program must remain in sequence and complete all courses on schedule.

**Admission Requirements (Effective Fall 2008)**

To be eligible for consideration for admission, the applicant must:

1. Be granted degree admission at Southwest Tennessee Community College.
2. Have completed the following prerequisite courses* with a minimum grade of "C":
   a. General Biology I - BIOL 1110
   b. Introduction to Biotechnology - BIOT 1010
   c. Statistics - MATH 1530
3. Have achieved an overall grade point average (GPA) of at least 2.0 on all college-level courses completed.
4. Have successfully completed any science courses within the past five years required for the degree with a minimum grade of "C".

*Courses must have been completed within the past five (5) years.

**Selection Criteria**

The Biotechnology Technician Admissions Committee ranks each applicant according to his or her Admissions index, which is derived from the variables listed below.

1. College-level GPA
2. Prerequisite course GPA

Criteria will be weighted equally.

A maximum of 24 students will be admitted in the Summer II and the spring semester.

Requirements must be fulfilled no later than semester immediately prior to desired admission.
Appendix 1 – Program Description, continued

RetentionPolicy

In order to retain a position in the program, the student must:

1. Maintain a GPA of 2.0 or higher
2. Earn a minimum grade of "C" in all BIOT courses required for the degree. Students failing to attain this requirement will be dismissed from the program
3. Complete the following courses prior to enrollment in the second year of the Biotechnology program:
   General Chemistry I - CHEM 1110
   General Chemistry II - CHEM 1120
   Microbiology - BIOL 1230
4. Remain in sequence and on schedule for all BIOT courses.
5. Students must be computer literate, including the use of EXCEL.

Readmission Policy

Students withdrawing from the program or dismissed for any reason may be considered for readmission the following year by the program coordinator 30 days prior to the first day of registration for that term. Students must submit a letter of intent to be readmitted to the program coordinator.
Appendix 2 – Program Requirements

**BIOTECHNOLOGY TECHNICIAN**
Associate of Applied Science Degree
Amy Beth Waddell

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOT 1010</td>
<td>Introduction to Biotechnology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 1110</td>
<td>General Biology I (Gen. Ed.)</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 1110</td>
<td>General Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1530</td>
<td>Statistics (Gen. Ed.)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOT 2410</td>
<td>Biotechnology Techniques I</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 1230</td>
<td>Microbiology</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 1120</td>
<td>General Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 1010</td>
<td>English Composition I (Gen. Ed.)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOT 2420</td>
<td>Biotechnology Techniques II</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 2010</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 2011</td>
<td>Organic Chemistry Lab I</td>
<td>1</td>
</tr>
<tr>
<td>ETHC 2030</td>
<td>Ethics (Gen. Ed.)</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 1010</td>
<td>General Psychology I (Gen. Ed.)</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOT 2430</td>
<td>Biotechnology Techniques III</td>
<td>4</td>
</tr>
<tr>
<td>BIOT 2450</td>
<td>Biotechnology Internship</td>
<td>5</td>
</tr>
<tr>
<td>****</td>
<td>Electives ¹</td>
<td><strong>8</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>17</strong></td>
</tr>
</tbody>
</table>

**Total Program Credits 60**

¹Electives should be chosen in consultation with the Biotechnology advisor. Those for university transfer should be selected from the General Education page. Course requirements for some advanced Biotechnology and Medical Technology degrees are listed below. Examine current catalogs of other schools and programs, including Bioinformatics, for elective options.
### BIOT 1010 - Introduction To Biotechnology

Includes career exploration, history and applications of DNA/RNA technology, molecular biology, bioethics, radiation safety, and laboratory practices. Laboratory exercises, field trips, and demonstrations illustrate the basic techniques of biotechnology, including fundamental concepts like the metric system, equipment safety, chemical nomenclature, states of matter, and solution concentrations.

### BIOT 2410 - Biotechnology Techniques I

An introduction to the theory and practice of basic laboratory techniques in molecular biology with an emphasis on basic laboratory functions and techniques. Proteins, gene expression, and regulation, immunochemistry, and cell culture will also be covered. This is a two semester project-oriented course applying the fundamental DNA and protein manipulation techniques used in biotechnology/molecular biology research-oriented laboratories in academia and industry.

### BIOT 2420 - Biotechnology Techniques II

The second semester of a two-semester project-oriented course applying the fundamental DNA and protein manipulation techniques used in biotechnology/molecular biology research-oriented laboratories in academia and industry. This course concentrates on DNA structure and function and the techniques of DNA analysis, including cloning, restriction digests, and polymerase chain reactions.

### BIOT 2430 - Biotechnology Techniques III

The third semester of techniques classes focuses on the fundamentals of the biochemistry laboratory. This course concentrates on the use of biochemical methods for analyzing solutions with spectrophotometry, centrifugation, chromatography, and electrophoresis.

### BIOT 2450 - Biotechnology Internship

An experience external to the college for a student in a specialized field, involving a written agreement between the educational institution and a business, industry or research facility. Mentored by a workplace employee, the student achieves objectives that are developed and documented by the college that are directly related to specific occupational outcomes. This may be a paid or unpaid experience.
Appendix 4 – Enrollment Data

Biotechnology Enrolment by Gender

<table>
<thead>
<tr>
<th>Semester</th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall08</td>
<td>20</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Sum08</td>
<td>14</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>Spring08</td>
<td>13</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>Fall07</td>
<td>11</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>Sum07</td>
<td>9</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Spring07</td>
<td>9</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Fall06</td>
<td>13</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>Sum06</td>
<td>7</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Spring06</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Fall05</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>101</strong></td>
<td><strong>50</strong></td>
<td><strong>151</strong></td>
</tr>
</tbody>
</table>

Biotechnology Enrolment by FT/PT Status

<table>
<thead>
<tr>
<th>Semester</th>
<th>Full-Time</th>
<th>Part-Time</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall08</td>
<td>13</td>
<td>17</td>
<td>30</td>
</tr>
<tr>
<td>Sum08</td>
<td>3</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>Spring08</td>
<td>9</td>
<td>13</td>
<td>22</td>
</tr>
<tr>
<td>Fall07</td>
<td>10</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>Sum07</td>
<td>14</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Spring07</td>
<td>9</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Fall06</td>
<td>6</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>Sum06</td>
<td>1</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Spring06</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Fall05</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>54</strong></td>
<td><strong>97</strong></td>
<td><strong>151</strong></td>
</tr>
</tbody>
</table>
Appendix 4 – Enrollment Data, continued

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian or Pacific Islander</td>
<td>2</td>
</tr>
<tr>
<td>Black, Not Hispanic</td>
<td>94</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2</td>
</tr>
<tr>
<td>White, Not Hispanic</td>
<td>48</td>
</tr>
<tr>
<td>Unclassified</td>
<td>5</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>151</td>
</tr>
</tbody>
</table>

### Biotechnology Enrollment by Age Group

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Fall 05</th>
<th>Spring 06</th>
<th>Summer 06</th>
<th>Fall 07</th>
<th>Spring 07</th>
<th>Summer 07</th>
<th>Fall 08</th>
<th>Summer 08</th>
<th>Fall 08</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 or Less</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>21 to 24</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>25 to 34</td>
<td>2</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 to 35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35 Plus</td>
<td>1</td>
<td>4</td>
<td>8</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>1</td>
<td>5</td>
<td>7</td>
<td>19</td>
<td>17</td>
<td>14</td>
<td>18</td>
<td>22</td>
<td>18</td>
<td>30</td>
</tr>
</tbody>
</table>

**Biotechnology Degrees Awarded** – Two AAS degrees have been awarded so far and they were awarded in Spring 2008. They were awarded to two females.
Appendix 5 – Faculty Credentials

JULIANN WAITS, Ph.D.

EDUCATION:


Master of Science, Vertebrate Zoology. The University of Memphis. May 1996.


EXPERIENCE:

- Assistant Professor, Southwest Tennessee Community College, Memphis, TN, 7/05-current
- Visiting Assistant Professor / Adjunct Professor University of Memphis, Memphis, TN, 8/05 –current
- Faculty Instructor, Owensboro Community and Technical College, Owensboro, KY, 8/02-06/05

PUBLICATIONS


Appendix 5 – Faculty Credentials, continued

AMY BETH WADDELL

EDUCATION:

Doctor of Philosophy, Program in Molecular Therapeutics and Toxicology, Department of Pharmacology, Emory University, Atlanta, GA, 1997. Thesis: “Opioid receptor agonist and antagonist modulation of cocaine: motor activity, antinociception, and lethality”.

Bachelor of Science, double major in Biology and Psychology, Georgetown University, Washington, D.C., 1992. Thesis: “N-acetylaspartylglutamate in the central nervous system of developing mice” - worked with cryostat and segmented tissue samples

Postdoctoral Training, Developmental Therapeutics Program, National Cancer Institute, Frederick Cancer Research and Development Center, Frederick, MD, 1998-1999. Project: Metabolism of KRN5500, an anti-colon carcinoma compound

EXPERIENCE:

- Assistant Professor, Coordinator Biotechnology Technician Program, Betty Rosenblatt Department Chair, Southwest Tennessee Community College, 2005-present

- Full-time Instructor, Natural Sciences Department, Saeid Baki Department Chair, Southwest Tennessee Community College, 2004-2005

- Adjunct Instructor, Natural Sciences Department, Saeid Baki Department Chair, Southwest Tennessee Community College, 2004

PUBLICATIONS:


Appendix 6 – Biotechnology Assessment Plan

I. Student Learning Objectives/Outcomes

Biotechnology students will demonstrate:
1. Knowledge and comprehension of core concepts, which includes but is not limited to knowledge of cellular biology, biochemistry, genetics, molecular biology, and microbiology.
2. Proficiency in laboratory techniques essential to biotechnology.
3. Knowledge of ethical principles regarding the use of biotechnology.
4. The ability to understand, analyze and evaluate original research literature and to communicate this understanding using appropriate technology.
5. The ability to clearly define questions or problems and develop comprehensive solutions individually and/or collaboratively.

II. Identification of where Objectives/Outcomes are Being Achieved

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>R</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
<tr>
<td>2</td>
<td>I</td>
<td>I</td>
<td>E</td>
<td>E</td>
<td>I</td>
<td>I</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>R</td>
<td>R</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E</td>
</tr>
</tbody>
</table>

I = students are introduced to the objective – prior exposure is not required or expected
E = course emphasizes the learning objective
R = an objective is reinforced, but not the key focus of the course – prior exposure is required or expected

III. Assessment Tools used to Measure Objectives/Outcomes

<table>
<thead>
<tr>
<th>outcome</th>
<th>yearly meeting</th>
<th>graduating student survey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(direct)</td>
<td>(indirect)</td>
</tr>
<tr>
<td>1</td>
<td>even academic years</td>
<td>yearly</td>
</tr>
<tr>
<td>2</td>
<td>odd academic years</td>
<td>yearly</td>
</tr>
<tr>
<td>3</td>
<td>even academic years</td>
<td>yearly</td>
</tr>
<tr>
<td>4</td>
<td>even academic years</td>
<td>yearly</td>
</tr>
<tr>
<td>5</td>
<td>odd academic years</td>
<td>yearly</td>
</tr>
</tbody>
</table>
Appendix 7 – Biotechnology Graduating Senior Survey

Core Knowledge
How would you rate your knowledge and understanding of key concepts in the following areas?

Poor = unable to recall key information or underlying concepts.
Adequate = able to recall much key information and many of the key concepts, but unable to apply them to new situations. Extensive = thorough understanding of the key information and underlying concepts and able to apply understanding to new situations or questions.

<table>
<thead>
<tr>
<th>Knowledge and comprehension of cellular biology:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge and comprehension of biochemistry:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge and comprehension of genetics:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge and comprehension of molecular biology:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge and comprehension of microbiology:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

Laboratory Proficiency
How proficient would you say you are with each of the following laboratory skills?

Poor = unable to recall the technique or never exposed to it.
Adequate = capable of performing the technique with a detailed protocol and time to repeat as necessary. Proficient = able to perform the technique with minimal instruction and able to obtain desired results on the first or second trial.

<table>
<thead>
<tr>
<th>Gel electrophoresis of protein or DNA.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Protein purification.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sterile technique.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use of micropipettes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Manipulation of DNA such as restriction digestion, ligation, and synthesis.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to collect, analyze and interpret data.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Design an experiment to amplify a segment of DNA.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calculate and prepare solutions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use computers to compare and analyze protein and nucleic acid sequences.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

Ethical Principals
Which of the following statements most accurately reflects your beliefs and understanding regarding ethics and biotechnology?

I plan on strictly working in a laboratory, so a consideration of ethics is irrelevant.

I know that there are ethical issues related to biotechnology, but I have not seriously considered what they are or how they should be dealt with.

I am aware of ethical issues related to biotechnology, and have explored them from an ethical, but not a scientific perspective.

I am aware of ethical issues related to biotechnology, and have explored them from a scientific, but not an ethical perspective.

I am aware of ethical issues related to biotechnology and I have considered how both ethical and scientific principles inform my understanding of the issues and my behavior.

Communication, analysis, teamwork and other skills
How proficient would you say you are with each of the following skills?

<table>
<thead>
<tr>
<th>Ability to find articles in the scientific literature using databases such as Medline.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to read the scientific literature and understand the purpose and importance of the study.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to read the scientific literature and understand the results of the study and how the conclusions were arrived at.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to interpret graphs, tables and figures found in the scientific literature.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to prepare a technical poster to present research findings at a meeting.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to write a scientific paper.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to prepare and deliver an oral presentation focused on the technical/scientific aspects.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to prepare and deliver an oral presentation on biotechnology to a general audience.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to plan experiments based on previous research studies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to identify problems that need to be addressed that are relevant to biotechnology.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to work in a team in a laboratory setting.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to work in a team to produce a team product such as a paper or presentation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ability to apply core knowledge and skills to real world problems.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
</tr>
</tbody>
</table>

1. What aspect(s) of the biotechnology program do you consider strengths of the program and why?
2. What aspect(s) of the biotechnology program do consider weaknesses of the program and why?
3. What if anything would like to see included in the program and why?
4. What if anything would you like to see removed from the program and why?
5. What are your plans after graduation and where are you at in the process?