# Quinsigamond Community College

## Internal Program Review

## 2002 - 2003

| Certificate In Biotechnology | Maggie Crowell-Murray |
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| **Program** | **Coordinator** |

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## Section I: Competitive Analysis and Regional Labor Market Demand

### 1. Market Influences

**A. Provide a broad definition of this employment sector. List specific knowledge and skill requirements for employment in this field.**

**Response:**
Biotechnology is a field that applies advanced technological tools to the study of living systems. Since its inception in the 1970's biotechnology has been grounded in the disciplines of biology, chemistry, engineering and agriculture. As research led to practical applications, biotechnology crossed in to the areas of medicine, law, environmental science, and infomatics. During the 1980's major scientific breakthroughs, particularly in molecular biology and genetics gave rise to the biotechnology industry. A variety of industries fall under the umbrella of "biotechnology". Two of the major employment sectors within the biotechnology field are biotechnology research and development, and biomanufacturing and pharmaceutical manufacturing.

Biomanufacturing or bioprocessing involves the large-scale production of protein which are used to treat or cure human disease, as an example, the production of insulin. It differs considerably from other forms of manufacturing. It does not fit the general conception of production work or manufacturing as a particular process may take a few days or several weeks. Producing purified protein in large scale requires that entry level workers have the technical expertise to complete established procedures. Biomanufacturing personnel must be highly skilled and attentive workers (1).

Although each of these subdivisions of the biotechnology industry has unique skill set requirements, they all require a some fundamental skills or knowledge. Individuals who are successful in these fields need to be competent in mathematical manipulations, graphing, chemistry, biology, instrumentation and media, buffer, documentation, and solution preparation. Additional skills may be required depending upon the product the industry produces; these skills may include quality control, micromanipulation, cell culture, and bacterial transformation. Overall a fundamental understanding of chemistry and biology with emphasis on mathematical manipulation and communication skills is necessary.

**B. Using the relevant labor statistics, indicate whether employment opportunities in the field are expected to increase or decrease over the next 3-5 years. Please cite the sources that you have used to make the predictions. (Note: It is easier for Admissions and Marketing Departments to refer to these predictions if they can quote the source.)**

**Response:**
Drawing from Massachusetts Labor statistics in Biotechnology expansive growth is predicted over the next 3-5 years. Over 350 biotechnology companies are located in Massachusetts making this state a major player in the national biotechnology industry. A total of 88 companies are located in Greater Worcester; fifty nine are biomedical and 29 are biotechnology companies. Both the Massachusetts Biotechnology Council (MBC) and Massachusetts Biomedical Initiatives (MBI) an incubator company for Worcester biotechnology startups predict growth in the biotechnological field. This growth is evident by the addition of eleven new companies over the past five years as well as the recent expansion of the two largest biotechnology employers in the area; Abbott and UMASS medical school. Abbot has recently completed a 35 million dollar expansion and plans to begin full scale manufacturing of a new anti-arthritis drug. They have recently expanded their workforce and have committed to the hiring of approximately 12 QCC graduates per year for the next five years. There is word that there will be an additional expansion at Abbott in the next two years boosting their need for trained entry level employees. UMASS Medical School has just completed the construction of a new biotechnology research building and is projecting the need for 200 entry level technicians. Preliminary results from a survey sent to 54 local biotechnology companies also indicate industrial growth. Each company is predicting expansion of their employee base as they make the transition from research and development to manufacturing.

**C. Review and analyze the most recent five years of institutional data to determine whether graduates of this program have found employment in their field and/or transferred to related four-year programs in their field within one year of graduation.**

**Response:**
There is currently no institutional data available. As part of this IPR an alumni survey will be created.

**D. Please identify the specific occupations (and job titles, if possible) for which program graduates are prepared. Identify the types of employers that have hired graduates of this program within the last 5 years.**

**Response:**
**Abbott Bioresearch Center:**

- Manufacturing Technician I-Biologics Manufacturing
- Manufacturing Associate-Pilot Plant Purification
- Advancement to Supervisor within these areas within 2 years

**Organogenesis:**

- Production Associate I- Cell Culture
- Production Associate I- Apligraf
- Validation Associate
- Media Support Associate
- Production Support Associate I/II

**UMASS Medical School:**

- Laboratory Assistant I
- Laboratory Technician I

**Genzyme:**

- Media Preparation I/II
- Production Associate
- Laboratory Technician

**Hybridon:**

- Laboratory Technician I/II
- Production Assistant I

This data is derived from company listings of job descriptions and from personal placement of students into these positions.

**E. Identify the institutions and the particular degree program to which the students transferred in the last three years.**

**Response:**
N/A

**F. Summary and Analysis: Market Influences**

**Response:**
Currently there is a solid market for graduates of QCC in the biotechnology Certificate Program. This market is predicted to grow substantially in the next 1-5 years.
The two largest biotechnology employers in Worcester; Abbott and UMASS Medical School are expanding their employee base significantly. This will have a significant impact on the certificate program. These two companies are predicting they will hire 12-20 students per year for the next five years. Entry level salaries are in the range of $26,000 to $36,000 with full benefits.

Recommended strategies for the program to remain competitive are:

- Maintain student capacity by recruiting students into the program Cap enrollment at 24 per year to assure quality and prevent saturation of the market until a proper assessment of need can be conducted and/or resources are available to support growth.
- Create alliances with both Abbott and UMASS to assure currency in industry standards, and a smooth student transition into the workforce.

## 2. Programmatic Currency

**A. Describe how the program maintains curricular currency**.

**Response:**
Currency is maintained through faculty and administrative attendance at conferences, faculty contacts with representatives from the various biotechnology industries, and through faculty visits to cooperative education placement sites. Previous to the 2001-2002 academic year, the curriculum had not been critically reviewed since its inception. Changes had been made for the purpose of increasing the academic quality of the students and to reduce reliance on adjunct faculty to deliver the curriculum. In the summer of 2001, the Coordinator of the program was contacted about the needs of the biotechnology industry for technicians. Late in the Fall semester 2001 a meeting was held on campus of representatives from several of the biotechnology companies that responded to a survey (attached) of industry needs. The input received stimulated an analysis of the curriculum that is being incorporated into the Internal Program Review process.

**B. Explain the existing mechanisms that allow for regular input from local employers or other relevant sources**

**Response:**
Currently there is no formal mechanism for obtaining input from the area biotechnology industry. Informally, information has been obtained from the Coordinator through visits to cooperative education placement sites. At the statewide level, the College has established formal contacts with the Massachusetts Biotechnology Education Foundation (MBEF). The MBEF works with the Massachusetts Biotechnology Counsel to support the development of the biotechnology industry in Massachusetts.

**C. Describe how this input affects the program. (Note: It is helpful with our accreditation process if you can include some specific examples of input that have led to recent changes in the program.)**

**Response:**
There have not been any programmatic changes in the recent past as a result of industry input. Changes made to the curriculum have been in response to faculty qualifications, and laboratory and course availability. It is anticipated that as a result of the recent meetings cited in "B", the current Biotechnolgy curriculum will be revised so as to put the Biotechniques course back into the curriculum. Additionally, the development of industry specific writing/documentation skills will be undertaken through the development of laboratory reports in the Cell Biology, Molecular Biology, and Biotechniques courses.

**D. Describe ways that the College could support program faculty's incorporating more area industry input.**

**Response:**
To this point in time, the College has not been asked for support as there were questions about the prospects for employment of the graduates, and the viability of the program. Industry input is currently being solicited as part of the IPR process. Initial feedback indicates that there is a strong demand for graduates and that the program is viable as needs become known, College support will be requested, as needed, through the appropriate channels. Of particular concern will be the collection and availability of data relative to employment and transfer of graduates.

**E. Summary and Analysis:**

**Response:**
Prior to the 2001-2002 academic year, oversight for the Biotechnology Certificate program fell to the Coordinator for the Biology/Chemistry work area. Initially, the Coordinator was actively involved with the Massachusetts Biotechnology Research Council (MBRC), a quasi-public organization charged with assisting with the development of the biotechnology industry in Massachusetts. This organization sponsored meetings for representatives from the various colleges and post secondary institutions that

offered biotechnology programs for the purpose of discussing curriculum matters and employment outlook. The MBRC eventually ceased to exist creating a leadership void at the state level in biotechnology education.
Prior to the dissolution of MBRC, employment prospects for graduates from a certificate program in biotechnology were poor. Employers actually preferred to hire applicants without any formal post secondary education. The desirability of post secondary education and training has only recently been recognized by the industry thereby enhancing the employability of associate and certificate program graduates.

In the summer of 2001, there was a dramatic increase in interest on the part of the biotechnology industry in the greater Worcester area in hiring a skilled/educated work force. Personnel from the College were approached from two major biotechnology firms requesting that the College provide meet this need. Contacts with these organizations have been strengthened through the appointment of a Coordinator for the Biotechnology Certificate program. The Coordinator constructed a needs assessment that was e-mailed to all of the Worcester area biotechnology companies. The survey was followed up with a focus group meeting consisting of representatives from responding companies. Finally, the Coordinator has been attending meetings and conferences sponsored by Massachusetts Biomedical Initiates (MBI), the apparent Successor Corporation to MBRC. There is interest, on the part of MBI, in the continuation and development of QCC's program. It is anticipated that there will be a further strengthening of the relationship between QCC and MBI.

## 3. The Pipeline: QCC Feeders

**A. Identify all feeders, both actual and potential (i.e., sources of applicants) to the program. Please include any potential "customized" feeders the College might be able to develop.**

**Response:**
Perhaps the most significant feeder is Quinsigamonds General Studies program. A recent mailing of marketing literature to students in this program elicited more than sixty inquiries. It is anticipated that this number will grow as a result of further promotion of the program. The Worcester Pipeline (involving Worcester North High School), Worcester Voc, and Shepard Hill are all potential sources of students. Worcester State College is another potential source especially for graduates from the biology program seeking additional credentials for employment in the biotech industry. Finally, in the Fall semester 2001, Abbott encouraged a number of its employees to enroll in the program. As noted earlier, for the better part of the last decade educational credentials were not valued for manufacturing technicians. The participation in the BEST grant by two large Massachusetts biotechnology firms is evidence that there is a need to have an educated workforce. It is anticipated that this need will help drive enrollment in the program over the next several years both in terms of retraining of incumbent workers and providing emergent workers with the knowledge and skills required by the industry.

**B. List all articulation agreements currently in place in this program (i.e., agreements with local Secondary schools, community-based organizations, proprietary schools, etc.).**

**Response:**
There are no active articulation agreements involving the Biotechnology Certificate program at this time. An agreement with Worcester State College is outdated and not functional.

**C. Do program faculty regularly collaborate with their peers in local high schools, four-year colleges and universities, business and industry, or community-based organizations on such activities as curriculum development, work-based learning, or professional development? Please cite examples from the most recent three-year period. If no active collaboration at this time, please comment on how this type of collaboration might enhance the program. In what ways could the College provide faculty support in this area:**

**Response:**
Regular collaboration does not exist, however, there is communication between industry personnel and biology faculty on an ad hoc basis. With the addition of a new faculty member to the Biology Department who possesses experience in biotechnology education, it is anticipated that the full-time faculty in the department will be able to take over the delivery of the majority of the curriculum.

**D. Explain the mechanisms in place within the program to insure that students who have been granted credit through articulation agreements transition smoothly into the QCC program. In what ways could the College increase its support in this area?**

**Response:**
N/A

**E. Explain the program's involvement with the Tech Prep consortia or other educational collaboratives, if relevant.**

**Response:**
The program has not had formal contact with the Tech Prep consortia, it has, as noted earlier, ties to the Worcester Public Schools, especially the North quadrant, through the College's participation in the Worcester Pipeline Collaborative.

**F. Summary and Analysis: The Pipeline: QCC Feeders**

**Response:**
Based upon our most current experience, the two most productive feeders to the Biotechnology Certificate program are Quinsigamond's General Studies program and incumbent workers in the area biotech industries.

## 4. Role of the Program Advisory Committee

**A. Is there an Active (meets at least once a year) advisory committee for this program?**

**Response:**
No committee exists at this time

**B. If yes, what is the composition of the advisory committee? How are appointments made to the committee? List Members.**

**Response:**
N/A

**C. Explain the roles and responsibilities of this committee**

**Response:**
When constituted, the roles and responsibilities of the committee will be congruent with those identified in the "Guidelines for Effective Utilization and Management of Program Advisory Committee's".

**D. If possible, cite examples of how committee input has had an impact on the program over the last 3-5 years.**

**Response:**
N/A

**E. Summary and Analysis: Role of the Program Advisory Committee**

**Response:**
The Biotechnology Certificate program originated through the now defunct Center for Employment and Training (CET) with very little, if any, involvement with Academic Affairs. With the dissolution of the CET approximately six years ago, the program was handed over to the Technologies and Health Care division of Academic Affairs. From about 1995 until 1998, MBRI was the coordinating agency that helped the College receive input from the biotech industry as well as other biotech programs in the state. Regularly scheduled meetings provided a forum for discussion of curriculum matters and placement. MBRI ceased to exist around 1999. From that time until the present contact with the biotech industry in the Worcester area has occurred primarily through the activity of one member of the biology faculty. With the growth in personnel needs, specifically technicians, there has been a renewed interest in the biotech industry in the College's program. Activities are currently underway to put together a formal advisory committee.

**5. Competition, Market, Strategies, and Enrollment Projections**

**A. Identify the program's primary competitors. Describe the process utilized and/or the rationale to determine the list of competitors.**

**Response:**
At present, there are no competitors in higher education in Worcester. Due to the shortage of workers in the industry, companies are hiring recent high school graduates and transitional workers with little of no formal education. While this may adversely impact on the pool of potential applicants in the short term, this should help the program in the long term.

**B. Identify QCC's program strengths and market niche with respect to these competitors. In other words, what makes QCC's program the first choice?**

**Response:**
Current survey results from employers indicate a level of education at either the Certificate or Bachelors degree is preferred for new hires. As the only program currently offered in the greater Worcester area, the College enjoys a competitive advantage. Worcester State College and WPI both have biotechnology programs, however, Worcester State's program is not active at this time and the graduates from the WPI program are not in competition for the jobs our graduates would be prepared for.

**C. Explain the specific marketing strategies the College has employed with respect to this program over the last three to five years. Please do NOT list general marketing strategies here. Identify marketing efforts relevant to your program specifically.**

**Response:**
There has not been a targeted marketing for the biotechnology program over the past five years with the exception of a flyer sent to General Studies students.

**D. Describe how program faculty work with the admissions officers to recruit students into the program. If unknown, outline a recruitment plan with specific activities.**

**Response:**
Office to bring industry on campus for informational meetings/job fairs. As noted in "C" the Program Coordinator developed and mailed out a flyer to General Studies students and also works directly with students who have indicated an interest in the program. Additionally, biology faculty collaborate with advising center personnel and other academic advisors to provide information about the program. Finally, the Coordinator has worked with the Admissions Office

**E. Is the need for this program expected to grow or decline over the next five years? Please base your response on specific data.**

**Response:**
The need is projected to grow, however, the amount of growth will depend on the production status of the biotech firms. The increased number of jobs at Umass and Abbott alone could assimilate all of the graduates our program has the potential to produce over the next three to five years.

**F. Based on analysis of information presented in this section, prepare enrollment projections for the next five years. Please describe what you believe is the optimum program size.**

**Response:**
The recommended enrollment is twenty-four students per year. This number was chosen for several reasons. First, current laboratory facilities can accommodate this number of students in one section. Secondly, this number will be of value in providing program identity through building strong working relationships between faculty and students. This is especially important with the heavy reliance, at present,

on adjunct faculty for the delivery of the curriculum. Finally, this number will provide stability in the job market and, hopefully, will provide a steady-state that meets the need of both the graduate and the industry.

**G. Summary and Analysis: Marketing Strategies, and Enrollment Projections**

**Response:**
Up to the present, there has not been a focused marketing strategy for the biotechnology certificate program. Recently, a mailing to General Studies students with a brief description of the program, including job outlook and potential employers, generated more than sixty inquiries. With the growth of the industry and the absence of any significant competition, reasonably conservative marketing should be more that adequate to fully enroll the program through the next five years.

## 6. Opportunities for Program Expansion

**A. Are there other directions this program might evolve in order to sustain currency and quality? Consider the following categories, but feel free to include other categories in your response:**

- **New certificate options within the program**
- **New concentrations within the program**
- **Different career ladder options within the program**
- **New Associate degree program possibilities**
- **Development of modularized courses**
- **Continuing/professional education in the field (i.e., CEU's, prep for recertification, etc.)**
- **Distance education course development**
- **More proactive job placement/support post-graduation**
- **Other…..**

**Response:**
The potential for offering an A.S. degree should be explored. On initial inspection it has been determined that some companies are listing an A.S. degree as a preferred qualification. An example is Organogenesis, a biotech firm located in Canton Mass that produces skin for grafting. Modularized courses are a second opportunity for growth and development. This would provide an opportunity to raft with the related programs like biomedical tech and manufacturing as well as addressing student re-training needs.

**B. Summary and Analysis: Opportunities for Program Expansion**

**Response:**
As previously noted, the desirability of expanding the certificate program should be addressed in the next three to five years based on an ongoing assessment and projection of market demand. The possibility of addressing short term training needs or skills upgrading should be examined as soon as practical. It must be noted that any expansion may have an impact on laboratory and equipment needs, and faculty.

## Section II: Curriculum, Instruction, Assessment, Program Credentials and Faculty

### 1. Foundations of the Program

**A. Describe the rationale for offering the degree with respect to environmental scan information (job outlook) and its unique niche in its particular Employment sector.**

**Response:**
Response: Currently QCC has the only Biotechnology Certificate in the Greater Worcester area. Most companies completing the needs survey and participating in the focus group suggested a certificate as the minimum educational requirement. Although the economy in faltering, Massachusetts continues to be a world leader in Biotechnologies with the largest concentration of companies. A recent survey conducted by MassBioEd indicated that there is currently a shortage of skilled workers in biomanufacturing. The survey projects that 1,000 jobs will be available statewide this year. QCC has received employment commitments from the two largest employers in Worcester, Abbott and UMASS Medical School. UMASS has indicated they will be filling 200 technician positions over the next 1-2 years. Abbott has indicated they could hire a minimum of 12 QCC graduates a year from the Biotechnology Certificate program. The current salary range for entry level positions is $26,000 to $44,000. QCC's Biotechnology Certificate Program, which currently has no local competition, will provide students with steady employment and help to reduce the statewide worker shortage in biotechnology.

**B. List degree or certificate objectives in measurable terms** (6-8 overall statements)

**Response:**
Introduce the student to the scientific techniques used in both research and manufacturing biotechnology Provide a general and broad academic and technical education to prepare students for the diversity of available biotechnology jobs available in the Greater Worcester area provide the academic and technical skills necessary to secure an entry-level position in either research or manufacturing biotechnology

**C. Define expected graduation competencies or student outcomes. Your response should include reference to general education outcomes, employability or "umbrella competencies", and career-related competencies or technical skills.**

**Response:**
Response: Students will attain a broad academic and technical background that will prepare them for the diversity of biotechnology positions available in the Greater Worcester area. General education outcomes will include strong written and verbal communication skills as well as computer competency in Microsoft Word and Excel. Because of the diversity of employment positions in the Worcester area, it is difficult to train the student in specific biotechnology techniques. Students will learn the universal laboratory techniques applied in most Biotech industries as well as the general laboratory skills necessary to be trained by the individual industry.

**D. Describe how the program supports the College's mission and purposes**

**Response:**
Response: The Biotechnology Certificate program provides a high quality educational experience leading to a career in a rapidly expanding industry. The success of the Biotechnology Certificate program is directly linked to the growth and development of the biotechnology industry in Central Massachusetts, as such, the program is aligned with a major goal of the College, workforce development.

**E. Prepare a draft program mission statement**

**Response:**
The Biotechnology Certificate program objectives are:

- To introduce the student to the techniques used in research and manufacturing in biotechnology.

- To provide the student with the academic and technical skills necessary to secure and entry-level technician position in either research of manufacturing biotechnology.

**F. Summary and Analysis: Foundations of the Program**

**Response:**
The design of the Biotechnology Certificate program reflects input from the biotechnology industry in Central Massachusetts as well as input from the state level through the Massachusetts Biotechnology Council. Curriculum content reflects the needs of the research as well as the manufacturing components of the biotechnology industry. Given the complexity of the technology, the use of radioactive materials, the requirement, in some instances, for animal experimentation, and the propriety nature of manufacturing processes or research initiatives, the College will never be in the position to meet all of the individual requirements of the area biotechnology industry. The attendant costs and lab space requirements also make it unlikely that the College will be able to keep up with major equipment/technology upgrades in the industry.

For the QCC biotechnology program to be viable and maintain relevancy, four conditions must be satisfied. They are:

- The program must develop, in the students, fundamental skills in the technology associated with the industry, written and verbal communication skills, and an understanding of good laboratory practice.
- Obtain continuous feedback on curriculum matters and graduate performance in the work place from the area biotechnology industry.
- Form alliances with area industry to provide laboratory experiences that it are not possible for the College to provide.
- Area biotechnology companies must provide the opportunity for training/externship placements for program faculty.

## 2. Curriculum

**A. Based on the analysis of regional labor market needs, evaluate the current curriculum strengths and identify those areas that you believe require enhancement.**

**Response:**
The overall Biotechnology Certificate curriculum is excellent providing a general education in biotechnology theory and practice. A recent survey and focus group highlighted these strengths and indicated a few weaknesses. These weaknesses include a lack of a laboratory component in the Cell Biology course, as well as a lack of technical writing and documentation course or component. Minimal industry input is also a weakness in the program. The Co-Op experience is a marginal substitute for a techniques and procedures course. Lastly the program needs to include a component on data entry and analysis using Excel or Orion. To date, two of these weaknesses have been addressed. A laboratory component has been added to Cell Biology, and the co-op experience has been replaced by the Biotechniques course. The remaining two issues are being addressed by the Coordinator and faculty teaching the biology courses in the program.

**B. Include the proposed curriculum for each of the current or proposed options in the program.**

**Response:**
The curriculum in effect for the Fall semester 2002 is:

| | |
|---|---|
| Cluster A: | BIO 159 Cell Biology<br>CHM 101 Introduction to the Chemistry of Living Systems<br>CIS 111 Introduction to Microcomputer Applications |
| Cluster B | BIO 160 Molecular Biology<br>BIO 231 General Microbiology |
| Cluster C | Techniques in Biotechnology |

**C. For each course in the revised curriculum, provide a description, statement of goals, major topics covered, primary tests or materials, and instructional technology used. (Please refer to the attached format.)**

**Response:**
**BIO 159 Cell Biology:**

- Provide a fundamental understanding of the structure and function of the cell
- Introduce cellular techniques and manipulations employed in the biotechnology industry
- Introduce proper data collection and analysis
- Introduce documentation and technical writing skills

**BIO 160 Molecular Biology:**

- Provide a fundamental understanding of the principles of molecular biology
- Introduce molecular techniques and manipulations as they apply to the biotechnology industry
- Enhance documentation and technical writing skills
- Enhance data collection and analysis

**BIO 231 General Microbiology:**

- Provide a fundamental understanding of the structure and function of microorganisms including bacteria, viruses, molds and fungi.
- Provide a fundamental understanding of the physiology and genetic nature of microorganisms
- Introduce the growth and manipulation techniques used with microorganisms in the biotechnology industry
- Enhance documentation and technical writing skills

- Enhance data collection and analysis

**CHM 101 Introduction to the Chemistry of Living Systems:**

- Provide a fundamental understanding of the principles of inorganic, organic and biological chemistry
- Provide an understanding of the way in which chemicals function in living systems
- Enhance documentation and technical writing skills
- Enhance data collection and analysis

SEE ENCLOSED SYLLABI FOR SPECIFIC DETAILS

**D. Describe the rational for the course sequence in the revised program. A rational of course sequence should be provided for the specific program related courses, the general education courses, electives, etc.**

**Response:**
The course sequence is based upon a logical progression of knowledge and skills acquisition. The student progresses from a basic understanding of the structural, physiological, and chemical properties of both prokaryotic and eukaryotic cells to a more focused study of the prokaryotic cell types used in many biomanufacturing processes. Upon completion of the foundation courses, the student is prepared to take Biotechniques, the program capstone course. The inclusion of Introduction to Microcomputers into the curriculum provides the student with the computer skills necessary to prepare laboratory reports that incorporate Excel and/or Access programs.

**E. Explain how the general education components are integrated with the department specific courses.**

**Response:**
As a certificate program, the Board of Higher Education guidelines and Quinsigamonds' guidelines covering general education requirements do not apply. The curriculum consists of courses specific to the development of entry level skills.

**F. Does the curriculum incorporate "writing across the curriculum"? Provide an illustration, if applicable.**

**Response:**
Technical writing and documentation are skills that are highly valued by the biotechnology industry. These skills will be developed through required written laboratory reports in the biology and biotechniques courses.

**G. Describe how the program meets the QCC philosophy of "high tech, high touch, high quality".**

**Response:**
The essential requirement for a biotechnology program is to provide the student with hands-on experiences in the laboratory setting with equipment similar to that the graduate will encounter in the work place. Some of these experiences can be provided to the student in the current laboratory facilities operated by the College. However, some experiences require the use of equipment that is either too expensive or too large for the College to accommodate or own. To ensure that the technology is current and consistent with that used in the industry, the Coordinator has undertaken the development of a laboratory to be used in the Cell Biology course. The unique feature of this lab is that it will be located at an area biotechnology company. Company personnel are working with the Coordinator to identify the equipment needs and will work with the Coordinator to obtain the equipment so identified.

**H. Does the program structure provide students with at least one elective choice? If no, is it possible to revise the curriculum so that there is at least one elective? Please explain your response.**

**Response:**
No, The focus of a certificate program, such as this one, is to provide the student with job related skills in as short a period of time as is practical. The program is eleven months in length and provides the students with the knowledge base and skill set deemed necessary by the industry for entry level technicians.

**I. Summary and Analysis: Description of Curriculum**

**Response:**
A this point in time, the curriculum meets the needs of both the research and manufacturing components of the Biotechnology industry in Central Massachusetts. Courses are being modified and laboratory experiences are being designed to meet the needs identified by the industry. Included in this development is a protocol to incorporate technical writing skills development into the program. The Full-time Biology faculty is committed to taking control and responsibility for the design and implementation of the curriculum, including the Biotechniques course.

## 3. Relevance of Instructional Methodologies, Assessment Strategies and Program Credentials

**A. Summarize the INSTRUCTION METHODOLOGIES utilized in the program. What are the strengths and challenges of these methodologies?**

**Response:**
The primary instructional methodologies utilized in the delivery of the curriculum are lecture and laboratory. The strength of the lecture format is dissemination of the large amount of scientific information required for the program. The laboratories offer a "hands on" exploratory methodology. This combination of lecture and laboratory format accommodates many learning styles.

**B. Provide recommendations for additional methodologies that would enhance students' learning. More specifically, are there additional ways in which instructional technology could enhance students' learning? Options for distance learning? Please explain your answer, and include how the College might support these efforts.**

**Response:**
Guest Lectures provided by industry would greatly enhance the students understanding of the biotechnology field and improve currency of the program. The college could support these efforts by providing monetary compensation for guest lecturers.

**C. Please provide a detailed assessment plan outlining the methodologies used for ongoing student assessment and final outcome assessment.**

**Response:**
Assessment in lecture includes examinations, and research papers. Assessment in the laboratory includes a laboratory notebook, laboratory quizzes, practicals, and formal laboratory reporting and documentation.

**D. Describe the strengths and challenges of each of the assessment methodologies listed above.**

**Response:**
Assessments methodologies assess student performance over a broad spectrum of skill sets.

**E. Provide recommendations for additional methodologies to evaluate student achievement.**

**Response:**
The capstone course, Biotechniques, provides the faculty with the opportunity to evaluate the full range of knowledge/skills developed in the program. The students will be provided with and opportunity to set up a small scale manufacturing process that requires the application of the knowledge and skills developed in all of the courses in the curriculum. This will provide the instructor with an ability to evaluate the students' ability to apply the knowledge and skills developed in the preceding courses including documentation and reporting of data.

**F. Has the program been evaluated by an EXTERNAL ACCREDITATION organization within the last five years?**

**Response:**
There is no external accreditation agency for the biotechnology industry, however, curriculum content reflects the input of area industry as well as the Massachusetts Biotechnology Education Foundation the education and training arm of the Massachusetts Biotechnology Council. Additionally, a formal advisory committee will be constituted for the 2002-2003 academic year.

**G. If yes, please provide name of the organization and date of last accreditation review. Did the program meet all of the accreditation requirements? If no, please explain. Attach the summary of the accrediting team's recommendations**.

**Response:**
N/A

**H. If the program has not been evaluated externally, list any appropriate professional accreditation or licensure for the program that the College should pursue. (E.g., Industry certifications, professional associations, etc.)**

**Responses:**
N/A see section II.F

**I. What changes, if any, might need to be considered to foster enhanced program quality?**

**Consider the following, but you need not limit your response:**

- **change in admission requirements**
- **inclusion of an internship or other work-based learning experience**
- **introduction of one or two electives to allow students to self-select learning opportunities**
- **development of a capstone course to synthesize the learning experience**
- **varied instructional methodologies**
- **enhanced assessment of student competencies**
- **better integration of technology applications**
- **specific instructional aides/software, etc.**
- **more coordination of faculty efforts, including the possibility of more full-time faculty**
- **attainment of program accreditation, certification, or licensure**

**Response:**

- admission requirement will include BIO 101 or proven competency
- The techniques course will become the capstone course and the course syllabus will updated regularly to reflect industry input.
- Industry will help advise on the integration of industrial techniques into the curriculum.
- Competencies for each course will be developed and faculty will be held to meeting these competencies in the delivery of the curriculum
- Full time faculty will be involved with and will oversee the program
- Adjunct faculty will be provided with an orientation as well as course objectives for each course, lecture and lab.
- Laboratory facilities will be integrated with local biotech companies the increase instructional resources in terms of equipment and staffing

**J. Summary and Analysis: Relevance**

**Response:**
The curriculum in place at the end of the 2001-2002 academic year reflects input from both the manufacturing and research arms of the Central Massachusetts biotechnology industry. The biology courses have been revised and the biotechniques course reintroduced into the curriculum. The chemistry requirement has been changed to better match the skills and knowledge base required by the industry. The Coordinator is working with faculty to develop or update course objectives for each biology course and for the biotechniques course. The Coordinator is also collaborating with a biotechnology company in Worcester to develop laboratory facilities for the revised Cell Biology course.
Assessment of student outcomes will be tied to the course objectives and will be assessed in accordance with the procedures identified in Section II.3.A. Program outcomes will be assessed, in part, by the students' performance in the capstone course, Biotechniques.

**4. Program Growth Opportunities**

**A. In your opinion, would it be beneficial to develop a common core curriculum along related career programs? E.g., computer education, business, administrative support, electronics, etc.) Please explain your answer.**

**Response:**
The Biotechnology Certificate program is highly industry specific and contains a relatively limited and focused core of courses.

**B. Describe, in detail, all potential areas for program growth. Include, but do not limit your response to the following:**

- **Career Ladder Potential**
- **New Degree or Certificate Options**
- **Professional/continuing Education Opportunities**
- **Professional Recertification Preparation/Test**
- **Flexible Delivery Options**
- **Enhanced Instructional Methodologies**
- **Improving Assessment for Student Competencies**
- **Distance Learning Course Development**

**Response:**
Career ladder potential: The primary employers in the Worcester area provide allow for advancement within their companies. All biotech companies provide ongoing refresher training. Further education is encouraged and all employees have access to tuition reimbursement plans.
As noted previously, there is a small, but growing demand for Associate Degree preparation for entry level technicians in the biotech industry. If a need can be documented for the companies in the College's service area, then the development of an A.S. degree would be explored as either a stand alone degree or a derivative of the General Studies program. A potential area for program growth would be for students to be able to get an Associate degree with a Certificate in Surgical Technology. (Refer to Section II, #IIH)

**C. Summary and Analysis: Program Growth Opportunities**

**Response:**
Program growth depends on the needs of the Central Massachusetts biotechnology industry and the availability of resources. At present, it is quite reasonable to expect that the industry can absorb a minimum of 20 graduates per year, exclusive of incumbent workers. As Quinsigamond's program becomes better known to the area industries, it is anticipated that there will be an effort by the industry to send their employees into the program for upgrading. It is, therefore, not unreasonable to assume that the program could double in size within one or two years. Growth of the Biotechnology program will put it in competition for laboratory, monetary, and personnel resources with other courses offered by the Biology/Chemistry department.

**5. <u>Students and Program Assessment (Review relevant data over the last five year period.)</u>**

**A. What have been the incoming students' average scores on QCC placement tests each year for the last five years?**

**Response:**
No data available. Complicating the problem of collecting data is the fact that students pursing the Biotechnology Certificate program do not have to declare their major until the semester they graduate.

**B. What is the graduation students' average college GPAs over the last five years? GPAs in major courses? Please describe the additional measures of central tendencies: i.e. median, mode, etc.**

**Response:**
N/A

**C. If relevant, how have students performed during their field placements or related work based learning experiences?**

**Response:**
Students have performed exceptionally during field placement. Of thirteen students placed in companies over the past eighteen months , eleven were hired for full time positions before completion of their placement. One student was offered full time employment but declined and one student did not complete the internship. By the end the spring 2002 semester three additional students were employed while completing the Coop experience and one student was hired directly out of the program before completing the Co-op.

**D. Indicate the number of students who have transferred to four-year programs, if applicable.**

**Response:**
N/A

**E. Track the average earnings of program graduates each year for the three years immediately following graduation.**

**Response:**
N/A

**F. Provide a summary of the program's enrollment patterns over the last five years.**

**Response:**
1998 – 5 graduated
1999 - 5 graduated
2000 – 3 graduated
2001 – 2 graduated
2002 – 4 graduated

Program enrollment is on the increase as a result of the new emphasis by the industry on an educated workforce. This determination is based on enrollments in two courses that are only required in the Biotechnology certificate program, Cell Biology and Molecular Biology. There were 19 students enrolled in each of these courses in the 2001-2002 academic year. When these student will complete is unknown as students need only declare a program in the semester in which they graduate.

**G. Indicate the program retention rate over the same period. Note: Consider two cohorts: fall to spring (same year); fall to Following Fall (one year).**

**Response:**
No valid data available. Students do not have to declare a major to pursue the Biotechnology certificate. As the program is an evening program and with no restrictions associated with enrolling in the courses other than academic requirements, very few students actually go through the process of enrolling in the program until the semester of their graduation. However, if the data for the courses in (F) are used, then retention appears to be good, at least for the 2001-2002 academic year.

**H. Determine the average number of semesters it takes for students to complete the program.**

**Response:**
Data is not readily available for graduates for the past five years, however, an analysis of the academic records of the four graduates of May 2002 reveals that it took an average of seven semesters to complete the program. This is somewhat misleading because one of the graduates transferred in several courses from a four-year institution, another was in General Studies and appeared to be taking courses without direction until finally selecting Biotechnology. The experience of the Program Coordinator is that the average length of time to complete the program is five semesters. That it takes more than two years on average to complete a ten-month certificate program is explained, in part, by the fact that four of the courses are only offered after four p.m. or in the summer. Additionally, the courses are only offered one semester each year, inclusive of Summer School.

**I. Define indicators of program quality. Describe strategies used to assess the success of the program in achieving its stated objects.**

**Response:**
At present, the single significant measure of program success is employment of graduates. The second indicator is feedback from the biotech industry. Currently this feedback has been obtained through contacts by the Program Coordinator and from the Focus Group convened in the Spring semester 2002 for input on curriculum issues. In the future it is anticipated that success in transfer to four-year institutions in biotechnology would also be used as an indicator.

**J. Summary and Analysis: Program Assessment**

**Response:**
The Biotechnology Certificate program is fundamentally sound and has the potential for significant growth over the next several years. The program has support from the area biotechnology industry as a source of emergent workers for the industry and for upgrading skills for incumbent workers. The faculty has been strengthened through the addition of qualified personnel and by the commitment of the full-time faculty to assume responsibility for the delivery of the program. Finally, course materials have been reviewed and expanded to include detailed objectives and methodologies. Program expansion is possible depending on the development of additional laboratory and equipment resources.

## 6. Faculty

**A. Is the current faculty able to adequately address the instructional needs of all courses, both general and specialty, in the program?**

**Response:**
At present the full-time faculty do not possess the knowledge or skills to offer all of the biology courses in the curriculum. Nor do they have the qualifications to teach the Biotechniques course. However, the faculty have committed to professional development activities that will permit them to instruct these courses.

**B. Is institutional support for upgrading faculty credentials required? If yes, please explain the kind of upgrade required and approximate cost associated with the upgrade?**

**Response:**
There are several mechanisms that can be used to support upgrading faculty credentials. One option is the awarding of a sabbatical, the other is awarding one or more externships.

**C. Over the last five years, what has been the ration between full-time and part time faculty within this program?**

**Response:**
The Biotechnology program is only offered through after four or weekend programming. As such, all of the instruction has, by definition, been provided by adjunct faculty, however, three of the full-time faculty of the Biology/Chemistry Department have taught core courses at various times.

**D. Describe how adjunct faculty are integrated into the existing program.**

**Response:**
Adjunct are the sole instructors. This has created inconsistencies and a lack of continuity and ownership in the program.

**E. Should the College employ additional full or part-time faculty in this discipline? Provide a detailed rationale.**

**Response:**
As with the delivery of any specialized technical program, it is highly desirable to have the program delivered by full-time faculty who's educational credentials and work history are consistent with the program goals. At present, the College must employ part-time instructors with the required expertise to deliver the program. Existing full-time faculty have strong related science backgrounds, but lack the industry experience. Should workforce development factors create pressure for program expansion beyond the projected numbers identified in this document, a request for the addition of a full-time faculty with appropriate credentials will be submitted for consideration.

**F. Describe how all faculty members contribute to curriculum development and over all program cohesiveness. Do ALL faculty members, both full and part-time have an opportunity to contribute to curriculum development?**

**Response:**
Through the end of the 2001-2002 academic year, control and development has fallen almost exclusively on the Program Coordinator.

**G. Does the current level of support staff meet the needs of the program faculty? Please explain your answer.**

**Response:**
Yes, the principle support staff include a full-time laboratory technician and a part-time laboratory technician.

**H. Summary and Analysis: Faculty**

**Response:**
Through the end of the 2001-2002 academic year, the full-time faculty did not possess the expertise or experience to deliver the entire curriculum. With the apparent low demand for the program and its graduates by industry, the impetus for a strong commitment to the program by the full-time faculty did not exist. With the new growing interest in the program, there has been an increased commitment by the full-time faculty to assuming responsibility for development and delivery of the curriculum. It is anticipated that there will be requests forthcoming in the 2002-2003 academic year for funding for skills/knowledge upgrading through participation in sabbaticals and externships.

## SECTION III: Institutional Support and Other Program Resources

**1. <u>Program Support (Please note: Use this section to reflect upon what institutional supports would useful and why).</u>**

**A. List targeted program marketing and recruitment strategies employed over the last two years? In your opinion, are they appropriate to sustain strong enrollment?**

**Response:**
A single "homemade" brochure has been the only new recruitment tool developed specifically for the Biotechnology program and it elicited a strong response. There were more than 60 responses to the brochure. This interest was reflected in enrollment in a core program course, Cell Biology, which jumped from an enrollment of five students in the Fall of 2000 to twenty four in the Fall semester 2001. Mechanisms are being put in place for further marketing, in the form of advertisement, a brochure, industry representatives on campus, these efforts coupled with appropriate advising should generate interest in the program. This is especially true given the new emphasis on biology and biotechnology following "9/11".

**B. Provide recommendations for new or additional marketing or recruitment strategies.**

**Response:**
There are three major pools of potential applicants to the program, high school graduates, incumbent workers in the biotechnology industry, and current QCC students enrolled in the General Studies program. To reach these populations, the following activities should be undertaken.

- Develop a standard brochure for the program
- Develop a better description of the program in the school catalog
- Hold a Job fair hosted on campus
- Invite industry representatives to speak on campus
- Conduct consistent advising

**C. Does the program have sufficient linkages with business, community-based organizations, other colleges and universities, or K-12 public schools? Please explain and cite specific examples. Present in chart form as explained in the guidelines for C & D, opposite page.**

**Response:**
Business linkages have been fostered in the last six months and these will continue to be developed. The K-12 linkages have been addressed through QCC's participation with the Worcester Public Schools in the <u>Worcester Pipeline</u> and through recruiting visits by Admissions personnel.

**D. Provide suggestions for improved program linkages. What, if any, assistance do the program faculty need in order to facilitate these linkages effectively?**

**Response:**
The development of an active program advisory committee

**E. Does the program have appropriate equipment to meet the instructional demands of the program? (e.g., medical equipment, laboratory supplies, computer hardware and/or peripherals)**

**Response:**
No.

**F. If no, provide a list of required equipment purchases or upgrades. Please present this list in prioritized fashion and identify immediacy of the priority.**

**Response:**
Repair/Calibrate current equipment:

- Fermentator
- Sub-zero freezer
- Incubator (s)
- Peristaltic pumps

**New Equipment Critical**

- PH meters *****
- Micropipettors*******
- Laboratory kits *******
- Conductivity meter
- Osmometer
- SDS Page mini gel apparatus
- Orbital shaker
- Water purification
- Top loading balances
- Tangental Flow equipment
- Liquid chromatography equipment
- Shaker baths

**Can acquire over time**

- Cell culture materials
- Liquid nitrogen tanks and storage
- Continuous flow centrifuge
- PLC bioreactor
- Protein purification columns

**** *indicated materials that are highest priority and absolutely necessary for the conduction of Biotech laboratories*

**G. Summary and Analysis: Program Supports**

**Response:**
The program has many support mechanisms already established. A full-time and part- time technicians are in place to assist in the preparation of laboratory materials. Currently the school does possess a number of instruments that are effective in the teaching of Biotechnology techniques. Due to laboratory space limitations, however many of these instruments have been placed in storage. These need to be resurrected and repaired and calibrated. There are also a number of instruments and materials that need to be purchased immediately to assure the conduction of quality laboratory experiences.

**2. Academic Supports**

**A. Are there sufficient instructional/research resources to support student learning in this program?**

**Response:**
No

**B. Assess the overall currency of the current collection of books, periodicals, and audiovisual materials in the library. Recommend new acquisitions and/or periodical subscriptions. In addition, please work with the library staff to weed outdated materials from the library's current holdings.**

**Response:**
The current materials available in the library as insufficient for program support. The Coordinator of the department in conjunction with the local industry is compiling a list of appropriate materials. These will be cross checked with the adjunct faculty members teaching the specific biotech courses. Once a consensus is obtained, a list of materials will be submitted for purchase.

**C. Are there sufficient technology resources, specifically software and hardware resources? Are these resources available and accessible to students? To faculty?**

**Response:**
With the use of the computer laboratory in room 302S there is sufficient hardware in place to support the program . There is some additional software that needs to be ordered to help enhance the program. The Coordinator in conjunction with both industry and the instructional staff are exploring the best possible programs. Further development of computer technologies, with computer hardware and analysis programs located directly in the laboratory and linked to the running experiment would be the ideal application of laboratory technologies.

**D. Provide a list of recommended technology acquisitions (i.e., software, hardware, PC projection units, etc.) Please prioritize this list and identify the immediacy of the priority.**

**Response:**
This list is still under revision as the coordinator and the instructors preview the software. However the general materials are recommended:
6- 12 computers located directly in the laboratory which have direct analysis software as well as Excel spreadsheets for immediate data input and analysis.
Software introducing the concepts of DNA sequencing, protein analysis, cellular energetics and microbial identification.

**E. Does the Individualized Learning Center provide ample academic support services for students in the program?**

**Response:**
No

**F. Provide recommendations for improved academic support services.**

**Response:**
The biotechnology program meets in the evening as a result students do not have access to a tutor for the biotechnology courses. The hiring of a general biology/chemistry tutor and the availability of evening hours would be very beneficial to the program.

**G. Summary and Analysis: Academic Supports**

**Response:**
Many academic supports of the Biotechnology program exist and are sufficient . Increased technologies in both laboratory hardware and software would greatly benefit the program. This is especially true of biotechnology since it exists as a progressive and "cutting edge" industry. Academic support in the form of an evening tutor would also greatly benefit the program.

**3. Student Supports**

**A. How do your students explore career opportunities and prepare to access them?**

**Response:**
Currently there is no formal mechanism in place. Currently the Coordinator of the program works directly with the student and industry in an effort to place the student into available biotechnology positions. The Coordinator has recently created a streamline hiring collaboration with the human resource office at Abbott

**B. Provide recommendations for enhancing students' career exploration and planning.**

**Response:**
- Incorporate more industry techniques and procedures into the course
- Bring industry on campus and/or into the classroom
- Incorporate resume writing and interview skills into the technical writing documentation components of the curriculum.
- Provide job fair as part of the techniques course
- Develop streamlined hiring procedures with additional biotech companies

**C. Are current student support services adequate to support the teaching and learning process?**
**Consider:**
- **Counseling Services**
- **Disability Services**
- **Health/Wellness Center**
- **Transfer Information**
- **Other Services (as listed in QCC catalog)**

**Response:**
N/A

**D. Provide recommendations for additional services that would be beneficial to your students.**

**Response:**
**N/A**

**E. Summary and Analysis: Student Supports**

**Response:**
Career exploration and placement needs to be expanded. Since there is a diversity of the types of jobs available in the industry students are often unaware of the myriad of career opportunities available to them. Bringing local industries on campus to discuss their role in the development of biotechnological techniques, and provide mini "career fairs" can rectify this deficiency. Streamlining communication regarding hiring with the local companies will also benefit student career exploration.

## 4. Physical Facilities

**A. Are the current physical facilities sufficient from an instructional perspective? If no, explain and provide recommendations.**

**Response:**
No, the present laboratory is shared by physics, physical science and anatomy and physiology. Much of the industrial biotechnology equipment has been placed in trailer storage to accommodate physics and physical science. The fermenter has been taken off line and its space has been converted to storage for physics. Instructors do not have access to vital instructional equipment. There is also no space to set up necessary new equipment. Recommend that a laboratory be designated for biology use only. Biotechnology equipment could be moved back into that space. Courses scheduled in that space would be those courses that use the same equipment. This would include other biology courses and there is possibly some overlap with the manufacturing program.

**B. Are the current physical facilities sufficient from a competitive perspective? If no, explain and provide recommendations.**

**Response:**
No. As stated above, equipment for the program has been placed in storage. This limits the both the quality and the currency of the curriculum. Recommendations are the same as above.

**C. Given enrollment projections, will additional classrooms or laboratories be required? If yes, please specify the requirements and identify immediacy of the need.**

**Response:**
Yes, laboratory space needs to be available to support 24 students and all of the equipment necessary to provide current quality instruction.

**D. Summary and Analysis: Physical Facilities**

**Response*:***
Physical facilities are severely lacking. A laboratory needs to be designated for the biotechnology program and the equipment necessary for curriculum delivery needs to be set up permanently in the laboratory. This laboratory could share space with laboratory courses that would overlap in the use of the equipment. The Coordinator of the program is currently trying to alleviate the space and equipment burdens by creating laboratories for specific courses at the appropriate industries. To date the search for funding these collaborative models has been unsuccessful.

## 5. Program Financing

**A. Has the program's funding been sufficient over the last five years? Please explain your response.**

**Response:**
No. No new equipment has been purchased and much of the existing equipment has been placed in storage or has fallen into disrepair. Any funding has been monies from the departmental budget. Biotechnology courses have the lowest priority on this agenda. Changes to the departmental spending procedures have changed in the past year and a half. Purchasing is no longer prioritized based on course need and course equipment over-lap. It has become a "first come first served" policy and biotech receives the lowest priority.

**B. Provide an analysis of the cost of this program. Be sure to include ALL costs. (For example, costs associated with instructional salaries, space, lost opportunity costs, equipment rentals and/or maintenance, etc.**

**Response:**
The Biotechnology program is currently offered only after 4 p.m. and, as such, core courses are taught exclusively by adjunct faculty. Instructional costs estimates are based upon Step 3 salaries in effect for the Fall semester 2002, and assume that the students take the Chemistry of Living System after 4 p.m. Introduction to Microcomputer Applications is ubiquitous with multiple sections, therefore, the cost for this course is not computed in the instructional costs.

| | |
|---|---|
| Instructional Costs | $22,000 |
| Coordinator Cost | $8,000 (one course reduction) |
| Equipment Cost/Repair | $40,000 to $100,000 |
| Supplies Cost | $3000 |
| Total Cost | $73,000-$113,000 |

**C. Based on your enrollment projections, are there projected increases or decreases in the budgetary requirements of this program over the next five years?**

**Response:**
There would be major budget increases initially then they would level off. This results from the fact that the program currently is unbudgeted. Initial increases would reflect equipment purchases and creating physical space. After these two steps the budget would level out and require funding for equipment maintenance and calibration.

**D. Summary and Analysis: Program Financing**

**Response:**
Over the past five years the biotechnology program has been under-funded. The program needs ample funding for the next two years, the funding demands would then taper off. The initial upfront funding would be necessary for the resurrection, repair and calibration of the biotechnology equipment currently in storage, as well as the purchase of new equipment. Additionally specific laboratory "kits" need to be purchased. After restoration of the biotechnology laboratories, the budget requirements would primarily support yearly maintenance and calibration of equipment and the ordering of bulk supplies.

## Section IV: Executive Summary of Findings

**Briefly summarize the program highlights and recommendations for program improvement (2-4 pages). Provide a summary of action steps that prioritize what needs to be done with an estimated timeline for completion. Remember that this document will be presented to the QCC Board of Trustees and the President's staff as a tool for negotiating necessary program resources.**

**Response:**

**Program Strengths**

- Availability of employment opportunities projected for the next 2-5 years
- Lack of local competition in the College's service area
- Current reputation of QCC students/program in the biotechnology industry
- Existing collaboration with local industry
- An active Program Coordinator who has connections to many of the biotechnology companies
- A commitment on the part of the Biology/Chemistry Department to assume full ownership of the program

**Strategic Institutional Supports**

| | |
|---|---|
| **IP** | • Existing laboratory space should be modified to accommodate program requirements<br>  • Only laboratory sections of courses with common equipment and supplies requirements should be scheduled in the lab so that equipment and supplies storage does not become an issue. |
| **IP** | • Equipment upgrades (purchase/repair) will have to be made, as existing equipment is out of date or in limited quantity. |
| **EP** | • Curriculum Revision<br>  • The core courses in the curriculum are being revised to incorporate the use of Excel and Access into the preparation of laboratory reports.<br>  • The objectives for the courses are being expanded to develop concepts in technical report writing into each core course in the curriculum<br>  • The revised materials for Cell Biology will be in place by Fall 2002, Molecular Biology will be in place by Spring 2003.<br>  • The revised Biotechniques course materials will be in place by the Summer of 2003.<br>  • Biotechnology components will be available for the Chemistry of Living Systems by S 2003.<br>  • Revised materials for Microbiology that includes concepts specific to biotechnology are completed |
| **IP** | • Advertisements and Recruitment<br>  • Very little targeted marketing for the program has occurred in the past.<br>  • Students primarily as a result of word of mouth advertising have populated the program.<br>  • If the College is to fulfill the workforce development needs of the industry, it will have to attract greater numbers of emergent workers to the program.<br>  • This translates into increased recruiting efforts targeted towards the recent high school graduate and students currently enrolled in the General Studies program. |
| **IP** | • Streamlining Career Exploration and Graduate Hiring Process<br>  • The Program Coordinator will continue to act as the point person with the biotechnology companies to assist in career exploration and recruitment activities.<br>  • Other areas of the College must become knowledgeable about the field to assist in advising and recruitment. |
| **IP** | • Creating competencies and establishing consistencies in faculty instruction for the program through professional development activities including externships |
| **EP** | • Increasing industry partnerships/collaboration |
| **IP** | • Generation of data on graduates, placements, applicants, etc |