

NORTHERN ESSEX COMMUNITY COLLEGE

Program Review Year 2013 – 2014

Name of Program:

Laboratory Science Program

Program Review Team Members

<u>Name</u>	<u>Title</u>
Marguerite White-Jeanneau	Laboratory Science Program Coordinator and Program Review Team Leader, Assistant Professor, Natural Science Department and Laboratory Science Program
Kevin Mitchell	Associate Professor, Natural Sciences Department and Laboratory Science Program
Jennifer Jackson-Stevens	Program Coordinator for the Respiratory Care Program
Liliana Brand	Associate Professor, Mathematics Department
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David Legg	Vice President of Quality Assurance, Charm Sciences, Lawrence, MA

DATE: _____

INTRODUCTION - BACKGROUND

REGIONAL ACCREDITATION CONTEXT FOR PROGRAM REVIEW

NEASC Standard 2.5: The institution has a system of periodic review of academic and other programs that includes the use of external perspectives.

NEASC Standard 4.8: The institution ... on a regular cycle reviews its degree programs under effective institutional policies that are implemented by designated bodies with established channels of communication and control. Faculty have a substantive voice in these matters.

SCHEDULING OF PROGRAM REVIEWS

The Associate Dean of Academic and Institutional Effectiveness shall maintain a copy of the current schedule for programs to be reviewed, including the names of the person(s) designated as program review team leader(s). The schedule shall be developed by the Deans/ Assistant Deans, and shall be posted on the College's website.

FORMATION OF PROGRAM REVIEW TEAM

The team leader will identify at least five program review team members as follows:

- A. Faculty
 - i. If there are full-time faculty members in the program in addition to the designated team leader, then at least one should be included on the team.
 - ii. If there are no full-time faculty members in the program in addition to the team leader, then the leader can consider including on the team:
 - a. At least one part-time faculty member in such cases where it is believed that the part-time faculty member has sufficient experience and investment in the program to make an informed and solid contribution to the program review, OR
 - b. If no such part-time member can be identified, at least one person who is not a faculty member but who can serve the intended purpose. This may include an outside professional, a faculty member from a related program (e.g., where there is overlap of courses), or some such other individual.
 - iii. At least one faculty member shall be from outside the department/program.
 - iv. At least one faculty member shall be from outside the division.
- B. External Representative
 - i. At least one Advisory Committee member, or a member of an effective approved alternative, should be included on the team. Alternative representatives include an individual from a four-year institution to which students from the program transfer. This individual would be knowledgeable concerning the program and its graduates. Another possible alternative is a representative of an area high school which is an important feeder source for the program.

SUGGESTED TIMELINE FOR PROGRAM REVIEW PREPARATION

The program review calls for insertion of the program's outcomes and assessment plan. This plan is very helpful in addressing many sections of the program review report. *The following timeline is based on the assumption that the outcomes and assessment plan has not been developed prior to the program review year.*

Date	Activity
January/ February	Inform/ Orient: Associate Dean of Academic and Institutional Effectiveness informs Dean and/or Assistant Dean and individual(s) who have been designated as program review team leaders of their programs scheduled for program review, which is due by February 1 of the next year. Associate Dean schedules meeting with Dean and/or Assistant Dean, and the designated team leader to orient them to the review materials and process. Deans and/or Assistant Deans inform team leader concerning any specific requirements related to the process.
February	Assemble team/ Begin meeting: Team leader identifies members of the team that will be involved in the program review. Team begins meeting, and develops a schedule of and process for meetings. First task is to orient team members to the work ahead.
February/ March	Develop program mission statement and program outcomes: Team members begin developing the program mission statement, objectives and student learning outcomes. Begin to develop the outcomes and curriculum map.
March	Complete curriculum and outcomes assessment maps.
March/ April	Complete the outcomes and assessment plan. Complete SECTION IX of the program review.
September	Complete SECTIONS I, II, AND III of the program review. NOTE: IN LATE SEPTEMBER, THE ASSOCIATE DEAN WILL PROVIDE THE TABLE NEEDED TO ADDRESS "D" IN SECTION III. Distribute Chart 6 to each faculty member involved in the program: Ask for returns by mid-October.
October	Complete SECTION IV, V, AND VI of the program review. IN OCTOBER, THE ASSOCIATE DEAN WILL PROVIDE THE CHARTS NEEDED TO ADDRESS SECTION V.
November	Complete SECTIONS VII, VIII, X AND XI. NOTE: IN EARLY NOVEMBER, THE ASSOCIATE DEAN WILL PROVIDE THE CHARTS NEEDED TO ADDRESS SECTIONS VII AND "C" IN SECTION XI.
November/ December	Complete SECTIONS XII THROUGH XV. Review and edit as needed.
By February 1	Submit final draft: Dean and/or Assistant Dean receives final copy of program review document.
April	Annual program review summit meeting: Attended by the President, Vice President of Academic Affairs, Deans, Assistant Deans, Associate Dean of Academic and Institutional Effectiveness, faculty involved in program reviews, and any other interested faculty and staff.

PROGRAM REVIEW

SECTION I: ACCREDITATION/ APPROVAL/ CERTIFICATION

A. Does the program have external (specialized) programmatic accreditation?

Yes _____ No ☒ _____

IF NO, skip to I (B).

IF YES, please complete items 1 through 8 below.

1. What is the name of the programmatic accreditation agency?
2. What is the current accreditation status of the program?
3. What date was the last accreditation status awarded?
4. What is the anticipated date of the next accreditation action?
5. How often does the program file an official report with the accrediting agency?
6. Where is the program currently in the review schedule (e.g., year 3 of a 7 year cycle)?
7. What were the strengths and weaknesses of the program, as identified by the accreditation agency during the last accreditation activity? *(Base your response in this area to the citation of Standards.)*
8. How has the program been revised to address the citations or recommendations?

B. Does the program have external (specialized) programmatic approval or certification?

Yes X____ No _____

IF NO, skip to I (C).

IF YES, please complete items 1 through 8 below.

1. What is the name of the programmatic approval or certification agency?

The Massachusetts Life Science Education Consortium (MLSEC) is a collaboration between the MassBioEd foundation and the Massachusetts Biotechnology Council. Its goal is to connect Massachusetts biotechnology industry representatives with higher education programs in the state to better promote and support career preparation in the life sciences.

2. What is the current approval or certification status of the program?

The Laboratory Science Program at Northern Essex Community College is currently endorsed by the MLSEC as a Gold Level Biotechnology Program.

3. What date was the last approval or certification status awarded?

The Laboratory Science Program applied for endorsement from MLSEC during their first round of applications in January 2011.

4. What is the anticipated date of the next approval or certification action?

Spring-Summer 2014

5. How often does the program file an official report with the approving or certifying agency?

The endorsement from MLSEC is valid for three years. At the end of the three year cycle, programs can reapply for endorsement. The MLSEC will be opening the process for the second round of endorsement applications sometime in Spring 2014.

6. Where is the program currently in the review schedule (e.g., year 3 of a 7 year cycle)?

The program is currently in year 3 of 3 year cycle.

7. What were the strengths and weaknesses of the program, as identified by the approval or certification agency during the last approval or certification activity? (*Base your response in this area to the citation of Standards.*)

To receive MLSEC endorsement, the Laboratory Science Program has to meet the following criteria:

- 1) Students completing the program courses achieve the core competencies agreed upon by MLSEC industry and higher education members. These core competencies can be found at:
https://www.massbioed.org/educators/higher_education/mlsec/core_competencies.
- 2) The program focuses on the knowledge and skills necessary for entry level positions in the research and manufacturing sectors of the biotechnology industry.
- 3) Credits earned through the program are readily linked to an associate's level degree.

The NECC Lab Science Program was further given gold level endorsement because, in addition to meeting the criteria above, it requires students to complete an internship before graduation.

8. How has the program been revised to address the citations or recommendations?

In order to meet these criteria prior to our first application, the Lab Science Program faculty had to review our curriculum and make sure that we were fully covering all required competencies. As a result of this review process, the lecture and laboratory curriculum of our SCI106 course, Integrated Science II, were revised to incorporate a greater amount of microbiology and nucleic acid chemistry. Furthermore, the coverage of protein chemistry was strengthened in the lecture and lab curriculum of the CHM203 course, Introduction to Organic and Biochemistry.

In preparation for our second endorsement application, the Laboratory Science Program has also requested approval to make BIO230, Cell Biology, a program requirement. This upper level course covers cell culture techniques, a major component of the MLSEC core competencies. Previously, this course was a program elective option. By making it a required course, it ensures that all graduates of the Lab Science program will receive training in all the MLSEC core competencies.

C. Is there an external accrediting, certifying, or approval organization relevant to your program from which you are not currently receiving accreditation, approval or certification?

Yes _____ No ☒ X_____

IF NO, skip to question II.

IF YES, please complete items 1 through 3 below.

1. What is the name of this external organization?

2. What status can your program receive from this organization?

Accreditation _____ Certification _____ Approval _____

3. Are you intending to apply for accreditation, certification, or approval from this organization?

Yes _____ No _____

IF NO, please explain, then go to question II.

IF YES, please complete items 4 through 7 below, then go to question II

4. Why are you intending to apply for accreditation, certification, or approval?

5. When are you intending to apply and why?

6. Are there any specific resources you will need when you go through the accreditation, certification, or approval process that you do not currently have? If yes, please describe.

7. Please provide information about any additional questions, concerns, etc. you may have with respect to your intention to apply for accreditation, certification, or approval.

SECTION II: MISSION AND PURPOSES

NEASC Standard 1.4: The mission and purposes of the institution are accepted and widely understood by its governing board, administration, faculty, staff, and students. They provide direction to the curricula and other activities and form the basis on which expectations for student learning are developed. Specific objectives, reflective of the institution's overall mission and purposes are developed by the institution's individual units.

NEASC Standard 4.1: The institution's programs are consistent with and serve to fulfill its mission and purposes...

NOTE: IF YOUR PROGRAM HAS EXTERNAL ACCREDITATION, APPROVAL, OR CERTIFICATION, please respond below only to those areas not addressed in the external report.

A. The program's mission statement is as follows:

The Associate in Applied Science degree program in Laboratory Science is designed to build the essential skills and knowledge required for entry level employment and/or transfer to a four-year college or university. The curriculum allows students with minimal science and mathematics backgrounds to enter the program and develop the skills needed to successfully complete upper level science courses.

The primary goals for the Laboratory Science Program are: (1) to prepare students to be laboratory technicians in the biotechnology, analytical chemistry and environmental sciences industries; and (2) to ensure that as many courses as possible in the Lab Science Program will transfer for those students that wish to eventually pursue a Baccalaureate degree.

In order to prepare students to obtain entry level jobs in local scientific companies, students graduating from the Laboratory Science Program will develop general laboratory skills, including lab safety knowledge and the ability to follow standard operating procedures (SOP). In addition to these general laboratory skills, students will focus their training in one of the three specific disciplines and develop a knowledge base that will allow them to continue to learn and grow in their chosen specialty. During the coursework, students will also have the opportunity to develop soft skills, such as oral and written communication, interpersonal relationships and proper work habits. The hands-on skills and theoretical knowledge gained while in the Laboratory Science Program will also prepare those students that wish to transfer to a four year institution.

B. Describe the process through which faculty developed the program mission.

The team leader developed the original draft for the mission statement after reviewing the program description provided to the Department of Higher Education when starting the Laboratory Science degree program. This draft was then distributed to the faculty in the program for their review and comment. The revised draft was then distributed to the program review team via e-mail for their review and comments.

C. Describe how the program's mission statement is consistent with, or aligns with, the mission of the College, which is as follows:

The mission of Northern Essex Community College is to serve the people of the Greater Merrimack Valley as a caring and comprehensive center of educational excellence that offers high quality, affordable adult and post-secondary education through the Associate Degree level, as well as a broad range of occupational programs and community services which enhance the social, cultural and economic life of the region.

The Lab Science program provides the people of the Greater Merrimack Valley the opportunity of a high quality preparation for a career in several types of laboratories. It prepares students for two possible routes into the scientific field, either entry level employment as a lab technician upon graduation with their Associate's degree or transfer to a four year degree program in the sciences.

D. Describe how this program facilitates the accomplishment of the College's Core Values.

(For more information, go to: <http://www.necc.mass.edu/about/values/>)

- **Student Engagement:** The Laboratory Science program focuses on hands-on education in the laboratory. The development of technical and soft skills is achieved through active engagement of students in a variety of laboratory and classroom activities. Core courses are designed to reinforce technical and soft skills at a variety of levels throughout the program.
- **Collaboration:** The Laboratory Science program has developed a variety of productive relationships with regional industry representatives through its advisory board and its externship program. Additionally, representatives of two regional universities sit on our advisory board and provide valuable guidance on preparing our students for transfer. Several articulation agreements have been developed or are being developed with four year institutions. Finally, the Laboratory Science program collaborates with a variety of local secondary schools (for example: Greater Lawrence Technical School, Haverhill High School STEM Academy, and several Haverhill middle schools) to promote STEM career choices and provide exposure to college and science laboratory work among local students.
- **Personal and Professional Growth:** The Lab Science program supports the professional development of its faculty. Faculty have participated in a variety of opportunities for additional technical training through Waters Corporation, the MassBioEd foundation, and the NSF funded Chemistry Collaborations, Workshops and Community of Scholars network. Furthermore, all graduating students are given honors credit on their transcripts for completing the Research Experience course, one of the final courses in the Lab Science program sequence. As part of this course, the students are all given the opportunity to present the results of their research projects at the NECC Honors Poster Session in the spring.
- **Respect:** The Lab Science faculty strive for clear and consistent communication with our students about course and program expectations at all times. We try to create an environment where students feel comfortable speaking to us about concerns and questions. We also communicate the necessity of respect for others in the classroom and lab as a requirement for all program courses.

- **Diversity:** The Lab Science program student population reflects the diverse student population at the college. From 2009 to 2012, total minority students comprised 35-47% of Lab Science program student enrollment. Hispanic student enrollment was 21-30% of total Lab Science program enrollment during the same time period. These percentages are from the 2009-2012 Demographics Reports generated by the NECC Office of Institutional Research and Planning.
- **Access and Opportunity:** All lab space used by the Lab Science program is handicapped accessible. The Lab Science faculty also gladly work with the Office of Learning Accommodations to further help students with documented learning disabilities. Finally, Lab Science faculty have collaborated with each other to choose one major textbook for use in three of the core science courses. This helps keep educational costs affordable for all our students.
- **Excellence:** The Lab Science faculty strive to provide the highest quality education and training for our students. We thoughtfully developed the curriculum and continue to revise it to better meet the needs of local industry and transfer institutions. We have been praised by industry externship hosts and transfer institutions for our 'fine job in teaching and training students . . . who are well prepared for entering the laboratory work setting.'

E. Describe how this program satisfies or is consistent with one or more of the College's Strategic Goals:

(For more information, go to: <http://facstaff.necc.mass.edu/vision-and-planning-initiatives/strategic-planning/strategic-goals-2012-2015/>)

Goal 1: Develop a Comprehensive Urban Campus in Downtown Lawrence: Currently the Lab Science program partners with Greater Lawrence Technical High School to provide workshops for their biotechnology classes that allow GLTS students to work with our instruments in our labs while learning more about NECC and the Lab Science program. Furthermore, one of the Lab Science faculty serves on the advisory board for the biotechnology program at Greater Lawrence Technical High School.

Goal 2: Improve Student Learning, Retention, and Graduation Rates: The Lab Science faculty started the program with the goal of a 60% or greater retention rate from one year to the next. Table 1 below compares the retention rates for Lab Science majors versus the total student population at NECC from fall to spring from 2009-2012. The data comes from the NECC student Retention Report generated by the *Office of Institutional Research & Planning* 06/10/2013.

Table 1. Student Retention Rates: A Comparison of LSP with NECC Total

	Retention Fall 09 - Spring 10	Retention Fall 10 - Spring 11	Retention Fall 11 - Spring 12
NECC Total	69%	68%	70%
LSP Cohort	72%	77%	79%

As the data shows, the retention rate for the Lab Science program exceeded both the 60% goal and the retention rate for the college as a whole for every fall to spring semester transition from 2009-2012. To further improve retention from 2009 to 2010, the learning objectives of the first two lab based courses were significantly modified and particular attention was paid to providing students more direct support with laboratory calculations.

Goal 3: Improve Academic Support Services: For the past two summers, a Lab Science faculty person has worked some hours in the Advising Center to provide immediate faculty contact for prospective new Lab Science majors. Furthermore, Lab Science faculty began reviewing and inputting suggested academic plans into DegreeWorks for all declared Lab Science majors. These academic plans should help support advisors and guide students into appropriate class choices.

Goal 4: Improve Student Career Preparation: One of the Lab Science program's key components for student career preparation is the required externship. Students gain valuable workplace training and resume experience that helps them stand out above other entry-level candidates. Approximately 53% of Lab Science graduates have chosen to seek employment as a lab technician upon graduation. For those seeking employment, 86% have found jobs in the STEM field.

Goal 5: Expand a 'Culture of Learning' Across the College: Lab Science faculty have participated in a variety of professional development activities. This includes content specific training offered by Waters Corporation, the MassBioEd foundation, and the NSF funded Chemistry Collaborations, Workshops and Community of Scholars network. In addition, faculty have participated in a variety of NECC professional development activities such as the Transitions to Academic Success training in reading strategies and the NECC Leadership Academy. What they've learned in these trainings has been used to improve curriculum and teaching strategies for improved student success.

SECTION II SUMMARY:

Strengths related to Mission and Purposes:

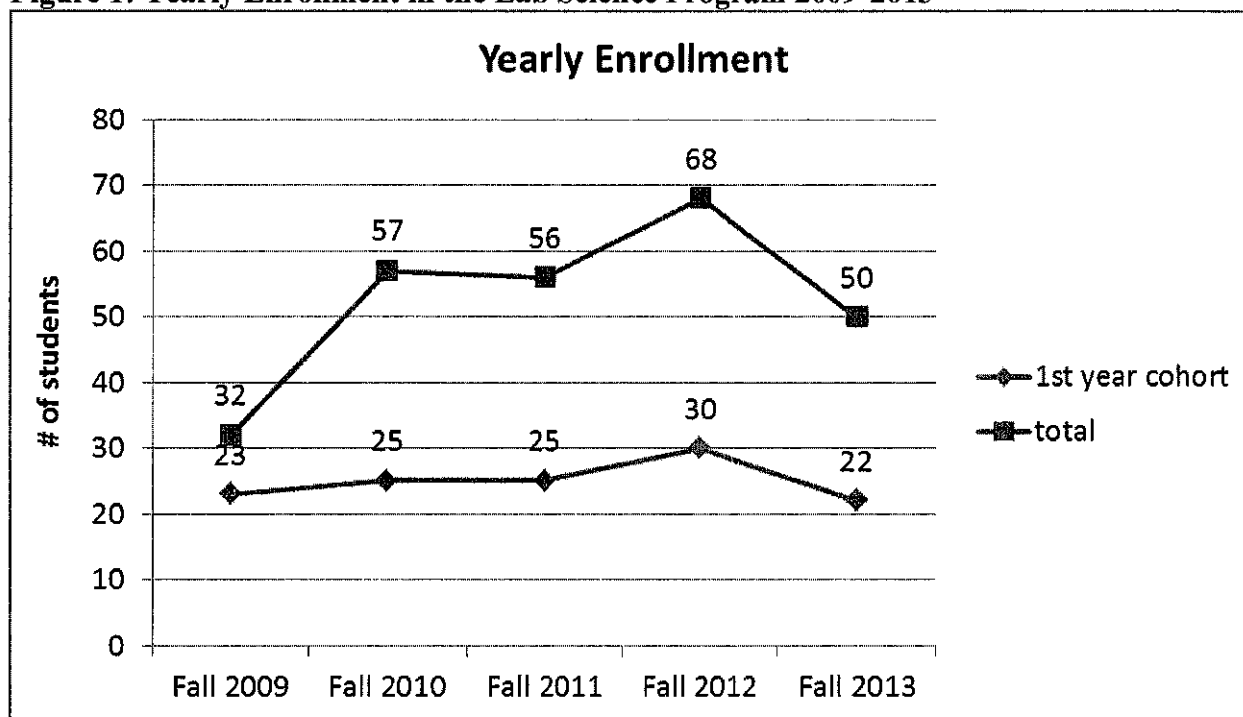
The Lab Science program strongly supports the mission of the College and its seven core values of student engagement, collaboration, personal and professional growth, respect, diversity, access and opportunity, and excellence. Furthermore, the Lab Science program contributes significantly to Strategic Goals 1, 2, 3, 4, and 5.

Challenges or Areas for Improvement related to Mission and Purpose:

While the Lab Science program and faculty do have connections with the biotechnology program at Greater Lawrence Technical High School in support of Strategic Goal 1, this connection could be strengthened by an articulation agreement between the two programs. A discussion was started about a year ago with Greater Lawrence Technical High School about this articulation agreement, but further process towards the agreement has not happened.

Relative to Strategic Goal 2, student retention rates from one year to the next are strong. However, total enrollment in the program slipped in Fall 2013. This can be seen in Figure 1 below. The data shown is from the *NECC Enrollment History by Program, Fall 2001-Fall 2013* report generated by the NECC Office of Institutional Research & Planning 9/20/2013 and from the enrollment history of the course Integrated Science I SCI105. Total enrollment includes all declared Lab Science majors taking the Lab Science program. These numbers reflect both those in the lab-based core courses as well as those still taking only developmental courses or general education course in preparation for the core program courses. The 1st year cohort numbers are based on our class records of enrollment each year in the first core lab course in the sequence, Integrated Science I (SCI105). The difference between the two data sets indicates that a significant number of declared majors are taking developmental or general education courses. Total enrollment also appears to have dropped in 2013. While it is unclear whether this downturn is an anomaly or the beginning of a trend, it is something that is worth watching in the future. Continuing efforts to increase student enrollment in the program could also ultimately increase total student retention and graduations.

Figure 1: Yearly Enrollment in the Lab Science Program 2009-2013



In support of Strategic Goal 3, Lab Science faculty have started to develop academic plans for all Lab Science majors in DegreeWorks. This work is not complete. As students continue to enroll and progress through the program, these academic plans should continue to be reviewed and inputted.

While many graduates find employment relatively easily in the STEM field after graduation, there is still a need for better support and training for the job search process for those still looking. If faculty work more closely in the future with the new Career Connections coordinator at the college and have students take advantage of the workshops offered on interviews and cover letters, this will strengthen the Lab Science program's success with Strategic Goal 4.

Recommendations for actions needed to be taken to address Challenges or Areas for Improvement:

1. The Lab Science faculty need to take the time necessary to review the biotechnology curriculum at Greater Lawrence Technical High School and decide what, if anything, will stand in for any of our courses. This will allow conversations to continue with Greater Lawrence Technical High School about an articulation agreement between the two programs. Such an articulation agreement could also help increase total Lab Science student enrollment (relative to Strategic Goal 2) by providing an alternative path into the program.
2. This past fall, Lab Science faculty have started focusing more attention and effort on student recruitment. The following connections have been formed:
 - a. Discussions have begun with faculty and administrators at the Haverhill High School STEM Academy on ways to collaborate to promote careers in STEM fields and the Lab Science program as a potential career pathway.
 - b. Discussions have begun with the NECC Center for Adult Education Programs and Practitioners (CAEPP) about a possible collaboration on a grant-funded summer STEM Academy to better recruit and prepare adult learners for success in the Lab Science program.
 - c. As part of an NECC Leadership Academy project, plans have begun for an appreciative inquiry based study of the Lab Science program strengths that we can market to prospective new students.

Faculty need to continue to pursue these opportunities and keep an eye out for additional ones.

3. Faculty also need to continue to review student academic plans in DegreeWorks and input new plans for incoming students. As part of this effort, students must be encouraged to come in and talk with faculty advisors to ensure their academic plans fit their goals and schedules.
4. Finally, faculty need to work more closely with Ashley Bragger, the new Career Connections coordinator, to find resources to better prepare our students for their job searches. This effort has begun. This spring, Ashley will be helping us coordinate a mock interview session with human resource professionals from Lonza Biologics and plan a workshop specifically for our students on informational interviews and interviewing skills. In addition, we've made attendance mandatory for our second year students at the resume writing and cover letter workshops organized by Ashley Bragger for the larger NECC community.

SECTION III: PROGRAM POLICIES AND PROCEDURES

NEASC Standard 4.3 Each educational program demonstrates coherence through its...policies and procedures for admission and retention...

NOTE: IF YOUR PROGRAM HAS EXTERNAL ACCREDITATION, APPROVAL, OR CERTIFICATION, please respond below only to those areas not addressed in the external report.

A. List any specific program policies and procedures, and comment on the rationale for any differences from institutional policies and procedures.

(Programs may need to develop specific policies and procedures related to the day-to-day operation of the specific program [e.g., to meet accreditation standards, to establish the parameters for clinical education experiences]. When there are specific program policies and procedures, these policies and procedures should be consistent with those of the institution. Differences between program-specific policies and institutional policies should be described within the context of the program.)

All lab-based courses at the college must adhere to the lab safety regulations developed by the Natural Sciences department and the NECC Safety Officer. This policy is not specific to just the Lab Science program but applies to all lab-based courses offered through the Natural Sciences department. There are currently no specific Lab Science program policies or procedures outside of the program curriculum requirements.

B. Describe the mechanism used to assure that all students in the program receive copies of current program-specific policies and procedures, relevant information about the program, and information about the institutional policies and procedures.

A copy of the Natural Science department lab safety regulations is distributed to students and reviewed with them during the first lab meeting of any science course at the college. Students must sign a statement that they understand and agree to abide by these regulations to continue to participate in labs.

Program curriculum requirements are communicated to students through meetings with their faculty and academic advisors. The information is reinforced by faculty during the program core courses as necessary.

C. Describe how the program defines “student success.” (For example, if the program facilitates student transfer, and students do indeed transfer, does this meet the program’s definition of success?) Describe the program’s policies, procedures and practices related to student success.

The two major pathways for graduates of the Lab Science program are transfer or employment. As a result, the two major indicators of student success are transfer to a 4 year program in the sciences or employment in the STEM field.

In addition, student success is defined relative to the learning outcomes defined in the Outcomes and Curriculum Map in Appendix 5. A successful student will have shown satisfactory level of accomplishment for all the outcomes outlined in the curriculum map.

D. Describe how significant modification of this program would impact other programs at NECC. (Reference Table 1 in Appendix 1.)

Significant modification of the Lab Science program will not have a major impact on other programs at NECC. As can be seen in Table 1 in Appendix 1, very few non-majors enroll in program courses. In Fall 2012 and Spring 2013, one non-major enrolled in the introductory program core courses of SCI 103 (Success in Science seminar), SCI 105 (Integrated Science I), SCI 104 (Topics in Laboratory Science), and SCI 106 (Integrated Science II).

SECTION III SUMMARY:

Strengths related to Program Policies and Procedures:

A comprehensive lab safety policy is essential to welfare and safety of any students or faculty working in a laboratory at the college. While the lab safety regulations are not specific to the Lab Science program alone, they are an integral part of the safety protocols we teach our students. The consistent and clear communication of these policies across the department is a major strength for all the science programs at the college.

Challenges or Areas for Improvement related to Program Policies and Procedures:

Communication of program curriculum requirements is always a challenge as it is the student's responsibility to schedule meetings with their faculty advisors. Talking with students during their core program courses is helpful and the program faculty take advantage of this opportunity when appropriate. However, students who are still in developmental courses do not get this class time contact with program faculty. As these students are often the ones who most need information about the program, its requirements, and career outlooks, this is a major gap in the faculty-student advising loop. Implementing DegreeWorks academic plans is a help in communicating with these students. However, these plans can't be effectively tailored to student goals and schedules until the students meet with their faculty advisor. Furthermore, the academic plans don't really help these students understand what the program is about or what they can do with a degree in Laboratory Sciences.

Recommendations for actions needed to be taken to deal with Challenges or Areas for Improvement:

1. Faculty must continue implementing academic plans in DegreeWorks for all newly enrolled and continuing Lab Science students.
2. Inviting all declared Lab Science majors (those enrolled in core program courses and those in developmental courses) to a welcome reception at the beginning of the fall semester would be a good way for faculty to meet new Lab Science students and answer any questions they might have about the program.

SECTION IV: CURRICULUM

NEASC Standard 4.3 Each educational program demonstrates coherence through its goals, structure and content...

NEASC Standard 4.5: Degree programs have a coherent design and are characterized by appropriate breadth, depth, continuity, sequential progression, and synthesis of learning.

NOTE: IF YOUR PROGRAM HAS EXTERNAL ACCREDITATION, APPROVAL, OR CERTIFICATION, please respond below only to those areas not addressed in the external report.

A. Describe the curriculum. *(You may use the same format used in the NECC Academic Catalog.)*

COURSE		Proficiency	Prerequisite
Number	Name		
SCI100	Basic Laboratory Calculations		
SCI103	Success in Science Seminar		
SCI105	Integrated Science I	College Reading Basic Writing	
SCI104	Topics in Laboratory Science	College Reading Basic Writing	
SCI106	Integrated Science II		SCI105
CHM121	General Chemistry I	College Reading	CHM111 or SCI105 MAT 120 or higher
CHM201	Introduction to Organic and Biochemistry		CHM121 and SCI106 or BIO220
CHM203	Instrumental Analysis		MAT 120 or higher and SCI106 or CHM122
SCI281	Research Experience Laboratory		
BIO280 CHM280, or ERS280	Research Seminars in Biotechnology, Chemical Analysis, or Environmental Science		Pre: CHM203 and ENG101 Co: SCI 281
SCI291 or 292	Externship In Laboratory Sciences I or II		CHM201, CHM203, SCI104, and SCI281
CIS 110	Computer Applications		
ENG101	English Composition I	Basic Reading Basic Writing	
MAT125	Statistics	College Reading	MAT022 or MAT 090
	Math Elective: MAT120 or Higher		
	General Education Elective: Recommended Social Sciences		

	General Education Elective: Recommended Humanities		
	General Education Elective: Recommended Humanities		
	Science Elective: Recommended BIO 215 or BIO220 or BIO230 or ERS125		

B. Discuss how the curriculum is an organized, sequential series of courses that progress from simple to complex learning.

During the first year of the program, students learn basic concepts in chemistry and biology (Integrated Science I and II, General Chemistry I). At the same time, students take seminars on Basic Lab Calculations, Success in Science, and Topics in Laboratory Science. The Basic Lab Calculations course specifically supports the students' first introduction to organized laboratory work in Integrated Science I. The Success in Science seminar and Topics in Laboratory Science course introduce students to career options in Laboratory Science while also providing more explicit instruction in goal setting, reading scientific literature, good manufacturing practices, communication and interpersonal skills, and ethics.

During the second year of the program, students gain more specific knowledge about organic and biochemistry as well as training with common laboratory instrumental methods (Introduction to Organic and Biochemistry and Instrumental Analysis). Students choose their concentration (Biotechnology, Analytical Chemistry or Environmental Science) during the second semester of their second year by choosing one of three research seminar options. This late choice allows students time to build their basic scientific background and explore the three concentrations before deciding which to pursue. It also aligns with employer needs. Employers expect our graduates to be readily trainable with a solid working knowledge of core lab techniques. All science labs regardless of the discipline require good analytical skills as well as the ability to properly prepare reagents, collect samples, follow lab safety procedures, and maintain and troubleshoot instruments. To ensure all of our students use the first year to develop the same core skills, we do not move them into their specialty areas until the second year.

Highlights of the second year are the Research Experience course in the spring semester and an Externship before graduation from the Laboratory Science Program. During the Research Experience course, students choose a semester long research project within their chosen concentration. They work closely with a faculty advisor to learn the background material associated with their project, master and troubleshoot appropriate standard operating procedures, and interpret and present the data they collect. This lab intensive course allows them the opportunity to refine the core techniques they've been learning throughout the program while gaining confidence in their lab skills as they work more independently on a semester long research project. As such, it helps prepare them for the final Externship course. The goal for the externship is for all students to have a laboratory experience in the "real world" and further develop their "soft skills", thus increasing their employment potential. While scheduled for the summer semester after their second year, students could choose to perform their Externship in the spring as long as prerequisites are met. It should be noted that the Externship course can be taken either as a 6 or a 3 credit course. This was done to accommodate students who may not be able to commit to approximately 360 off-campus externship hours during the summer due to time,

budget, and familial restrictions. Students that take the 3 credit externship only need to complete 180 externship hours but they do need to take an additional elective.

C. Describe the curriculum development, review and revision processes used by the program to assure that the curriculum meets the needs of students and graduates. Include discussion of the mechanisms that allow input into these processes from (1) employers of program graduates and (2) schools to which students transfer (if applicable).

The Laboratory Science Program curriculum was initially developed after faculty met with coordinators of biotechnology programs from other regional community colleges. These discussions indicated that the most successful technician training programs were those that worked closely with local companies and designed curriculum to meet industry needs. Further research by faculty into job opportunities for lab technicians revealed that entry level technicians were needed in environmental analysis and analytical chemistry companies in addition to biotechnology. Subsequently, an online survey was distributed to a variety of regional scientific companies in a variety of concentrations. Over 100 companies participated by answering questions on entry level lab technician hiring trends, level of education, skills/competencies, and externship opportunities. The data on skills/competencies was used to develop the initial curriculum. The faculty worked collaboratively with each other during the development process with regular peer review to make sure all major skills/competencies indicated by the industry survey were adequately covered. This collaboration has continued with the review of curriculum. A regular discussion is held at Lab Science faculty meetings on what areas of our curriculum need to be tweaked to better prepare our students for work and transfer.

During the initial program development, an advisory board was also formed comprised of regional industry representatives and representatives of transfer programs at four year universities. They have provided crucial review of our curriculum. The fall advisory board meeting usually focuses on a specific topic of curriculum on which we'd like more input. The industry supervisors of student externships also provide crucial feedback during their final assessments of student work. As a direct result of externship supervisor feedback, the structure of the Externship course was altered to include one week on campus prior to student placement in industry labs. This week includes specific instruction on the student's role as an extern in a busy working laboratory. Finally, transfer institutions have provided crucial input on curriculum as well. One of the major transfer programs for our students is the Clinical Laboratory Science program at University of Massachusetts Lowell. After the first of our graduates transferred, a discussion began between faculty at UMass Lowell and the Lab Science faculty about topics on which our students needed more training. The curriculum of the Introduction to Organic and Biochemistry course was altered to meet this need. Furthermore, students who are interested in transfer to the Clinical Laboratory Science program are now encouraged to enroll in a higher level Organic Chemistry course at UMass Lowell prior to officially transferring. Most of our students who have transferred to UMass Lowell have gone on to do very well in the Clinical Laboratory Science program as a result.

D. How does the curriculum contribute to the student accomplishing the six institutional learning outcomes - Written and Oral Communication Skills, Information Literacy, Quantitative Reasoning, Global awareness, and Science and Technology?

The following core program courses have been designated intensive in one or more of the institutional learning outcomes:

Written Communication: SCI281, Research Experience Laboratory

Oral Communication: SCI104, Topics in Laboratory Science

Information Literacy: CHM203, Instrumental Analysis

Quantitative Reasoning: CHM121, General Chemistry I and MAT 125, Statistics

Science and Technology: All Lab Courses including SCI105, SCI106, CHM121, CHM201, CHM203, and SCI281.

Students will have to meet the Global Awareness institutional learning outcome through their choice in general education electives.

E. How does the curriculum contribute to the student accomplishing program specific learning outcomes, as detailed in the program's Curriculum Map in Appendix 5?

As clearly seen in the Curriculum Map in Appendix 5, almost all the program specific learning outcomes are covered in multiple courses throughout the curriculum. This means that important topics are thoughtfully developed and reinforced throughout the program leading to better student mastery.

SECTION IV SUMMARY:

Strengths related to Curriculum:

The curriculum was thoughtfully developed and implemented to train students for entry level employment as a lab technician or for transfer to an appropriate four year program. Faculty have actively sought the input of regional industry and transfer programs and implemented their suggestions into the curriculum. Faculty continue to review and revise the curriculum on a regular basis.

Challenges or Areas for Improvement related to Curriculum:

While most program specific learning outcomes are covered in a multiple courses, there are two outcomes that are only covered in 1 course (outcomes 12 and 16). These are specific outcomes required for gold level endorsement by MLSEC and the program would be strengthened if these were reinforced in more courses.

Recommendations for actions needed to be taken to deal with Challenges or Areas for Improvement:

1. Cell Biology (BIO230) provides further reinforcement for outcomes 12 and 16. Currently BIO230 is a recommended elective for students in the biotechnology concentration. Lab Science faculty are seeking approval to make it a required course for all students in the program in preparation for their reapplication for gold level endorsement by MLSEC.

SECTION V: PROGRAM RESOURCES - FACULTY

NEASC Standard 5.2: The preparation and qualifications of all faculty are appropriate to the field and level of their assignments. Qualifications are measured by advanced degrees held, evidence of scholarship, advanced study, creative activities, teaching abilities, and relevant professional experience, training, and credentials.

NOTE: IF YOUR PROGRAM HAS EXTERNAL ACCREDITATION, APPROVAL, OR CERTIFICATION, please respond below only to those areas not addressed in the external report.

A. Discuss the number of faculty assigned to the program with respect to its adequacy to complete all activities associated with maintaining a high-quality educational program. (See completed Chart 5(A), Chart 5(B), and Chart 5(C) in Appendix 3.)

There are four primary faculty that teach in the Lab Science program. They teach almost all the Lab Science core courses as some combination of their full dayload or as a DCE class. In addition, they also teach non-Lab Science courses in the Natural Sciences department each semester. Because each of these faculty are consistently responsible for the same course from one year to the next, it allows them to develop more thoughtful and well-executed instruction that coordinates well with the other courses in the program.

While the number of faculty are very appropriate for teaching the number of program courses, the faculty also take on primary responsibility for helping students find and secure externships each year. This activity is above and beyond their teaching responsibility and can consume a large portion of their time in the spring semester.

B. Indicate the percentage of faculty that are full-time, as well as the percentage of credit hours taught by full-time faculty. (See Chart 5 (D) in Appendix 3.)

As seen in Chart 5 (D), 43% of faculty taught Lab Science courses as part of their full time dayload in Spring 2012. This meant that 39% of program courses were taught by full time faculty. These percentages rose in subsequent semesters. In Fall 2012, 60% of the faculty taught Lab Science courses as part of their full time dayload. In Spring 2013, this percentage was 57%.

It should be noted that almost all of the program courses were still taught by the four primary faculty associated with the Lab Science program in each semester. Every semester, these faculty taught a portion of the program courses as DCE classes instead of part of their primary dayload. The only semester someone other than the four primary faculty taught a Lab Science course was in Spring 2012. A DCE instructor (Andrella King) taught the Lab Science section of General Chemistry I. The Lab Science program no longer requests its own section of General Chemistry I as many of our students find the general sections fit their schedule better than the Lab Science section.

C. Discuss how the percentage of full-time faculty, both in terms of numbers and credit hours taught, impacts the program.

Almost all the program core classes are taught by the same four faculty who teach the courses as some combination of their full dayload or as a DCE class. Each faculty member takes consistent

responsibility for the same classes from year to year allowing them to better craft a cohesive and effective curriculum. It is an excellent arrangement for the program.

D. For each faculty member, document their credentials and professional activities. (See the copies of Chart 6 in Appendix 3 completed for each faculty member (full, part-time, or DCE). (Note: Each individual faculty member should complete his/her own chart and submit it to the Program Coordinator or designee.) Describe and summarize the credentials and the activities of program faculty with respect to maintaining their status as content experts and remaining current in their field of expertise.

As seen in Chart 6, all four of the primary faculty involved in the program have Ph.D.s in chemistry or biochemistry. All engage in relevant professional development activities related to their content areas, teaching responsibilities, and program management. One maintains an active membership in a relevant professional organization, the American Chemical Society. The faculty are all well-qualified as content experts in their fields.

SECTION V SUMMARY:

Strengths related to Program Resources - Faculty:

The faculty are all excellent teachers in their fields. Because the same four faculty teach the core courses in the program each year, they are able to take individual responsibility for their classes and craft a particularly cohesive and effective curriculum.

Challenges or Areas for Improvement related to Program Resources - Faculty:

Helping students find and secure externships is a major task taken on by faculty on top of their teaching responsibilities. At current enrollment levels, it is barely manageable. Should enrollment levels increase, it will be too large of a task for faculty to manage on top of their teaching responsibilities.

Recommendations for actions needed to be taken to deal with Challenges or Areas for Improvement:

1. As other programs at the college (Business and Journalism, for example) start to develop externship programs, the college should consider having a staff person who can help faculty and students in a wide variety of programs find and secure appropriate externship opportunities.

SECTION VI: PROGRAM RESOURCES – CLASSROOMS AND LABORATORIES, INSTRUCTIONAL TECHNOLOGY, LIBRARY/ LEARNING, AND FINANCIAL

NEASC Standard 4.3...The institution provides sufficient resources to sustain and improve its academic programs.

NEASC Standard 4.6: The institution ensures that students use information resources and information technology as an integral part of their education. The institution provides appropriate orientation and training for use of these resources, as well as instruction and support in information literacy and information technology appropriate to the degree level and field of study.

NEASC Standard 7.7: Through ownership or guaranteed access, the institution makes available the library and information resources necessary for the fulfillment of its mission and purposes. These resources are sufficient in quality, level, diversity, quantity, and currency to support and enrich the institution's academic offerings...

NEASC Standard 8.2: Classrooms and other facilities are appropriately equipped and adequate in capacity. Classrooms and other teaching spaces support teaching methods appropriate to the discipline. Students and faculty have access to appropriate physical, technological, and educational resources to support teaching and learning.

NOTE: IF YOUR PROGRAM HAS EXTERNAL ACCREDITATION, APPROVAL, OR CERTIFICATION, please respond below only to those areas not addressed in the external report.

A. Discuss whether the program has classrooms and laboratories of sufficient quality and quantity to provide an environment conducive to effective teaching and learning.

There is one dedicated Lab Science laboratory (E261). It is used for Integrated I and Integrated II classes. Other Laboratory core classes are based in either the chemistry labs or the microbiology lab. All of these lab spaces are recently renovated and in good condition. The Laboratory Science space (E261) is smaller than other labs in the building. The maximum capacity is 20 students and that is very crowded. At that full capacity, there is no room for moving between lab desks easily and quickly which can be a safety hazard. Furthermore, the room only has one sink which results in a traffic jam while students clean up their glassware after lab. Not all of our instrumentation is able to fit in that space currently and the Lab Science program has had to take over a portion of the microbiology lab to accommodate our gas chromatograph and a donated laminar flow hood. The Instrumental Analysis and Research Experience classes must split their lab time between the microbiology lab where the GC is located and the lab science space where all the other program instrumentation is found.

B. Describe the instructional technology required to support the program's curriculum plan. Discuss whether the current instructional technology is of sufficient quality and quantity to provide an environment conducive to effective teaching and learning.

The Laboratory Science program does require a large amount of instrumentation to train students adequately in current lab techniques. We have acquired a fair number of nice instruments not commonly found at a community college including an HPLC, GC with thermal desorber system, an analytical UV-Vis spectrophotometer, multiple centrifuges, ovens, incubators, electrophoresis setups, thermal cyclers for PCR analysis, as well as a water deionization system. The program also uses the Natural Science department autoclave and cold room facilities.

One area of concern is the number of thermal cyclers. These instruments are shared with biology classes in Haverhill and Lawrence and currently there is only one working thermal cycler available. This is not enough to appropriately train students in PCR which is an important molecular biology lab technique. To maintain a clean environment necessary for training students in cell biology techniques, the Lab Science program also needs access to a laminar flow hood that connects to an appropriate ventilation system. The current laminar flow hood does not have this capability. Most industry labs today also use autosamplers as part of their instrumentation. To better prepare our students for the type of technology used in current industry, we should upgrade one of our instruments with an autosampler. Finally, the autoclave on the Haverhill campus needs to be replaced or completely overhauled. It is often not working. Service technicians have to be called 4 or 5 times a year to repair it.

C. Discuss whether the program has access to library and related learning resources adequate to support the curriculum plan and to provide an environment conducive to effective teaching and learning.

The program does have access to library resources and the library staff has been very responsive to our needs. They set up a chemistry LibGuide for our students in the Instrumental Analysis and Research Experience courses providing direct links to appropriate scientific databases and citation styles. They have also been very open to meeting with our students to teach them more about library resources available for scientific literature searches.

D. Discuss whether the program's financial resources are adequate for the program to achieve its stated mission.

The program budget includes allowances for major recurring equipment maintenance and service contract fees as well as consumable teaching supplies like reagents. While there is not money in the program budget for lab renovation and new equipment purchases, the college received a Capital Grant from the Massachusetts Life Science Center which has allowed renovation of many of the science labs. The last renovation scheduled for next year will hopefully create a new general use laboratory which can be used by larger sections of Integrated Science I and II as well as Ecology, Cell Biology, and a new forensic science course. Molecular biology lab equipment will be moved into that room freeing up space in the smaller Lab Science room (E261). This will allow us to move the GC downstairs into E261 and have one instrumentation lab. Additional funds have been requested through the Perkins Vocational Grant to cover more equipment for this new lab space as well as the cost of upgrading the thermal desorber-gas chromatograph system with an autosampler and service support for moving it into E261.

SECTION VI SUMMARY:

Strengths related to Program Resources – Classrooms and Laboratories, Instructional Technology, Library/ Learning, Financial

The laboratory spaces are recently renovated (or soon to be renovated) and in good condition. The program has access to a wide variety of instrumentation and equipment necessary for training students in current lab techniques. The library staff has been very responsive to our requests for help in connecting our students with appropriate scientific research tools. Financially, we are able to maintain and service our major instruments and provide supplies for our laboratories from the college budget. Renovation costs for new science lab space will be covered by the Capital Grant from the Massachusetts Life Science Center.

Challenges or Areas for Improvement related to Program Resources - Classrooms and Laboratories, Instructional Technology, Library/ Learning, Financial

The current program laboratory space is small and crowded especially for our larger classes of Integrated Science I and II. Space issues in this room have also required that some major instrumentation be located upstairs in the microbiology lab. This means that the Instrumental Analysis and Research Experience classes must split their time between two lab rooms. There is a need for more PCR equipment for use in molecular biology experiments and an autosampler upgrade for one of our current instruments. There is also a need for a better laminar flow hood for cell biology experiments and a reliable autoclave.

Recommendations for actions needed to be taken to deal with Challenges or Areas for Improvement:

1. The last renovation covered under the MLSC Capital grant will make a large and currently underused geology lab into a general use laboratory to be shared by Integrated Science I and II, Cell Biology, Ecology, and a new forensic science class. Molecular biology equipment will be moved from the current Lab Science room into this lab. The Lab Science lab room will become an instrumentation lab and the GC will be moved from the microbiology lab. Additional funding will be required to finish outfitting the new general lab space and to provide support upgrading and reinstalling the thermal desorber and GC in the Lab Science lab. If this funding is not available through the Perkins Vocational grant, additional sources of support will have to be found.
2. An additional PCR system with thermal cycler should be purchased for use by the Lab Science program and biology classes. One of the Lab Science faculty, Dr. Kevin Mitchell, is currently collaborating on a grant proposal with Dr. Steven Fuchs from Tufts University to support a research project worked on by students at both institutions. Funding for more PCR equipment at NECC is being requested through this grant proposal as well as through the Perkins Vocational grant.
3. Alternative set-ups for a laminar flow hood need to be investigated. This could include ways to provide appropriate ventilation to our current hood or purchasing a new hood that will work more readily with our current facilities.
4. Finally, either a new autoclave should be purchased for the Haverhill campus or there should be a complete overhaul done to the current one.

SECTION VII: STUDENTS

NOTE: IF YOUR PROGRAM HAS EXTERNAL ACCREDITATION, APPROVAL, OR CERTIFICATION, please respond below only to those areas not addressed in the external report.

IF THE PROGRAM HAS DATA FROM A PREVIOUS REVIEW OR REPORT, COMPARE WITH CURRENT DATA, AND DISCUSS ANY CHANGES.

A. Analyze and discuss the data in Chart 1, included in Appendix 2, which relates to student demand for the program.

Over the three year period covered in Chart 1 in Appendix 2, applications to the program appear to be increasing. In academic year 2010-2011, 27 students applied while in 2011-2012 and 2012-2013, 36 and 39 students applied, respectively. While applications appear to have increased, the number of students actually enrolling in the program has remained relatively steady. In both academic year 2010-2011 and 2011-2012, 25 new students enrolled in the program. For 2012-2013, this fell to 23 new students enrolled. Approximately 50% of these new students each year are first time freshman at the college, 30% are external transfers, and 20% are readmitted students.

Total student enrollment in the program did increase from Fall 2010 to spring 2013. In academic year 2010-2011, 58 students were enrolled. This increased to 72 total students for academic year 2011-2012 and 79 students in 2012-2013. These increases in enrollment occurred despite a relatively consistent number of new students each year. Many of our students are choosing to transfer to four year programs. In many cases, these students end up taking courses at the college for a semester or two after finishing their core program courses. Often they are finishing electives to more fully meet transfer institution requirements. These increases in total student enrollment may reflect more students preparing to transfer rather than new student enrollment.

B. Analyze and discuss student program completion and transfer, referring to Chart 2 in Appendix 2.

The number of program graduates is relatively small. As can be seen in Chart 2 in Appendix 2, an average of 5 students graduated per year for the 2010-2013 time period. The number of students that transfer prior to graduation is much larger. Of the 58 total students enrolled in 2010-2011, only 8 graduated. However, 22 more students (40% of the original 58 students) ended up transferring at some point during the following three year period. Considering the dual goals of the program (employment or transfer), these should also be considered successes of the program.

C. Analyze and describe the demographic characteristics of students enrolled in program, referring to Chart 3 in Appendix 2.

The minority student percentage in the Lab Science program has been fairly steady ranging from 34% in academic year 2012-2013 to 38% in academic year 2011-2012. Approximately 25% of the Lab Science program student population over this time period was Hispanic. This is fairly consistent with college-wide demographics. According to data obtained from the NECC Fall 2010 Demographics Report, Fall 2011 Demographics Report, and Fall 2012 Demographics Report generated by the NECC Office of Institutional Research & Planning, the percentage of Hispanic students at the college ranged from 27% to 34%.

D. Analyze and discuss student retention and positive college outcomes by student demographics, referring to Chart 4 in Appendix 2. *Note: Only address if number of students in each category represented in Chart 4 is at least 10.*

Not applicable.

E. Describe the program policies, procedures, and practices that are in place related to student retention. Discuss how are they implemented? Comment on their effectiveness.

There are no formal program policies or procedures related to retention other than the curriculum grade requirements. A grade of C or better is necessary in all lab based program courses to move on to the next course in the sequence. Students who are in danger of not meeting this requirement are usually identified partway through the semester. Individual faculty vary in how they deal with these students, but most of the Lab Science faculty will approach at risk students to let them know what they must do to improve their grades. While we have not done a formal study of how effective this approach is towards improving retention, anecdotally it doesn't appear to improve retention greatly. In most cases, students who are at risk academically in the program are usually not fully aware of or prepared for the rigor and work involved in a science program.

What appears to have had greater success in helping some of these students is to provide more direct support for some of the trouble areas. For example, we added a 1 credit seminar in Basic Laboratory Calculations to be taken at the same time as the first lab course in the sequence, Integrated Science I. This provides direct support for the types of calculations and data analysis introduced in the Integrated Science I labs and done repeatedly throughout the program. Recently, more explicit training on effective reading and note-taking strategies for scientific procedures, textbooks, and literature has also been incorporated into Integrated Science I. Anecdotal evidence suggests it has helped students prepare better for labs and other assignments. For reinforcement, other faculty in the program are also planning to include more explicit use of these techniques into their courses.

F. Referring to Chart 4, is there evidence that any segment of the student population has a higher attrition rate from this program? *Note: Only address if number of students in each category represented in Chart 4 is at least 10. If so, what action has the program taken to address this phenomenon?*

Not applicable.

SECTION VII SUMMARY:

Strengths related to Students:

The Lab Science student body reflects the diversity of the college's general population. Lab Science faculty are actively incorporating strategies to help support at-risk students and improve retention.

Challenges or Areas for Improvement related to Students:

The increase in total student enrollment from 2010-2013 probably reflects students who have stayed at the college to finish completing elective and transfer requirements rather than an increase in new student enrollment.

Recommendations for actions needed to be taken to deal with Challenges or Areas for Improvement:

1. Lab Science faculty need to continue their efforts to market the Lab Science program and increase new student recruitment. For a summary of these current efforts, please see Section II, page 13 of this report.

SECTION VIII: CONTENT EXPERTS

NEASC Standard 4.9: ...The evaluation of existing programs includes an external perspective and assessment of their effectiveness...

NOTE: IF YOUR PROGRAM HAS EXTERNAL ACCREDITATION, APPROVAL, OR CERTIFICATION, please respond below only to those areas not addressed in the external report.

A. Does the program have an Advisory Committee?

Yes X____ No _____

IF NO, skip to B.

IF YES, please complete items 1 through 5 below.

1. Insert the roster of Advisory Committee members.

Washington Alves, Manufacturing Group Leader
Merrimack Pharmaceuticals, Cambridge, MA

Darlene Capuano, Lab Director
BAL Laboratories, Cranston, RI

Alan Carifio, Chief Chemist
Andover Water Treatment Plant, Andover, MA

Sharon Cload, Vice President of Discovery
Adnexus Therapeutics, Waltham, MA

Arlee Dulak, Lecturer, Clinical Lab Sciences Program
University of Massachusetts Lowell, MA

Stephen Fuchs, Assistant Professor Department of Biology
Tufts University, Medford, MA

Nicole Gagnon, QA Compliance Specialist III
Lonza Biologics, Portsmouth, NH

James Galasyn, Chemistry Laboratory Manager
Northeast Lab Services, Waterville, ME

Robert Goguen, NECC Lab Science Program Graduate and Applications Chemist
IonSense, Saugus, MA

John Hannon, Independent Consultant
4JH Construction and Engineering, Quincy, MA

David Legg, Vice President of Quality Assurance
Charm Sciences, Lawrence, MA

Cherilee Lewis, Biotechnology Instructor
Greater Lawrence Technical High School, Lawrence, MA

Jim McColgan, Senior Manager
Pfizer, Andover, MA

Thy Nguyen, NECC Lab Science Program Graduate and Transfer Student
University of Massachusetts Lowell, MA

Oscar Pancorbo, Division and Station Director
Massachusetts DEP William X. Wall Experimental Station, Lawrence, MA

Eugene Rogers, Professor and Coordinator Clinical Lab Sciences Program
University of Massachusetts Lowell, MA

Peter Saltzman, Adjunct Instructor
Northern Essex Community College, Haverhill, MA

Erin Soley, Scientist
Merrimack Pharmaceuticals, Cambridge, MA

Sonia Wallman, Biotechnology Department Chair
Great Bay Community College, Portsmouth, NH

Shuhao Zhu, Associate Director Protein Biochemistry and Screening
Archemix Corporation, Cambridge, MA

2. Report the schedule of meetings for the past three years, or as many as available if the Advisory Committee has been meeting for less than three years.

May 10, 2011
December 13, 2011
May 21, 2012
April 4, 2013
October 3, 2013

3. Insert copies of the Advisory Committee minutes for the past three years.

See Appendix 4.

4. Describe the input of the Advisory Committee experts on program outcomes.

Two members of the advisory board are serving as members of this program review team. They have been very helpful in reviewing the program outcomes drafted by the Lab Science faculty and providing comments and suggestions.

5. Describe the usefulness of the Advisory Committee relative to anticipating changes and challenges that need to be met by the program.

The Lab Science Program Advisory Board has been extremely useful in anticipating challenges the program has had to face in developing our curriculum and externships. Many aspects of the structure of our current externship program were informed by advice from our board members. See the minutes from the meeting held on December 13, 2011 as an example (Appendix 4). As seen in those minutes, they've provided excellent input on the types of skills we should be cultivating in our students in preparation for their externships. At the meeting this past fall, we asked for input on better preparing our students for job searches. As seen in the minutes for the meeting held on October 3, 2013, the board members gave very useful advice on effective resumes as well as suggestions for incorporating informational interviews into the arsenal of job search tools we provide to students.

NOW GO TO QUESTION C.

B. Does the program have any plans to develop an Advisory Committee?

Yes _____

No _____

IF NO, what is the program's rationale for this decision?

IF YES, please detail below.

NOW GO TO C.

C. Does the program use content experts other than those represented in an Advisory Committee?

Yes X_____

No _____

IF NO, skip to Section IX.

IF YES, please discuss below and then go to Section IX.

Externship supervisors are laboratory supervisors and managers working at the host site who agree to provide feedback to our students on their performance during the externship course. While some of these supervisors are members of our advisory board, many of them are not. At the end of the externship, we also ask the supervisors to provide us feedback on ways we can improve preparation of our students.

SECTION VIII SUMMARY:

Strengths related to Content Experts:

The Lab Science program has a diverse and helpful advisory board. The externship supervisors that have worked with us to date have also been committed to providing well-structured and appropriate externship experiences for our students as well as giving useful and thoughtful feedback.

Challenges or Areas for Improvement related to Content Experts:

Not every member of the advisory board is active. We are trying to expand our advisory board membership as a result. We are also constantly on the lookout for more externship sites and supervisors.

Recommendations for actions needed to be taken to deal with Challenges or Areas for Improvement:

1. Over the past year, we have added three new members to the advisory board. We will continue to keep an eye out for new advisory board members. Our externship supervisors are a good source for potential new advisory board members and should be approached on this topic.
2. We will continue to market our program to regional companies to develop new externship opportunities. As mentioned in Section 5 page 23, the college should consider the addition of a staff member dedicated to helping identify and develop externship opportunities for a variety of programs.

3. SECTION IX: PROGRAM LEARNING OUTCOMES AND ASSESSMENT

NEASC Standard 4.4: The institution publishes the learning goals and requirements for each program. Such goals include the knowledge, intellectual and academic skills, and methods of inquiry to be acquired. In addition, if relevant to the program, goals include creative abilities and values to be developed and specific career-preparation practices to be mastered.

NEASC Standard 4.44: The institution implements and supports a systematic and broad-based approach to the assessment of student learning focused on educational improvement through understanding what and how students are learning through their academic program... this approach is based on a clear statement of what students are expected to gain, achieve, demonstrate, or know by the time they complete their academic program.

NEASC Standard 4.48: The institution's system of periodic review of academic programs includes a focus on understanding what and how students learn as a result of the program.

NOTE: IF YOUR PROGRAM HAS EXTERNAL ACCREDITATION, APPROVAL, OR CERTIFICATION, please respond below only to those areas not addressed in the external report.

A. Develop, or review if previously developed, the program's learning outcomes. Display in a Curriculum Map to be included in Appendix 5.

See Appendix 5.

B. If the program outcomes are newly developed, discuss plan to assess these outcomes in the coming year in an Assessment Map, to be included in Appendix 5.

The program outcomes are newly developed. For assessment purposes, we've identified major courses and activities that can be used to gauge student mastery of these outcomes. To meet requirements of the Massachusetts Life Science Education Consortium endorsement process, we have outlined a large number of outcomes. Collecting and analyzing data on all twenty three of these outcomes each year is not practical. As a result, we plan to focus on select outcomes that are all gauged by externship supervisors as they complete their final assessment surveys of the students they supervised. Because the externship is the final capstone educational experience for students, using data from the supervisor assessment surveys should indicate how well students really mastered those outcomes before graduating. It also has the advantage of being an independent assessment by professionals outside the program and is therefore an excellent indicator of how well we prepared the students for entry level work in the laboratory.

The outcomes selected represent core skills that students would be expected to demonstrate in any entry level lab position regardless of field. They are:

Outcome 3: Identify and use appropriate quantitative methods in data analysis, explain results and present them appropriately in graphs and tables

Outcome 5: Thoughtfully analyze results and data, identifying potential errors and uncertainties and their effects on results

Outcome 6: Read and follow a standard operating procedure (SOP) in a laboratory setting

Outcome 9: Maintain an appropriate laboratory notebook or similar record of work conducted in the laboratory using good documentation practices (GDP)

Outcome 13: Prepare solutions and media appropriately including obtaining the correct pH and performing the appropriate calculations for solution preparation

Outcome 21: Demonstrate appropriate and respectful teamwork and communication skills

Outcome 23: Exhibit appropriate workplace behaviors such as time management, effective communication (written and verbal) and presentation skills, and integrity in work

If program outcomes had previously been developed, discuss plans for assessment going forward. Include information in a new or revised Assessment Map, to be included in Appendix 5.

C. If assessment activities related to the learning outcomes have already taken place, summarize what was learned from these activities, what action plans were developed as a result of the assessment findings, what actions have been implemented, and what the results of these implementations have been.

The development of the Lab Science Program was funded by a grant from the National Science Foundation which also required an assessment of the first student cohort of the program as part of the grant reporting process. To meet this requirement while developing the program curriculum, the Lab Science faculty identified several key skills that could be assessed during classes and the final externship experience. The following are the skills selected for assessment as part of the NSF grant that helped start the Lab Science Program:

Soft Skills:

- Analytical Reasoning
- Communications
- Teamwork

Hard Skills:

- Maintaining Lab Notebooks
- Following Standard Operating Procedures (SOPs)
- Preparing solutions

The original assessment plan involved evaluating each of these skills during select first and second year classes using a set of detailed rubrics the faculty developed. Each skill would also be assessed using the final externship survey results. That assessment plan turned out to be too large to be implemented successfully given the time frame. Instead, the soft skills were assessed during the students' first year classes and their final externship survey for the first cohort of students (2010-2011). The hard skills were only assessed during the final externship survey (2011). While it is not a full data set, it still provides some interesting results.

Summary of Soft Skill Results:

- Most of the students who stayed with the program through the externship were already performing at a proficient level or above for their soft skills in their first year courses.

- Most of our students continued to perform at a proficient level or above during their externship.
- There were five criteria that students were actually rated lower on average during their externship than during their first year courses. Those criteria follow as well as the ways we've altered our curriculum to better address them.
 - Oral Communication Criteria 2: Student describes a situation to the extent that listener can visualize experience clearly without questions. To better prepare students in this area, we introduced more emphasis on technical presentation assignments and asked Linda Desjardins, the faculty oral communications coach, to work with us on presentation skills in our first year courses.
 - Listening skills Criteria 1: Student demonstrates receptive listening skills (this includes: hearing, interpreting, analyzing and synthesizing information). During the second year courses, we're gradually moving from all written lab instructions to a combination of verbal and written lab instructions to help students get more comfortable with taking notes while someone else is giving directions.
 - Analytical Reasoning Criteria 3: Student gathers information from a variety of reputable sources and presents multiple viewpoints; information cited is presented in student's own words. We've worked with Gail Stuart, NECC reference librarian, to develop appropriate research and citation assignments that make the Instrumental Analysis course Information Literacy intensive.
 - Teamwork Criteria 3 and 4:
 - Criteria 3: The student demonstrated appropriate and respectful communication and interactions with peers, faculty, and/or supervisor
 - Criteria 4: The student demonstrated a positive and cooperative attitude towards the group work by making multiple useful suggestions and contributions towards the final product
 - Both the lower scores during the externship represent one student who didn't quite understand the difference in expectations put on her as an extern in an industry lab compared to those as a student in an academic lab. We've incorporated a pre-externship 'boot camp' to make sure students understand their roles as externs, appropriate behavior in their host laboratories, etc.

Summary of Hard Skill Results:

- Externships supervisors were satisfied with the students technical skills in the 3 assessment areas. Supervisors rated all students during the first cohort as satisfactory or above in their ability to maintain an appropriate lab notebook, follow standard operating procedures, and prepare solutions appropriately. The curriculum was developed with a

strong emphasis on these core skills and we have continued that emphasis with later cohorts of students.

SECTION IX SUMMARY:

Strengths related to Program Learning Outcomes and Assessment:

The current Lab Science Program outcomes are comprehensive and cover all the criteria required for endorsement by the Massachusetts Life Science Education Consortium. In the future, focusing on select outcome assessment through the externship supervisor survey should be manageable in terms of data collection and analysis.

Challenges or Areas for Improvement related to Program Learning Outcomes and Assessment:

Only select Program Learning Outcomes will be assessed formally. Faculty must still be aware of student performance for the other outcomes so they can address potential issues and problems. Faculty must also take the time to enter in the data and perform data analysis on the externship survey results in a timely fashion including the backlog of data from the 2012 and 2013 externships. Initial analyses have begun with this data but more thorough and efficient analyses would be possible if the data were available in spreadsheet format.

Recommendations for actions needed to be taken to deal with Challenges or Areas for Improvement:

1. The full list of outcomes should be informally reviewed by faculty on a yearly basis. This review should include a discussion of student activities and informal faculty assessments of their performance as well as any potential issues or problems that should be addressed through the curriculum.
2. The backlog of data from the 2012 and 2013 externship supervisor surveys must be fully analyzed. Once the electronic database of survey results is created, the faculty must continue inputting future survey results in a timely fashion.

SECTION X: PROGRAM LINKAGES, EXTERNAL AGREEMENTS, AND AFFILIATIONS

NOTE: IF YOUR PROGRAM HAS EXTERNAL ACCREDITATION, APPROVAL, OR CERTIFICATION, please respond below only to those areas not addressed in the external report.

A. Describe any linkages, activities or agreements with area high schools.

The Labs Science program has developed partnerships with local high schools to promote STEM education and the Lab Science program. Currently, the program has collaborations with six regional high schools: Greater Lawrence Technical School, Whittier Vocational School, Haverhill High School, Lawrence High School, Shawsheen High School and Sparhawk High School. The outreach activities have been expanded to include several regional middle schools: Amesbury Academy, Nettle Middle School and Whittier Middle School.

We've also been approached by Greater Lawrence Technical School about developing an articulation agreement with their biotechnology program. We are in the process of reviewing their curriculum to determine what, if any, courses can stand in for or program courses.

B. Describe any linkages, activities or agreements with four-year colleges.

To this date, the Lab Science program has two approved articulation agreements with four year colleges. A third agreement is in process. These agreements are:

1. UNIVERSITY OF MASSACHUSETTS, LOWELL for the Bachelor of Science Clinical Laboratory and Nutritional Sciences.
2. RIVIER COLLEGE for the Bachelor of Science: Biology.
3. In process: BOSTON UNIVERSITY, METROPOLITAN COLLEGE for the Bachelor of Science Clinical Laboratory and Clinical Sciences.

C. Describe any linkages, activities or agreements with business and industry, including clinical sites, internships, practicums, service learning, and volunteer work.

To date, three cohorts of Lab Science students have completed externships at regional laboratories. The following is a list of the companies who have hosted students:

- Charm Sciences, Inc.
- Lawrence General Hospital
- Adnexus Therapeutics
- University of Michigan
- Haverhill Water Department
- Northeastern University

Northern Essex Community College
Laboratory Science Program

- Department of Public Health
- Dept. of Environmental Protection
- Tufts University, Medford Campus
- Covantas Energy
- Optimum Analytical and Consulting
- Bach Pharma, Inc.
- Strem Chemicals, Inc.
- BioConcepts Laboratories, Inc.
- Normandeau Environmental Consultants
- 1366 Technologies

SECTION X SUMMARY:

Strengths related to Program Linkages, External Agreements, and Affiliations:

The Lab Science program has developed a variety of strong links to local secondary schools, four year colleges, and businesses. The outreach workshops are in great demand with our partner high school and secondary schools. Approximately half of our students take advantage of the transfer agreements with four year colleges, particularly with the University of Massachusetts Lowell. Finally, the externship host sites represent a wide variety of laboratory areas and have all provided a positive and valuable training experience for our students.

Challenges or Areas for Improvement related to Program Linkages, External Agreements, and Affiliations:

The Lab Science faculty need to move forward with the curriculum review for the biotechnology program at Greater Lawrence Technical School so we can make a decision on whether to continue with the articulation agreement process.

We cannot expect all of the laboratories who have hosted externs in the past to continue to do so in the future. As a result, we must continue to expand our list of potential externship hosts.

Recommendations for actions needed to be taken to deal with Challenges or Areas for Improvement:

1. The Lab Science faculty needs to find the time to review and discuss the curriculum for the biotechnology program at Greater Lawrence Technical School.
2. The Lab Science program needs to continue to promote itself amongst local scientific businesses to keep developing a pool of potential externship sites for future students.

SECTION XI: GRADUATE EMPLOYMENT

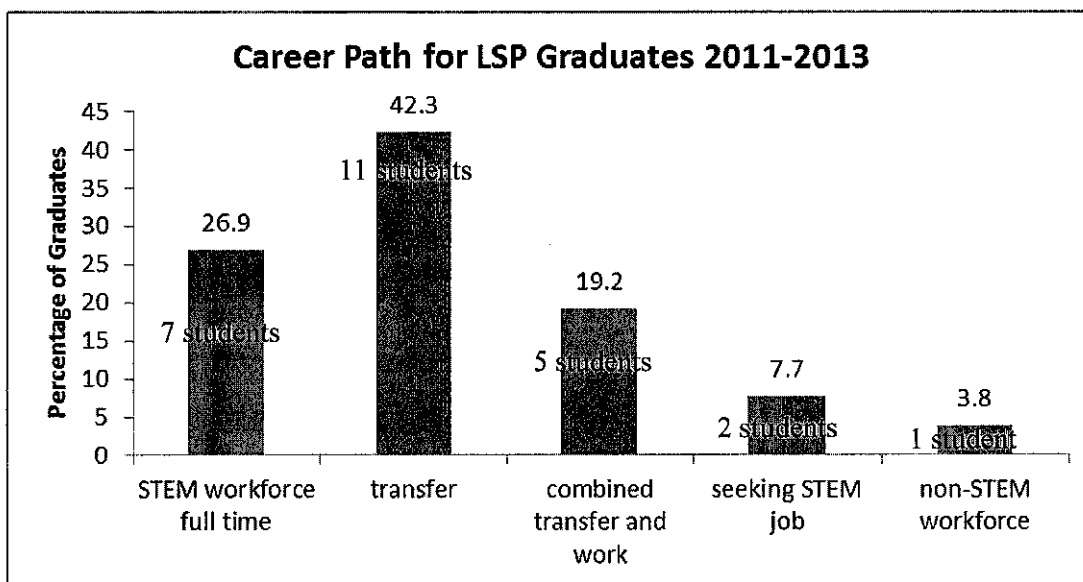
NOTE: IF YOUR PROGRAM HAS EXTERNAL ACCREDITATION, APPROVAL, OR CERTIFICATION, please respond below only to those areas not addressed in the external report.

IF PRIMARILY A TRANSFER PROGRAM, SKIP TO SECTION XII. COMPLETE THIS SECTION ONLY IF THE PROGRAM IS A CERTIFICATE PROGRAM, OR AN ASSOCIATE'S DEGREE CAREER PROGRAM.

TO ADDRESS THIS SECTION, USE THE INFORMATION IN THE OCCUPATION PROFILE REPORT PROVIDED TO YOU, AS WELL AS FROM ANY OTHER EMPLOYMENT PROJECTION REPORTS OR SOURCES AVAILABLE TO YOU.

A. Provide information with respect to the job placements of recent program graduates. Indicate the source(s) of this information.

The graph below represents the career paths taken by Lab Science students after completion of the externship (total = 26 students). The graph was generated from data from various sources including surveys completed by LSP graduates and contacts with the students through social media (e.g. LinkedIn), phone, or email. Data were collected for graduates from 2011 to 2013.



Seven students (26.9%) joined the workforce full-time in a STEM field. Eleven students (42.3%) chose to transfer to a 4-year college or university full-time in a STEM related field. Five students decided to transfer to while also working working part-time at a STEM related company (Combined, 19.2%). Two students (7.7%) from the class of 2013 were still seeking a job in a STEM company the last time we had contact with them. (October 2013). Finally, one student decided to continue in a non-STEM related field (3.8%). Considering the

program has two goals, either transfer or employment in a STEM field, this mean 88.5% or 23 out of 26 graduates have successfully continued on in the sciences.

B. Provide information with respect to employer satisfaction with program graduates. Indicate the source(s) of this information.

While we don't have any formal data from the current employers of many of our graduates, we do have the results of the externship supervisor surveys as an indication of how well graduates were prepared for entry-level employment. The table below represents an initial summary of the average ratings supervisors gave our graduates from 2011-2013. Supervisors rated students on a scale of 1-5 with 3 representing satisfactory performance. A rating of 4 meant the student generally exceeded the established performance standards at the lab while 5 represented consistent achievement above expectations.

Summary of Results of Externship Supervisor Survey 2011-2013

Criteria Evaluated	Average 2011	Average 2012	Average 2013
Maintaining a Lab Notebook	4.3	4.3	4.4
Following SOP	4.3	4.3	4.5
Preparing solutions	4.1	4.7	4.6
Teamwork and interpersonal skills	4.3	4.7	4.4
Analytical Skills in the Lab	4.0	4.2	4.6
Oral and Written Communication Skills	3.9	4.5	4.4
Time Management	4.3	5.0	4.4
Attitude	4.8	5.0	4.5
Focus on the Task	4.0	4.6	4.5
Receptiveness	4.4	4.8	4.5

In addition to these positive ratings, many supervisors made very complimentary comments about our graduates. Several of these are transcribed below:

The student "is an excellent intern who follows instructions and learns new material very easily. He would be an excellent lab technician in any lab."

The student "is extremely hardworking and thoughtful of things that need to be done in the group. She has excellent physical laboratory skills for someone with her level of experience."

The student "was a delight to have in the lab and had she not disliked her commute so strongly I would have thought seriously about hiring her full-time."

The student "met all our expectations. He'd certainly be welcome back in the future!"

The student "was very successful in her internship role this summer and met all expectations. Her dedication, organizational skills, scientific knowledge, and willingness to learn on the job

were all assets for our company . . . The scientists and doctors she worked with were impressed by her level of scientific expertise.”

The student “has a very energetic and friendly attitude. She is intelligent and hard-working, attentive to duties and responsibilities and enthusiastic about learning new things. She was a pleasure to work with and everyone here enjoyed having her work with us . . . She would be an asset to any facility that hires her.”

The student “would make a great member of [the company family] as he has been a joy to have as a member of our laboratory for the summer.”

The student “has a very positive attitude working in the laboratory setting. Skills learned from school and our laboratory has effectively made him a skillful laboratory technician . . . We were very impressed with his acquired laboratory skills from your institution. It was reflected in our laboratory as he showed great initiative in our laboratory work environment.”

Several hosting companies have decided to hire our students on a full or part-time basis after their summer externships. Many others have commented that they would hire the students if they had the resources available to do so. Based on the experiences gained through their externships, several of our students have gone on to successfully compete against graduates with four year degrees for entry-level technician positions at other companies. One these former students has reported back that his current employers have commented that “they have never had an employee with an associates degree with such a high knowledge level in science.”

C. Referring to the *Occupation Profile Report* provided to you (see Appendix 6), and any other sources of employment projections which you may have, discuss future employment prospects for graduates of your program.

The employment prospects are strong for our graduates, particularly for those who go into biotechnology, environmental analysis, and pharmaceutical companies. As outlined in the employment projections given in Appendix 6, job opportunities are expected to grow between 14 and 24 percent from 2010 to 2020, on average or above average for all occupations in the country.

SECTION XI SUMMARY:

Strengths related to Graduate Employment:

Our graduates are well prepared and receive considerable praise from externship supervisors on the strength of their lab skills and potential as lab technicians. When transfer and part-time employment are included, 88.5% of our graduates (23 out of 26) have successfully continued on in STEM fields.

Challenges or Areas for Improvement related to Graduate Employment:

While many graduates find employment relatively easily in the STEM field after graduation, there is still a need for better support and training for the job search process for those still looking. Faculty need to work more closely in the future with the new Career Connections coordinator at the college and have students take advantage of the workshops offered on interviews and cover letters. We know

our students are well prepared for entry level work in the field, we want to make sure they have the job search skills necessary to get hired for those entry level positions as well.

Recommendations for actions needed to be taken to deal with Challenges or Areas for Improvement:

1. Faculty need to work more closely with Ashley Bragger, the new Career Connections coordinator, to find resources to better prepare our students for their job searches. This effort has begun. This spring, Ashley will be helping us coordinate a mock interview session with human resource professionals from Lonza Biologics and plan a workshop specifically for our students on informational interviews and interviewing skills. In addition, we've made attendance mandatory for our second year students at the resume writing and cover letter workshops organized by Ashley Bragger for the larger NECC community.

SECTION XII: PROGRAM DASHBOARD

TO COMPLETE THIS TABLE, USE THE INFORMATION CONTAINED IN THIS REVIEW OR THE PROGRAM'S EXTERNAL REPORT (ACCREDITATION, APPROVAL, OR CERTIFICATION).

ITEM	TOPIC	SOURCE	TIME PERIODS		
A	Number of program majors	Chart 1	YR 1 (AY 09-10)	YR 2 (AY 10-11)	YR 3 (AY 11-12)
			58	72	79
B	Number of program graduates	Chart 2	8	2	6
C	Percentage of females enrolled (Only if at least 10 enrollees)	Chart 3	60%	61%	59%
D	Percentage of minority enrollees (Only if at least 10 enrollees)	Chart 3	36%	38%	34%
E	Number of FTE faculty	Chart 5a	Spring 2012	Fall 2012	Spring 2013
			4	3	4
F	Number of program-specific courses	Table 1	YR 1 (AY 11-12)		
			8		
G	Enrollment in program-specific courses – Majors (M)/ Non-majors (N)	Table 1	YR 1 (AY 11-12)		
	1 SCI100 Basic Lab Calculations		20/0		
	2 SCI103 Success in Science Seminar		21/0		
	3 SCI104 Topics in Laboratory Science		18/1		
	4 SCI105 Integrated Science I		25/1		
	5 SCI106 Integrated Science II		17/0		
	6 SCI281 Research Experience Laboratory		13/0		
	7 SCI291 Externship in Laboratory Science I		8/0		
	8 SCI292 Externship in Laboratory Science II		2/0		
	9				
	10				
H	Linkages, activities or agreements with area high schools (Y or N). (Section X)				Y
I	Linkages, activities or agreements with four-year colleges? area high schools (Y or N). (Section X)				Y
J	Linkages, activities or agreements with business and industry (Y or N). (Section X)				Y

SECTION XIII: SUMMARY – PROGRAM STRENGTHS

A. List and describe the program's major strengths, as detailed at the end of each section of this review, or in the program's external report (accreditation, approval, or certification).

SECTION	AREA OF STRENGTH
I	<p>To receive MLSEC endorsement, the Laboratory Science Program has met the following criteria:</p> <ol style="list-style-type: none"> 1) Students completing the program courses achieve the core competencies agreed upon by MLSEC industry and higher education members. . 2) The program focuses on the knowledge and skills necessary for entry level positions in the research and manufacturing sectors of the biotechnology industry. 3) Credits earned through the program are readily linked to an associate's level degree. <p>The NECC Lab Science Program was further given gold level endorsement because, in addition to meeting the criteria above, it requires students to complete an internship before graduation</p>
II	<p>The Lab Science program strongly supports the mission of the College and its seven core values of student engagement, collaboration, personal and professional growth, respect, diversity, access and opportunity, and excellence. Furthermore, the Lab Science program contributes significantly to Strategic Goals 1, 2, 3, 4, and 5</p>
III	<p>A comprehensive lab safety policy is essential to welfare and safety of any students or faculty working in a laboratory at the college. While the lab safety regulations are not specific to the Lab Science program alone, they are an integral part of the safety protocols we teach our students.</p>
IV	<p>The curriculum was thoughtfully developed and implemented to train students for entry level employment as a lab technician or for transfer to an appropriate four year program. Faculty have actively sought the input of regional industry and transfer programs and implemented their suggestions into the curriculum. Faculty continue to review and revise the curriculum on a regular basis.</p>
V	<p>The faculty are all excellent teachers in their fields. Because the same four faculty teach the core courses in the program each year, they are able to take individual responsibility for their classes and craft a particularly cohesive and effective curriculum.</p>
VI	<p>The laboratory spaces are recently renovated (or soon to be renovated) and in good condition. The program has access to a wide variety of instrumentation and equipment necessary for training students in current lab techniques. The library staff has been very responsive to our requests for help in connecting our students with appropriate scientific research tools. Financially, we are able to maintain and service our major instruments and provide supplies for our laboratories from the college budget. Renovation costs for new science lab space will be covered by the Capital Grant from the Massachusetts Life Science Center.</p>

Northern Essex Community College
Laboratory Science Program

VII	The Lab Science student body reflects the diversity of the college's general population. Lab Science faculty are actively incorporating strategies to help support at-risk students and improve retention.
VIII	The Lab Science program has a diverse and helpful advisory board. The externship supervisors that have worked with us to date have also been committed to providing well-structured and appropriate externship experiences for our students as well as giving useful and thoughtful feedback.
IX	The current Lab Science Program outcomes are comprehensive and cover all the criteria required for endorsement by the Massachusetts Life Science Education Consortium. In the future, focusing on select outcome assessment through the externship supervisor survey should be manageable in terms of data collection and analysis.
X	The Lab Science program has developed a variety of strong links to local secondary schools, four year colleges, and businesses. The outreach workshops are in great demand with our partner high school and secondary schools. Approximately half of our students take advantage of the transfer agreements with four year colleges, particularly with the University of Massachusetts Lowell. Finally, the externship host sites represent a wide variety of laboratory areas and have all provided a positive and valuable training experience for our students
XI	Our graduates are well prepared and receive considerable praise from externship supervisors on the strength of their lab skills and potential as lab technicians. When transfer and part-time employment are included, 88.5% of our graduates (23 out of 26) have successfully continued on in STEM fields.
XII	

SECTION XIV: SUMMARY – PROGRAM CHALLENGES AND AREAS FOR IMPROVEMENT – ACTION PLANS

A. List and describe the program’s major challenges and areas for improvement detailed at the end of each section of this review, or. For each challenge, describe the action recommendation, as well as the individuals responsible for implementation.

SECTION	CHALLENGE - AREA FOR IMPROVEMENT	ACTION RECOMMENDATION – INDIVIDUAL(S) RESPONSIBLE
I	In preparation for our second endorsement application with the MLSEC, the Laboratory Science Program has requested approval to make BIO230, Cell Biology, a program requirement. Previously, this course was a program elective option. By making it a required course, it ensures that all graduates of the Lab Science program will receive training in all the MLSEC core competencies.	This request has been submitted to the Academic Affairs Committee for approval. The request was made by Kevin Mitchell, program faculty.
II	The Lab Science program does need to move forward in evaluating a proposed articulation agreement between our program and the biotechnology program at Greater Lawrence Technical High School. In addition, the faculty need to keep an eye on enrollment levels and continue efforts to recruit more students into the program. To improve advising of our current students, faculty also need to input academic plans into DegreeWorks and provide opportunities to connect with students in developmental courses who have not yet entered the core program courses. Finally, faculty need to take advantage of the resources offered by the developing programs at Career Services to help prepare and support our students in their job searches after graduation.	<p>The Lab Science faculty need to take the time necessary to review the biotechnology curriculum at Greater Lawrence Technical High School and decide what, if anything, will stand in for any of our courses. All Lab Science faculty are responsible for this action.</p> <p>The following recruitment efforts have begun since the fall of 2013:</p> <ul style="list-style-type: none"> • Discussions have begun with faculty and administrators at the Haverhill High School STEM Academy on ways to collaborate to promote careers in STEM fields and the Lab Science program as a potential career pathway. Kim Waligora is responsible for this connection. • Discussions have begun with the NECC Center for Adult Education Programs and Practitioners (CAEPP) about a possible collaboration on a grant-funded summer STEM Academy to better recruit and prepare adult

		<p>learners for success in the Lab Science program. Kevin Mitchell is responsible for this action.</p> <ul style="list-style-type: none"> As part of an NECC Leadership Academy project, plans have begun for an appreciative inquiry based study of the Lab Science program strengths that we can market to prospective new students. Marguerite White-Jeanneau is responsible for this action. <p>Faculty also need to continue to review student academic plans in DegreeWorks and input new plans for incoming students. As part of this effort, students must be encouraged to come in and talk with faculty advisors to ensure their academic plans fit their goals and schedules. All Lab Science faculty are responsible for this action.</p> <p>Finally, faculty need to work more closely with Ashley Bragger, the new Career Connections coordinator, to find resources to better prepare our students for their job searches. All faculty are responsible for this action.</p>
III	<p>Students who are still in developmental courses do not get class time contact with program faculty and often don't come in for advising time with faculty. Academic plans for these students in DegreeWorks can't be effectively tailored to these students goals and schedules without this contact. Furthermore, the academic plans don't really help these students understand what the program is about or what they can do with a degree in Laboratory Sciences. This is a major gap in the faculty-student advising loop.</p>	<p>Faculty must continue implementing academic plans in DegreeWorks for all newly enrolled and continuing Lab Science students. This is the responsibility of all Lab Science faculty.</p> <p>Inviting all declared Lab Science majors (those enrolled in core program courses and those in developmental courses) to a welcome reception at the beginning of the fall semester would be a good way for faculty to meet new Lab Science students and answer any questions they might have about the</p>

		program. This will be the responsibility of the program coordinator, Marguerite White-Jeanneau.
IV	While most program specific learning outcomes are covered in a multiple courses, there are two outcomes that are only covered in 1 course (outcomes 12 and 16). These are specific outcomes required for gold level endorsement by MLSEC and the program would be strengthened if these were reinforced in more courses.	Cell Biology (BIO230) provides further reinforcement for outcomes 12 and 16. Currently BIO230 is a recommended elective for students in the biotechnology concentration. Lab Science faculty have already applied for approval for this action with the Academic Affairs committee. Kevin Mitchell initiated this process.
V	Helping students find and secure externships is a major task taken on by faculty on top of their teaching responsibilities. At current enrollment levels, it is barely manageable. Should enrollment levels increase, it will be too large of a task for faculty to manage on top of their teaching responsibilities.	As other programs at the college (Business and Journalism, for example) start to develop externship programs, the college should consider having a staff person who can help faculty and students in a wide variety of programs find and secure appropriate externship opportunities. This is the responsibility of the college administration.
VI	The current program laboratory space is small and crowded especially for our larger classes of Integrated Science I and II. Space issues in this room have also required that some major instrumentation be located upstairs in the microbiology lab. This means that the Instrumental Analysis and Research Experience classes must split their time between two lab rooms. There is a need for more PCR equipment for use in molecular biology experiments and an autosampler upgrade for one of our current instruments. There is also a need for a working laminar flow hood for cell biology experiments and a reliable autoclave.	The last renovation covered under the MLSC Capital grant will make a large and currently underused geology lab into a general use laboratory to be shared by Integrated Science I and II, Cell Biology, Ecology, and a new forensic science class. Molecular biology equipment will be moved from the current Lab Science room into this lab. The Lab Science lab room will become an instrumentation lab and the GC will be moved from the microbiology lab. Additional funding has been requested through the Perkins Vocational grant to finish outfitting the new general lab space and to provide support for an autosampler upgrade and reinstallation of the GC in the Lab Science lab. Mike Cross (Natural Sciences Department Chair) and Bob West (Department Lab Technician) are leading this action with the assistance of the rest of the

		<p>Lab Science faculty.</p> <p>Additional thermal cyclers have been requested through the Perkins Vocational grant. They will also be included on a grant proposal written in collaboration between Steven Fuchs of Tufts University and Kevin Mitchell. Kevin Mitchell, Mike Cross, and Bob West are all contributing to these efforts.</p> <p>Alternative set-ups for a laminar flow hood need to be investigated. Kim Waligora is leading this action.</p> <p>Finally, either a new autoclave should be purchased for the Haverhill campus or there should be a complete overhaul done to the current one. Bob West (Lab Technician) is leading this action.</p>
VII	The increase in total student enrollment from 2010-2013 probably reflects students who have stayed at the college to finish completing elective and transfer requirements rather than an increase in new student enrollment.	Lab Science faculty need to continue their efforts to market the Lab Science program and increase new student recruitment. Please see Section II recommended actions for more details.
VIII	Not every member of the advisory board is active. We are trying to expand our advisory board membership as a result. We are also constantly on the lookout for more externship sites and supervisors.	<p>We will continue to keep an eye out for new advisory board members. Our externship supervisors are a good source for potential new advisory board members and should be approached on this topic. All Lab Science faculty are responsible for this action.</p> <p>We will continue to market our program to regional companies to develop new externship opportunities. All Lab Science faculty are responsible for this action. In addition, the college should consider the addition of a staff member dedicated to helping identify and develop externship opportunities for a variety of</p>

		programs as suggested in section 5.
IX	Only select Program Learning Outcomes will be assessed formally in the future. Faculty must still be aware of student performance for the other outcomes so they can address potential issues and problems. Faculty must also take the time to enter in the data and perform data analysis on the externship survey results in a timely fashion including the backlog of data from the 2012 and 2013 externships. Initial analyses have begun with this data but more thorough and efficient analyses would be possible if the data were available in spreadsheet format.	<p>The full list of outcomes should be informally reviewed by faculty on a yearly basis. This is the responsibility of all Lab Science faculty.</p> <p>The backlog of data from the 2012 and 2013 externship supervisor surveys must be entered into a spreadsheet and fully analyzed. This is the responsibility of Kim Waligora and Marguerite White-Jeanneau.</p>
X	The Lab Science faculty need to move forward with the curriculum review for the biotechnology program at Greater Lawrence Technical School so we can make a decision on whether to continue with the articulation agreement process. Furthermore, we cannot expect all of the laboratories who have hosted externs in the past to continue to do so in the future. As a result, we must continue to expand our list of potential externship hosts.	<p>The Lab Science faculty needs to find the time to review and discuss the curriculum for the biotechnology program at Greater Lawrence Technical School. This is the responsibility of all Lab Science faculty.</p> <p>The Lab Science program needs to continue to promote itself amongst local scientific businesses to keep developing a pool of potential externship sites for future students. This is the responsibility of all Lab Science faculty.</p>
XI	There is still a need for better support and training for the job search process for those graduates still looking for employment in the STEM field. Faculty need to work more closely in the future with the new Career Connections coordinator at the college and have students take advantage of the workshops offered on interviews and cover letters.	Faculty need to work more closely with Ashley Bragger, the new Career Connections coordinator, to find resources to better prepare our students for their job searches. All faculty are responsible for this action.
XII		

SECTION XV: RESOURCES REQUESTED

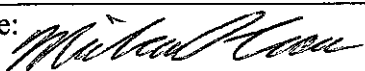


If any specific resource needs were identified in this program review, and included in SECTION XIV Action Plan(s), please list these resources below, indicating for each whether the type of resource needed is Equipment, Personnel, space, or Other. If applicable and known, provide vendor and estimated cost information.

SECTION	RESOURCE NEED	TYPE OF RESOURCE	VENDOR/ ESTIMATED COST
VI	Renovation of E262 to become combined Lab Science/General Use Lab	Other	Covered through MLSC Capitol Grant Estimated costs \$150,000
VI	Supplies for general outfitting of E262 and instrumentation upgrade and moves to E251	Equipment and Other	Requested through Perkins Vocational grant: \$76,052.93
VI	One PCR system and thermal cycler	Equipment	Requested through Perkins Vocational Grant: \$26,961.75
VI	A new autoclave for the Haverhill campus	Equipment	\$40,000

REVIEW SUBMISSION

PROGRAM:	
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Submits this Program Review document in fulfillment of the NECC requirements for a comprehensive and systemic review of each academic program.

Individual Responsible for Completing the Program Review	
Name:	Title:
Signature:	Date:
Program Coordinator	
Name:	
Signature:	Date:
Department Chair (if appropriate)	
Name: Mike Cross	Title: Dept. Chair
Signature: 	Date: 6 May 2014
Assistant Dean/Director	
Name: Mark Reinhold	Title: Acting Asst. Dean
Signature: 	Date: 06 MAY 14
Dean of Division	
Name: JUDY ZUBROW	Title: DEAN
Signature: 	Date: 5/6/14

APPENDICES

APPENDIX 1

LABORATORY SCIENCE PROGRAM REVIEW TABLE 1 – ENROLLMENT IN PROGRAM-SPECIFIC COURSES MAJORS (M) / NON-MAJORS (N)

By Term

	Term	Course	AY 12 – 13 (M / N)	Sections Offered
1	Fall 2012	SCI100 Basic Lab Calculations	20 (20 / 0)	1
2	Fall 2012	SCI103 Success in Science Seminar	21 (21 / 0)	1
3	Fall 2012	SCI105 Integrated Science I	26 (25 / 1)	2
1	Spring 2013	SCI104 Topics in Laboratory Science	19 (18 / 1)	1
2	Spring 2013	SCI106 Integrated Science II	17 (17 / 0)	1
3	Spring 2013	SCI281 Research Experience Laboratory	13 (13 / 0)	1
4	Spring 2013	SCI291 Externship in Laboratory Science I	1 (1 / 0)	1
1	Summer 2013	SCI291 Externship in Laboratory Science I	7 (7 / 0)	1
2	Summer 2013	SCI292 Externship in Laboratory Science II	2 (2 / 0)	1

By Academic Year (Unduplicated)

	Term	Course	AY 11 – 12 (M / N)	Sections Offered
1	Fall 2012, Spring 2013, & Summer 2013	SCI100 Basic Lab Calculations	20 (20 / 0)	1
2	Fall 2012, Spring 2013, & Summer 2013	SCI103 Success in Science Seminar	21 (21 / 0)	1
3	Fall 2012, Spring 2013, & Summer 2013	SCI104 Topics in Laboratory Science	19 (18 / 1)	1
4	Fall 2012, Spring 2013, & Summer 2013	SCI105 Integrated Science I	26 (25 / 1)	2
5	Fall 2012, Spring 2013, & Summer	SCI106 Integrated Science II	17 (17 / 0)	1

Northern Essex Community College
Laboratory Science Program

	2013			
6	Fall 2012, Spring 2013, & Summer 2013	SCI281 Research Experience Laboratory	13 (13 / 0)	1
7	Fall 2012, Spring 2013, & Summer 2013	SCI291 Externship in Laboratory Science I	8 (8 / 0)	2
8	Fall 2012, Spring 2013, & Summer 2013	SCI292 Externship in Laboratory Science II	2 (2 / 0)	1

APPENDIX 2

Chart 1. Student Demand

	AY 2010- 2011	AY 2011- 2012	AY 2012- 2013	3 Year Average
Total Applications	27	36	39	34
First Time Freshmen who registered	12	11	16	13
External Transfers who registered	11	7	5	8
Internal Transfers who registered				
Readmitted Students who registered	2	7	2	4
Total Students new to program	25	25	23	24
Total Unduplicated Enrollment	58	72	79	70

Chart 2. Program Completion/Student Transfer

	AY 2010- 2011	AY 2011- 2012	AY 2012- 2013	3 Year Average
Program Graduates	8	2	6	5
Students who transfer prior to graduation from program (multiple years out)	22	12	4	13

**Chart 3. Student
Demographics**

		Asian	Black	Cape Verdean	Hawaiian/Pacific Islander	Hispanic	Native American/ Native Alaskan	White	Non- Resident Alien	Multi- Racial	Unknown	Total	Minority Percentage (unprorated)
AY 2010-2011	Male	0	2	0	1	5	0	14	1	0	0	23	35%
	Female	1	0	0	2	10	0	20	1	0	1	35	37%
	Total	1	2	0	3	15	0	34	2	0	1	58	36%
AY 2011-2012	Male	1	1	0	0	5	1	19	1	0	0	28	29%
	Female	4	1	0	2	12	0	23	1	0	1	44	43%
	Total	5	2	0	2	17	1	42	2	0	1	72	38%
AY 2012-2013	Male	0	0	0	0	5	0	27	0	0	0	32	16%
	Female	1	6	0	0	15	0	24	1	0	0	47	47%
	Total	1	6	0	0	20	0	51	1	0	0	79	34%

FALL 2013 ACADEMIC PROGRAM REVIEW: LABORATORY SCIENCE PROGRAM

CHART 5 (A), (B), (C), (D): FACULTY RESOURCES

**CHART 5 (D): COMPARISONS BETWEEN FULL-TIME AND NON-FULL-TIME FACULTY (PART-TIME AND DCE):
OVERALL NUMBERS AND CREDIT HOURS TAUGHT**

TERM	# FULL-TIME FACULTY (FTF)	# CREDIT HOURS TAUGHT BY FULL-TIME FACULTY (FTCH)	# OF NON-FULL-TIME FACULTY (NFTF)	# CREDIT HOURS TAUGHT BY NON-FULL-TIME FACULTY (NFTCH)	TOTAL # OF FACULTY (FTF + NFTF) (TF)	TOTAL # CREDIT HOURS TAUGHT by FTF + NFTF (TCH)	PERCENTAGE OF FACULTY THAT ARE FULL-TIME (FTF / TF)	PERCENTAGE OF CREDIT HOURS TAUGHT BY FULL-TIME FACULTY (FTCH / TCH)
SPRING (2013)	4	11	3	5	7	16	57%	69%
FALL (2012)	3	12	2	6	5	18	60%	67%
SPRING (2012)	3	9	4	14	7	23	43%	39%

CHART 6: FACULTY CREDENTIALS
For science faculty members who teach core and elective courses in the Lab Science Program

DATE: November/December 2013

NAME: Marguerite White-Jeanneau

Current Academic Rank:		Assistant Professor		Tenure Status		Tenured []		Not Tenured [x]	
Academic Degrees:									
Bachelor Degree BA [x] BS []		Concentration:		Environmental Chemistry					
Institution Granting Degree:		Connecticut College							
Masters Degree: MA []		MS [x]		MEd []		MBA []		MPH []	
Concentration:		(1) Secondary Education (2) Geochemical Systems						Other :	
Institution Granting Degree		(1) Indiana University; (2) University of New Hampshire							
Doctorate: Concentration: Earth Systems Science		PhD [x]		EdD []		JD []		Other:	
Institution Granting Degree		University of New Hampshire							
Certifications									
Type		Issuing Agency				Date			
Membership in Professional Organizations									
American Chemical Society		Awards							
Publications (relevant to teaching responsibilities)									
		Presentations (relevant to teaching responsibilities)							
		Assessing Skills in a Two-year Lab Science Program Using Internal and External Expertise By M. White-Jeanneau and N. Custodia-Lora given at Spring 2012 AMCOA conference							

CHART 6 (CONTINUED)

Continuing Education Activities/Professional Development (For past 3 years, or of major significance prior to this time and related to area of teaching responsibility)			
Type	Sponsoring Agency	Date	
NECC Leadership Academy	NECC	9/2013-5/2014	
HPLC Method and Development Course	Waters Corporation	12/2009	
Environmental Chemistry	NSF Chemistry Collaborations, Workshops and Community of Scholars	6/2009	
Other information which you believe demonstrates your academic and experiential qualifications, and maintenance of expertise in your area of educational responsibility.			

CHART 6: FACULTY CREDENTIALS
For science faculty members who teach core and elective courses in the Lab Science Program
DATE: November/December 2013

NAME: Kevin Mitchell					
Current Academic Rank: Associate Professor		Tenure Status		Tenured []	Not Tenured [X]
Academic Degrees:					
Bachelor Degree BA [] BS [X]		Concentration:		Biochemistry	
Institution Granting Degree:		California Polytechnic State University – San Luis Obispo			
Masters Degree:	MA []	MS []	MEd []	MBA []	MPH [] Other :
Concentration:					
Institution Granting Degree					
Doctorate:		PhD [X]	EdD []	JD []	Other:
Concentration: Biochemistry					
Institution Granting Degree		University of Wisconsin-Madison			
Certifications					
Type		Issuing Agency		Date	
Membership in Professional Organizations		Awards			
Publications (relevant to teaching responsibilities)		Presentations (relevant to teaching responsibilities)			
		Ran workshop on Reading Apprenticeship techniques			

CHART 6 (CONTINUED)

Continuing Education Activities/Professional Development (For past 3 years, or of major significance prior to this time and related to area of teaching responsibility)		
Type	Sponsoring Agency	Date
Member of the Transitions to Academic Success committee to promote and improve reading in classes	NECC	Fall 2011 - present
Attended National Science Teachers Association national meeting	NSTA	Spring 2013
Attended the "How People Learn Math" series of workshops	NECC	Spring 2011
Attended the "Critical Thinking" workshop	NECC	Summer 2011
Other information which you believe demonstrates your academic and experiential qualifications, and maintenance of expertise in your area of educational responsibility.		
<p>I am maintaining connections with research scientists in academia and industry to keep up with modern trends and needs and to develop research collaborations to provide more opportunities for our students. I am also working on incorporating more real-world type labs into other courses. For example, in Microbiology, I have developed labs that allow students to use both standard biochemical tests and sequencing of 16sDNA to identify an unknown bacterium and perform the same analysis used by the EPA to analyze public waterways for bacterial contamination. In Integrated Science I, I have students act as quality control specialists to determine salicylate content in solutions such as face creams.</p>		

CHART 6: FACULTY CREDENTIALS
For science faculty members who teach core and elective courses in the Lab Science Program

DATE: November/December 2013

NAME: Michael Cross						
Current Academic Rank:		Assistant Professor		Tenure Status		Not Tenured [x]
Academic Degrees:						
Bachelor Degree BA [] BS [x]		Concentration:		Chemistry		
Institution Granting Degree:		University of Utah				
Masters Degree:	MA []	MS []	MEd []	MBA []	MPH []	Other :
Concentration:						
Institution Granting Degree						
Doctorate:	PhD [x]		EdD []	JD []	Other:	
Concentration: Organic Chemistry						
Institution Granting Degree		University of Utah				
Certifications						
Type		Issuing Agency			Date	
Membership in Professional Organizations		Awards				
		MVB Magazine 40 Under 40 – 2013				
		NECC Employee Recognition Award - 2012				
Publications (relevant to teaching responsibilities)		Presentations (relevant to teaching responsibilities)				

CHART 6 (CONTINUED)

Continuing Education Activities/Professional Development (For past 3 years, or of major significance prior to this time and related to area of teaching responsibility)		Type	Sponsoring Agency	Date
		Professional Grant Development Workshop	Grant Training Center	Nov. 2012
Other information which you believe demonstrates your academic and experiential qualifications, and maintenance of expertise in your area of educational responsibility.				

CHART 6: FACULTY CREDENTIALS
For science faculty members who teach core and elective courses in the Lab Science Program

DATE: November/December 2013

NAME: Kim Waligora						
Current Academic Rank:		Associate Professor		Tenure Status		Tenured [] Not Tenured [x]
Academic Degrees:						
Bachelor Degree BA [] BS [x]		Concentration:		Biotechnology		
Institution Granting Degree:		Rochester Institute of Technology				
Masters Degree:	MA []	MS [x]	MEd []	MBA []	MPH []	Other :
Concentration:		Boston University				
Institution Granting Degree		Boston University				
Doctorate:		PhD [x]	EdD []	JD []	Other:	
Concentration:		Boston University				
Institution Granting Degree		Boston University				
Certifications						
Type		Issuing Agency			Date	
Massachusetts Teaching Certificate (Grades 5-12)		Department of Education			9/2011	
Membership in Professional Organizations		Awards				
Publications (relevant to teaching responsibilities)		Presentations (relevant to teaching responsibilities)				

CHART 6 (CONTINUED)

Continuing Education Activities/Professional Development (For past 3 years, or of major significance prior to this time and related to area of teaching responsibility)			
Type	Sponsoring Agency	Date	
ATE – Genomic Approaches in BioSciences Workshop	DNA Learning Center, Cold Springs Laboratory	8/2012	
Other information which you believe demonstrates your academic and experiential qualifications, and maintenance of expertise in your area of educational responsibility.			

APPENDIX 4
ADVISORY COMMITTEE MINUTES

**Northern Essex Community College
Minutes – Laboratory Science Advisory Board
May 10, 2011**

Minutes

The meeting started with a poster session by the second year students. Advisory board members were able to view the poster presentations and ask the students questions. First year students also attended the event to see the posters, talk to second year students and to meet the advisory board members.

After the poster session, Noemi Custodia-Lora spoke to the group about updates and acknowledgements. She first updated the group on the new Lab Science Program team which consists of: Dr. Marguerite White, Dr. Kevin Mitchell, Dr. Noemi Custodia-Lora, and new members Dr. Kimberly Waligora and Dr. Michael Cross.

Noemi Custodia-Lora then informed the group that there was an articulation agreement between the Associate in Applied Science Degree: Laboratory Science of Northern Essex Community College and the University of Massachusetts Lowell Bachelor of Science Clinical Laboratory and Nutritional Sciences.

The next update was the news that Northern Essex Community College's laboratory science associate degree received a gold endorsement from the Massachusetts Biotechnology Council. Laboratory competencies required to receive the gold endorsement are:

1. Following standard operating procedures
2. Solution, Buffer and Media Prep
3. Mammalian, plant or insect cell culture (tissue)
4. Microbiology and Molecular Biology techniques
5. Following aseptic and sterilization techniques as mandated
6. Field experience – Externship

Finally Noemi Custodia-Lora updated the group on NECC's externship experience. It is a for credit experience. Nine students completed their externships this semester in Massachusetts and Michigan. The students worked in private industry, universities, and government agencies. Feedback about the externships showed the following strengths:

1. Maintaining a proper laboratory notebook
2. Following Standard Operating Procedures (SOP)
3. Team-work and interpersonal skills
4. Oral and written communication skills
5. A positive attitude about the task(s) to perform
6. Receptiveness to constructive criticism

Feedback also provided the following issues:

1. Interview/initial screening
2. Immediate supervisor expectations
3. Externship schedule
4. Student academic workload

Based on this feedback the following changes will be made to the externship program:

1. It will incorporate the interview process before starting the externship
2. There will be a required two-week pre-externship workshop
3. The externship experience will begin after the completion of the student's research project

The next externship will be in May 2012.

After the updates, Noemi Custodia-Lora and Marguerite White acknowledged Adnexus Therapeutics, David Legg from Charm Sciences Inc, and Washington Alves from Merrimack Pharmaceuticals for their outstanding and invaluable support of Northern Essex's Laboratory Science Program. Each was presented with a plaque. Each second year student was then given a small gift as congratulations for completing the program.

For the final portion of the meeting students met with advisory board members for mock interviews. The information gathered in these interviews was collected by Noemi Custodia-Lora so faculty can review the advisory board member's comments.

The meeting ended shortly after 8PM.

**Northern Essex Community College
Minutes – Laboratory Science Advisory Board
December 13, 2011**

Minutes

Marguerite White began the meeting asking advisory board members if there is a better way to choose the dates for advisory board meetings. It was suggested that the NECC lab science staff select a few possible dates and then send a doodle poll to the advisory board to see which date would work best. Advisory board members were also asked how far in advance we should be scheduling these meetings. Most people seemed to feel at least one month in advance would work. One person suggested it would be better if we could give more than one month notice, however, another person pointed out that they don't know their schedules that far in advance and it would be hard to pick a date not knowing their schedule.

Marguerite then updated the board members on the class of 2011. There were ten graduates in May, 2011. Of those ten graduates, five have transferred or are preparing to transfer to UMASS Lowell in clinical sciences, biological sciences, and the biotechnology option. Four of the ten graduates decided to join the workforce. One went to work at Charm Sciences, two went to work for Toxikon, and one is in the interview process with Lowell General Hospital.

After updating board members on the class of 2011, Marguerite updated the board on changes to our externship program. NECC's second class is coming up on their externships (summer 2012) and we have made changes to the program based on the first class. The first change is that we moved the externship to the summer so students don't have to balance their externship with other courses that they are taking. However, in doing that, to meet financial aid requirements we had to make the externship six credits which equals 350 hours. Students will work the minimum of 350 hours between June and mid-August. The schedule will be one that works best for the company and the student.

Another change to the externship program is that students will have one week of pre-externship training on campus with faculty to better prepare them for their externship. The pre-externship training will include background information (researching the topics, instrumentation and techniques employed at their externship site). It will also include expectations and priorities and the differences between the NECC academic labs vs. the professional laboratories. Review of lab calculations (dilutions, concentrations, conversions, and lab-specific calculations) will also be included.

The externship will now be less work on the part of the company because students don't have to do a research project as part of the "research experience course" that needs to be completed. They are just there to do the work which will be easier for the company that hires them.

The final portion of the meeting was an open discussion on improvements to the externship. The board members were asked three questions about the externships.

The first question was how early in the spring would be ideal to start looking for a candidate for the summer. One person suggested February/March. Another person felt it would vary by company because for some companies April or later would be better so the company can have an idea which positions will be open during the summer.

The second question was whether advisory board members would like to hand pick the candidates to interview or would they like to set the interview process up like a job fair. Board members expressed interest in both of these ideas. It was suggested that students write student/candidate statements that companies can use to see if they would fit in with that particular company. The statements would be about one page, three paragraphs that encompass information on why the student likes lab sciences and what they would like to do for their externship. This would allow the companies to learn a lot about the student, much like a cover letter. One suggestion was with NECC's current group of six students it may be best to put together a packet of the students statements send that to the advisory board to review. Another person suggested NECC direct students to board members based on their statements and what we know about the companies. It was also suggested with NECC's upcoming group of about twenty students a job fair might be a better option. The job fair would be more efficient and a pro would be that the job fair would be open to "outside" organizations.

The third question was what particular competencies the board would be looking for in an ideal candidate. The list below represents the board's feedback to this question:

1. Technical writing
2. Summarizing results
3. Data interpretation
4. Basic lab skills (pipetting, aseptic technique)
5. Presentation skills
6. Pulling data together in a spreadsheet. Excel: data tables, statistics/graphical/presentation
7. Being comfortable to ask questions/ask for clarification
8. Understanding the larger picture
9. Following protocols
10. Making sure their lab notebooks/data are understandable by someone else
11. Reading complex scientific information from published literature and understanding how that relates to what they are doing
12. Understanding the company they are going to, the company's mission, how their group fits in with that, and the importance of their role
13. Throughout the externship students should be asking for feedback from their supervisor so they don't wait and get it all at the end

Kevin Mitchell asked the board members if they felt it was more important for the externship for students to understand how to read scientific information or analyze data/deal with data/be in the lab and the feeling was that the importance should be placed on data over reading.

It was suggested that we might want to look into social media sites and getting our information out there. It would be easy for students to access what we are doing and a way to have alumni communication.

**Northern Essex Community College
Minutes – Laboratory Science Advisory Board
May 21, 2012**

Minutes

The meeting started with a poster session by the second year students. Advisory board members were able to view the poster presentations and ask the students questions. Several graduates of the program also attended the event to see the posters, talk to second year students and to meet the advisory board members.

After the poster session, Michael Cross and Kim Waligora gave a brief presentation on the work our first and second year students have been doing over the past year. For the final portion of the meeting students met with advisory board members for mock interviews. The meeting ended shortly after 8PM.

**Northern Essex Community College
Minutes – Laboratory Science Advisory Board
April 4, 2013**

Minutes

The meeting started with a welcome from Mike Cross to advisory board members and students. A brief update was given on the program news including the award of a Capital Grant from the Massachusetts Life Science Council for laboratory renovations.

Next, the second year students gave presentations on their research projects.

For the final portion of the meeting students met with advisory board members for mock interviews. The meeting ended shortly after 8PM.

**Lab Science Advisory Board Meeting Minutes
October 3, 2013**

5:30-7:15 Dinner and NECC wide Advisory board summit held in TC103. Discussion amongst various program advisory boards at NECC regarding:

- What we do well at NECC in preparing our students?
- What experiences are most appropriate for students preparing to join the workforce?
- What we can improve upon at NECC to better prepare our students for the workforce?

The general consensus seemed to be that experiential learning (externships, shadowing, clinical experiences) were some of the best things to do to prepare our students. Focusing on writing, reading, teamwork and other soft skills were also important.

7:30-8:30 Individual Lab Science Meeting held in E255 (newly renovated physics lab).

M. White-Jeanneau presented enrollment, retention, externship, and career path data for the last five years (taken from the 2013 program update report to the Massachusetts DHE).

K. Waligora presented externship results from the 2013 graduating class including placement info and supervisor ratings and comments

K. Mitchell led a discussion on student resume recommendations and advice for job searches. Seven student resumes were quickly reviewed and rated. Advisory board members offered feedback on what was appropriate/effective and what was not. The following is a summary of their comments:

- Be careful of 'copycat' resumes from our students. Many of them were very similar in wording and format. If submitted to the same opportunity, they will automatically get discarded for not being reflections of individuals.
- Focus on keywords (techniques) not full descriptions of experiments. Further details on experiments can be given in interviews.
- Make sure to include all employment history whether lab related or not. It tells that students are reliable and can hold down a job. Don't put it on the last page – feature it on the first page.
- Lists of courses taken are more confusing than helpful. Courses like 'integrated science' are not universally recognizable.
- Include GPA if it is good.
- One page is better. Lists and bullet points are easier to read than lots of text.
- Be careful of formatting. It must be consistent throughout.
- Informational interviews are a good strategy to introduce students to networking and give them more insight into the types of companies they might be interested in working at.

APPENDIX 5
OUTCOMES ASSESSMENT PLAN

Northern Essex Community College
Laboratory Science Program

Outcomes and Curriculum Map - Laboratory Science			
<p>PROGRAM MISSION STATEMENT: The Associate in Applied Science degree program in Laboratory Science is designed to build the essential skills and knowledge required for entry level employment and/or transfer to a four-year college or university. The curriculum allows students with minimal science and mathematics backgrounds to enter the program and develop the skills needed to successfully complete upper level science courses.</p> <p>The primary goals for the Laboratory Science Program are: (1) to prepare students to be laboratory technicians in the biotechnology, analytical chemistry and environmental sciences industries; and (2) to ensure that as many courses as possible in the Lab Science Program will transfer for those students that wish to eventually pursue a Baccalaureate degree.</p> <p>In order to prepare students to obtain entry level jobs in local scientific companies, students graduating from the Laboratory Science Program will develop general laboratory skills, including lab safety knowledge and the ability to follow standard operating procedures (SOP). In addition to these general laboratory skills, students will focus their training in one of the three specific disciplines and develop a knowledge base that will allow them to continue to learn and grow in their chosen specialty. During the coursework, students will also have the opportunity to develop soft skills, such as oral and written communication, interpersonal relationships and proper work habits. The hands-on skills and theoretical knowledge gained while in the Laboratory Science Program will also prepare those students that wish to transfer to a four year institution.</p>			
OBJECTIVES	ASSOCIATED LEARNING OUTCOMES	PROGRAM CURRICULUM: SPECIFIC COURSES AND RELATIONSHIP TO OUTCOME	
The objectives of the Laboratory Science Associate in Applied Science Degree Program include to assist students in the development of:	The graduating student will be able to:	Requirements	
		<div>CHM121 General Chemistry I</div> <div>CHM201 Introduction to Organic & Biochemistry</div> <div>CIS110 Computer Applications</div> <div>ENG101 English Composition I</div> <div>MAT125 Statistics</div> <div>SCI100 Basic Lab Calculations</div> <div>SCI103 Success in Science Seminar</div> <div>SCI104 Topics in Laboratory Science</div> <div>SCI105 Integrated Science I</div> <div>SCI106 Integrated Science II</div> <div>SCI281 Research Experience Laboratory</div> <div>SCI291 Externship in Laboratory Science I OR SCI292</div> <div>Concentrations</div> <div><div>Analytical Chemistry</div><div>Biotechnology</div><div>Environmental Sciences</div><div>CHM280 Research Seminar in Analytical Chemistry</div><div>BIO280 Research Seminar in Biotechnology</div><div>ERS280 Research Seminar in Environmental Sciences</div></div>	
		Electives	
		<div>Math Elective (3/4)</div> <div>General Education Elective (3)</div> <div>General Education Elective (3)</div> <div>General Education Elective (3)</div> <div>Science Elective (4)</div>	

**Northern Essex Community College
Laboratory Science Program**

[illegible]

Northern Essex Community College
Laboratory Science Program

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Northern Essex Community College
Laboratory Science Program

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Northern Essex Community College
Laboratory Science Program

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Northern Essex Community College
Laboratory Science Program

[illegible]

OBJECTIVES		ASSOCIATED LEARNING OUTCOMES	ASSESSMENT METHOD(S)
1	The objectives of the Laboratory Science Associate in Applied Science Degree Program include to assist students in the development of:	The graduating student will be able to:	In which courses or other curricular experiences such as practicums, internships, etc.
1	The ability to comprehend, translate, and use the language of biotechnology, chemistry, and the environmental sciences	1 Explain fundamental concepts in biotechnology, chemistry, and the environmental sciences	SCI281 Research Experience Presentations, Lab Report, and Poster
		2 Gather information from a variety of reputable and appropriate sources and identify assumptions and biases in information presented. Cite information appropriately and in own words	SCI291/2 Externship Supervisor Survey
		3 Identify and use appropriate quantitative methods in data analysis, explain results and present them appropriately in graphs and tables	SCI291/2 Externship Supervisor Survey
		4 Report results appropriately in written and oral formats	SCI281 Research Experience Presentations, Lab Report, and Poster
		5 Thoughtfully analyze results and data, identifying potential errors and uncertainties and their effects on results	SCI291/2 Externship Supervisor Survey
		6 Read and follow a standard operating procedure (SOP) in a laboratory setting	SCI291/2 Externship Supervisor Survey
2	Standard laboratory practices and workplace functions.		

Northern Essex Community College
Laboratory Science Program

3	7	Demonstrate appropriate lab safety conduct	Lab Assignments in every lab course in the program (SCI105-106, 281 and 291/2, CHM121, 201, and 203)
	8	Apply problem solving skills, mathematics and critical thinking to analyze problems, propose solutions and make decisions	Lab Assignments in every lab course in the program (SCI105-106, 281 and 291/2, CHM121, 201, and 203)
	9	Maintain an appropriate laboratory notebook or similar record of work conducted in the laboratory using good documentation practices (GDP)	SCI291/2 Externship Supervisor Survey
	10	Be able to demonstrate, through example, current Good Manufacturing Practices (cGMP)	CHM203 Instrumental Analysis Lab Assignments
	11	Operate common laboratory equipment and instruments and perform validation and corrective maintenance, as required	CHM203 Instrumental Analysis Lab Assignments
	12	Use aseptic technique and be able to prepare sterile media	SCI106 Integrated Science II Lab Assignments
	13	Prepare solutions and media appropriately including obtaining the correct pH and performing the appropriate calculations for solution preparation	SCI291/2 Externship Supervisor Survey
	14	Use a spectrophotometer properly and be able to determine the concentration of an unknown using UV-vis spectrophotometry	CHM203 Instrumental Analysis Lab Assignments
	15	Perform chromatographic techniques (gel filtration, ion exchange, HPLC, GC, TLC)	CHM203 Instrumental Analysis Lab Assignments
	Laboratory techniques and experience with common laboratory techniques used in biotechnology, chemistry, and environmental sciences		

Northern Essex Community College
Laboratory Science Program

		16	Perform basic microbiology and cell biology techniques such as cell fractionation, culturing, maintenance, enumeration, and preservation	SCI106 Integrated Science II Lab Assignments
		17	Understand and use basic protein and nucleic chemistry techniques such as purification, quantitation, electrophoresis, blots, ELISA, and PCR	SCI106 Integrated Science II Lab Assignments
4	The ability to conduct mathematical and computational operations involved in the laboratory, including the use of applicable software	18	Perform appropriate laboratory calculations including: solution preparation calculations, standard curves and linear regressions, unit conversions using the metric (SI) system of measurement, and basic statistical analysis of data	Lab Assignments in every lab course in the program (SCI105-106, 281 and 291/2, CHM121, 201, and 203)
		19	Navigate instrument specific software appropriately to conduct instrumental analyses	CHM203 Instrumental Analysis Lab Assignments
		20	Use spreadsheet and word processing software appropriately to analyze and present laboratory results	SCI281 Research Experience Presentations, Lab Report, and Poster
5	Appropriate professional and interpersonal skills for the workplace.	21	Demonstrate appropriate and respectful teamwork and communication skills	SCI291/2 Externship Supervisor Survey
		22	Engage in continuing education activities including literature research to learn new techniques and instrumentation necessary to maintain and enhance skills and competencies	CHM203 Instrumental Analysis Research Paper

Northern Essex Community College
Laboratory Science Program

		23	Exhibit appropriate workplace behaviors such as time management, effective communication (written and verbal) and presentation skills, and integrity in work	SCI291/2 Externship Supervisor Survey
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APPENDIX 6

OCCUPATION PROFILE REPORT

Biological Technician

Education

Biological technicians typically need a bachelor's degree in biology or a closely related field. Most colleges and universities offer bachelor's degree programs in biological science.

Biological science programs usually include courses in general biology, as well as in specific subfields such as ecology, microbiology, and molecular biology. In addition to taking courses in biology, students must study chemistry, mathematics, and physics. Computer science courses are helpful for modeling and simulating biological processes and for operating some laboratory equipment.

It is important for students to gain laboratory experience before entering the workforce. Students should take biology courses that emphasize laboratory work. They often can also gain laboratory experience through summer internships with prospective employers, such as pharmaceutical and medicine manufacturers.

Job Outlook

Employment of biological technicians is projected to increase 14 percent from 2010 to 2020, as fast as the average for all occupations. Greater demand for biotechnology research is expected to increase the need for these workers.

Biotechnology research plays a key role in scientific advancements that improve our way of life. Biological technicians will be needed to help scientists develop new medicines and treatments for diseases such as cancer and Alzheimer's.

In agriculture, biotechnology research will be used to create genetically engineered crops that provide greater yields and require less pesticide and fertilizer. In addition, efforts to discover new and improved ways to clean and preserve the environment will continue to add to job growth. Finally, biological technicians will be needed to help develop alternative sources of energy, such as biofuels and biomass.

Job Prospects

Strong competition for jobs is expected. There have been large increases in the number of bachelor's degrees in biology and other life sciences awarded each year, and this trend is expected to continue. Applicants who have laboratory experience, either through coursework or previous work experience, should have the best opportunities.

Source: Occupational Outlook Handbook

Pharmaceutical Technician

Education and Training Requirements

Many companies prefer to hire people who have attended a college or technical institute for two years. You may also need some on-the-job training. For some jobs, employers prefer to hire people who have a bachelor's degree in one of the biological sciences. College courses that would be useful in the drug industry include chemistry, biology, engineering, and veterinary science. Some colleges offer pre-pharmacy courses.

Advancement Possibilities and Employment Outlook

As they gain experience, technicians are usually given more responsibility. They often become supervisors of other workers. They can increase their chances for advancement by taking more courses related to their work. Some technicians may decide to pursue a five-year pharmacy degree program. Others take the one-year certification programs offered in some states. Pharmaceutical technicians can also advance by going into technical writing or sales work.

The employment outlook for pharmaceutical technicians is very good. There will be some increase in the total number of technicians employed in the drug industry. There will also be openings to replace workers who leave the field. The drug industry is only slightly affected by changes in the economy. Employment levels tend to be stable.

Source: StateUniversity.com

Environmental Science and Protection Technicians

Education

Most employers prefer applicants who have at least an associate's degree, or 2 years of postsecondary training, in a natural science or science-related technology. However, some entry-level positions require a high school diploma.

Many technical and community colleges offer programs in environmental studies or a related technology, such as remote sensing or geographic information systems (GIS). Associate's degree programs at community colleges are traditionally designed to provide easy transfer to bachelor's degree programs at colleges and universities because a bachelor's degree can be useful for future career advancement. Technical institutes usually offer technical training but provide less theory and general education than community colleges offer.

A well-rounded background in natural sciences is important for environmental science technicians, so students should take courses in chemistry, biology, geology, and physics. Coursework in mathematics, statistics, and computer science also is useful because technicians routinely do data analysis and modeling. Many schools offer internships and cooperative-education programs, which help students gain valuable experience while attending school. Internships and cooperative-education experience can enhance the students' employment prospects.

Job Outlook

Employment of environmental science and protection technicians is expected to grow by 24 percent from 2010 to 2020, faster than the average for all occupations. Heightened public interest in the hazards facing the environment, as well as the increasing demands placed on the environment by population growth, are expected to spur demand for environmental science and protection technicians.

Further demand is expected as a result of new and increasingly complex environmental laws and regulations.

Most employment growth for environmental science and protection technicians is projected to be in private consulting firms. More businesses and governments are expected to use these firms in the future to help them monitor and manager the environment and comply with regulations.

Job Prospects

Environmental science and protection technicians should have good opportunities for employment. In addition to openings due to growth, many job openings are expected to be created by those who retire or leave the occupation for other reasons. Job candidates with an associate's degree or experience should have the best opportunities.

Job opportunities available in state and local governments will vary from year to year with the budgets of state and local environmental protection agencies.

Source: Occupational Outlook Handbook

Chemical Technician

How to Become a Chemical Technician

Required Education for a Career in Chemical Technology

While it was once common for those beginning a career in Chemical Technology to be hired with only a high school diploma and receive on-the-job training, a 2-year degree in applied science or chemical technology is becoming the standard requirement for many employers. In fact, the U.S. Bureau of Labor Statistics reports that of those holding a degree, those who are well trained in the use of laboratory equipment will have the best job opportunities. With or without a degree, strong math, science and laboratory skills will be necessary for a successful career in Chemical Technology.

Skills Required for a Career in Chemical Technology

Chemical Technicians need to be both self-directed and good team members. They should enjoy applying scientific methods to solve problems and be open to listening to the ideas of others. Also, a Chemical Technician must be clear in both written and verbal communication and be capable of explaining procedures to those who lack a scientific background.

Career and Economic Outlook for Chemical Technology

The USBLS currently projects job growth in Chemical Technology to be slower than average. This is largely due to company downsizing and outsourcing of contracts. In 2006, the USBLS reported the median hourly wage for a Chemical Technician at \$18.87.

Source: Education Portal