

BOARD OF HIGHER EDUCATION

REQUEST FOR BOARD ACTION

NO.: AAC 09-11

BOARD DATE: April 30, 2009

NORTHERN ESSEX COMMUNITY COLLEGE
Associate in Applied Science in Laboratory Science

MOVED: The Board of Higher Education hereby approves the request of **Northern Essex Community College** to award the **Associate in Applied Science in Laboratory Science**.

One year after graduating the program's first class, the College shall submit to the Board a status report addressing its success in reaching program goals as stated in the application and in the areas of enrollment, curriculum, faculty, resources and program effectiveness.

Authority: Massachusetts General Laws Chapter 15A, Section 9(b)

Contact: Dr. Francesca Purcell, Associate Commissioner for Academic and P-16 Policy

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April 2009

Northern Essex Community College

Associate in Applied Science in Laboratory Science

Intent and Mission

The proposed Associate in Applied Science in Laboratory Science is designed to prepare students with the knowledge and skills necessary to obtain employment for entry-level laboratory technician positions. In addition to general laboratory skills, students will focus their training in one of the three concentrations—biotechnology, analytical chemistry, or environmental sciences—and develop a knowledge base that will allow them to continue to learn in their chosen area. Students will also develop skills, such as oral and written communication, interpersonal relationships, and proper work habits.

Northern Essex Community College (NECC) applied for an Advanced Technological Education (ATE) grant from the National Science Foundation (NSF), which was awarded in July 2008 to partially support the costs associated with the development and implementation of the proposed program for the next three years. Ten percent of the total award has been allocated to an external evaluator to ensure that program goals are met.

The proposed program is in alignment with the mission of NECC to serve the people of the greater Merrimack Valley region by offering high-quality, affordable adult and post-secondary education, including occupational and community services that enhance the social, cultural, and economic life of the region.

The NECC Board of Trustees approved the proposed program on September 3, 2008. A Letter of Intent was circulated on November 5, 2008. Massachusetts Bay Community College (MassBay) congratulated NECC for its efforts to respond to the demand for trained laboratory technicians and also expressed concern about the proposed program's ability to prepare students to transfer to four-year institutions in the science areas. MassBay encouraged NECC to reconsider the dual purpose of the proposed program. NECC acknowledged the concern expressed by MassBay about the difficulty of creating an Associate in Applied Science Degree that could fully meet both the goals of transfer and career preparation. NECC explicitly modified these dual goals, originally expressed in its letter of intent, and clarified that the primary goal of the proposed program is career preparation, while ensuring that as many of the program's courses as possible can be transferred.

Need and Demand

According to the Massachusetts Department of Workforce Development, employment in professional, scientific, and technical services rose 3.1 percent in 2007. In 2006 the Center for Labor Market Studies at Northeastern University reported more than 86,000 job vacancies in key life sciences occupations in the state. Importantly, two independent reports suggest this hiring demand is expected to continue. A new study by the University of Massachusetts' Donohue Institute, "Growing Talent: Meeting the Evolving Needs of the Massachusetts Life Sciences Industry, September 2008," reports that 88 percent of Massachusetts life sciences companies expect modest or substantial growth in their Massachusetts workforce over the next two years, and no employers project a decline. At a recent meeting on March 5, 2009, of the Massachusetts Life Sciences Education Consortium (an organization that brings together the life sciences industry and higher education), both Robert Coughlin, the President of the

Massachusetts Biotechnology Council, and Lynn Griesemer of the University of Massachusetts Boston's Donahue Institute, urged the colleges to continue to work on developing programs that will prepare workers for the life sciences industry even in these difficult economic times. Likewise, the New England Economic Partnership predicts that employment opportunities in the life sciences cluster will increase twice as fast as Massachusetts' overall employment growth.

Preliminary results from a survey conducted in early 2009 by NECC of employers of laboratory technicians in New England find that almost 90 percent of the respondents are planning on hiring technicians, and almost 40 percent are planning to hire at least four technicians in the next year. Over 60 percent report at least some need to hire technicians. These hiring trends are mirrored in the Merrimack Valley area served by Northern Essex Community College's two campuses. According to the Merrimack Valley Workforce Investment Board (MVWIB) Labor Force Blueprint Update (2007), there has been a significant growth in the number of companies in the area dedicated to the life sciences, including chemistry, biotechnology, environmental, and nanotechnology. Additionally, within the next five years, many of these companies will need to replace the workers nearing retirement age, which in some cases is a large percentage of the workforce (*MVWIB Labor Force Blueprint Update 2007*).

Programs that prepare students for employment upon graduation are highly competitive at NECC. For example, the nursing program currently has a total of 99 students, and there are 668 students enrolled in the General Studies: Nursing major, waiting to enter the program. However, more than 50 percent of these students may not enter the nursing program due to limited program capacity. The next largest health program, radiology, has a similar situation. Currently, there are 46 students enrolled in the radiology program, while an additional 205 students wait to enter as General Studies: Radiology majors. Similarly, less than half of the students interested in the radiology program may be accepted due to limited program capacity. Informal conversations with students not accepted into these programs indicate they would be interested in applying to other degree options as long as these programs prepared the students to seek employment upon graduation. The proposed laboratory science program will offer an alternative for these students.

A survey performed by the College under a Title V grant—a federal grant awarded to NECC by the U.S. Department of Education to expand the capacity to serve Latino and low-income students—revealed that most Latino students do not enroll in any of the existing science programs because these programs do not prepare students to enter the job market after graduation. The repeated response from the Latino students was “I have a family to support, so I need to get an associate degree that will allow me to work right after graduation.” Therefore, the proposed program has been designed to serve students with an interest in the sciences who wish to obtain a job with their associate degree.

Curriculum (Attachment A)

The proposed laboratory science program curriculum requires that graduating students complete 60 credits. During the first year, students will learn basic concepts in general chemistry, physics and biology (Integrated Science I and II). At the same time, students will take the course “Topics in Applied Sciences,” where they will relate scientific concepts to techniques and methodologies in the different areas of the program (biotechnology, analytical chemistry, environmental sciences).

The curriculum is unique in the sense that it will allow students in developmental courses to complete the degree in reasonable time. College entrance assessment results for 2006/2007 indicate that 68 percent of students enrolling at NECC scored below college level in one or more of the core academic proficiencies, which are reading, writing and mathematics. To address this concern, a series of multidisciplinary learning modules are being developed that will enable

students to move through developmental and general education coursework in the required disciplines while concurrently learning necessary lab skills. Each of the modules will address a specific scientific principle through lecture and lab work, teaching both skills and theoretical requirements. Skill building in mathematics, computer applications, and technical writing/reading will be integrated into the lab work. All assignments and lectures will be coordinated to enhance the laboratory sessions. Quantitative analytical skills will be taught in the mathematics course and then applied in the lab. The data generated and analyzed will be managed in the computer applications course. Finally, all of the discipline-specific work will be detailed in the English Composition course that is being redesigned to focus on technical writing. A capstone project will highlight a portfolio and research paper to demonstrate the complete integration of all first-year core course objectives. While each course in the first-year learning module will receive individual credits and will be listed on transcripts as separate courses, the design is fully integrated.

Students will select one of three concentrations—biotechnology, analytical chemistry, and environmental sciences—in the second year. Students must complete both a research project and an externship in their chosen concentration.

NECC anticipates that the curriculum will evolve over time to keep current with the demand of employers and up to date with emerging lab techniques. To facilitate further development of curriculum, NECC formed an advisory board with representatives from regional industry, government agencies, and four-year schools. The associated costs of creating the advisory board, meetings, industry needs surveys, and externship placement will be supported by the NSF ATE grant from 2008-2011.

Admission and Enrollment

Ideally, all students will enter prepared to take College Algebra and English Composition I in their first semester. However, entrance into the program will be allowed even if students are required to take developmental courses. Faculty and advisors are prepared to work with all interested students, and extensive advising will help students understand proficiencies, prerequisites and other requirements, as well as contribute to students' retention. For example, in coordination with the mathematics department, summer developmental math courses will be available for students interested in entering in the fall.

Enrollment Projections

	# of Students Year 1	# of Students Year 2	# of Students Year 3	# of Students Year 4
New Full Time	15	20	20	20
Continuing Full Time	0	15	20	20
New Part Time	5	5	5	5
Continuing Part Time	0	5	10	10
Totals	20	45	55	55

Resources and Budget (Attachment B)

In fall 2008 the Natural Sciences Department hired two new full-time faculty members for the proposed program. The remaining courses will be taught by existing faculty. The College plans to hire a laboratory technician to serve the Laboratory Science Program. Administrative work for the program will be done by the three existing staff members of the Business, Math, Science, and Technology Division.

Required instructional materials, such as perishable lab supplies, chemicals, disposable lab supplies, waste removal and equipment maintenance, will be provided in the regular Laboratory Science Program and Natural Sciences Department annual budget lines in the College budget. Additionally, the NSF ATE grant will partially cover annual supplies through June 2011. After this time, NECC will assume the funding of perishable supplies (approximately \$15,000 annually) and implement a computerized supply ordering and inventory system to improve efficiency.

The NECC Library has recently been awarded a grant to increase resources in science education. This grant will support the purchase of new science books and an online database subscription for science publications. These materials will benefit the Laboratory Science students as well as the 2,000 students enrolled in science courses annually at the College. Additional materials required for the library will include renewal to the online resources. Funds for this will be supported by the Library's annual Capital Budget.

NECC has recently renovated two chemistry labs and the chemistry stockroom into state-of-the-art teaching and preparatory spaces. Additionally, the College has funded the development and remodeling of the Laboratory Science Core Lab Space. Completed in November 2008, this space will serve as the primary teaching laboratory for the proposed program. The large initial investments of equipment and classroom materials have been provided by the following funding sources: Northern Essex's Capital Budget, NSF Advanced Technology Education Grant, Perkins Voc Ed funding, Fund for the Improvement of Post-Secondary Education (FIPSE) grant, and external donations from the Massachusetts Department of Environmental Protection (Mass-DEP). Additional equipment donations committed by the Mass-DEP are expected for the 2009-2010 academic year. This large investment of resources will allow students to work in one of the best-equipped undergraduate teaching laboratories in the region.

Program Goals and Objectives

Goal	Measurable Objective	Strategy for Achievement	Timetable
Prepare students to be laboratory technicians in the biotechnology, analytical chemistry and environmental sciences industries	Recruit students to fill all available seats in the program (15 in the first year and 20 each in the years after)	Advertise the laboratory science program in regional news media.	Spring 2009
		Develop partnerships with local high schools to prepare students in advance to enroll as full time students.	Spring 2009
		Recruit among students not accepted into competitive health related sciences programs but still interested in a career in science.	Spring 2009
	Retention rate of 60% for all students in the program, including Latino students.	Employ modules of the learning community-cohort model to enable students to move through developmental and general education coursework while concurrently learning necessary lab skills.	Develop modules by spring 2009 for fall 2009 implementation
		Encourage students to take the first year courses of the program as a learning community/cohort.	Begin advising for this purpose: spring and summer 2009

	Approximately 70% of the students enrolled will have graduated by the sixth year.	Train science faculty to advise students in the program about educational goals, academic progress, course requirements, transfer options, class schedules, and College resources including tutoring, scholarships, and library services.	Initial training in spring 2009 but refresher training every six months after that.
	All students in the program will have a “real work experience” with potential employers in the region.	Mandatory externships in regional industries for all students during the last semester in second year into the program.	First group of students in externship: spring 2011
	75% of the graduating students will join the workforce upon graduation.	Maintain and update the curriculum every six months to match regional industry demands as indicated by data collected from industry surveys and online resources.	Began fall 2008 and will continue every six months after that.
		Provide opportunities for students to develop soft skills necessary for successful employment starting in year one with the Success in Science Seminar.	Fall 2009
Increase the number of underrepresented students, especially Latino students, graduating with science degrees and obtaining employment in local industry	Enroll and retain at least 3 Latino students (20%) in year one and increase Latino student enrollment in subsequent years to 33% (5 students) to match NECC’s total Latino student enrollment.	Advertise program in regional news media both in English and Spanish.	Spring 2009
		Work with the Latino community in the region to advertise the program and attract new students.	Spring 2009
		Use bilingual and bicultural faculty and staff for Latino student advising.	Spring 2009
		Invite bilingual, bicultural professionals in scientific careers to speak to students about their experiences.	Spring 2010
	Approximately, 20% of the students enrolled in the program will have come from ESL or developmental programs.	Develop recruitment activities specifically for ESL students, such as class visits, meetings with Latino science faculty, and science seminars on the careers possible with an associates degree in Laboratory Science.	Began fall 2008 and will continue throughout the year

Ensure that as many courses as possible in the Lab Science Program will transfer for those students that wish to pursue a baccalaureate degree	25% of the students will transfer to four-year schools.	Maintain first-year curriculum similar to a traditional science undergraduate program.	Fall 2009
		Provide students with sound theoretical knowledge in science.	Fall 2009
	At least three articulation agreements will be signed with regional four-year institutions.	Develop transfer agreements with four-year institutions in the region.	Spring 2010

External Review

The proposed program was reviewed by Guy Hamilton, Biotechnology Program Director, Shoreline Community College, Shoreline, Washington; and Dr. Barkley C. Sive, Research Associate Professor, Climate Change Research Center, Institute for the Study of Earth, Oceans and Space, University of New Hampshire. Both reviewers considered the program to be consistent with NECC’s academic mission, fully supported by the College, and designed to meet a clearly demonstrated need for entry-level laboratory technicians in Massachusetts and, more specifically, in the Merrimack Valley region. The National Science Foundation (NSF) grant awarded to the College was also mentioned by both reviewers as an important indicator of the merit of the proposed program and that it will complement the funding provided by the College. Dr. Sive referred to the program faculty as a “committed, highly motivated, vibrant and highly skilled group of educators,” pointing out that five of the seven science/math faculty had doctorates in fields directly related to the program. He also highlighted the multidisciplinary learning communities as being a mechanism to foster student success.

Reviewer recommendations included making minor curriculum modifications, ensuring sufficient training in each concentration and in independent lab skills, and tracking program graduate employment trends. NECC responded to the curriculum and training concerns fully and will proactively contact graduates on an annual basis and also sponsor annual alumni events.

Staff Analysis and Recommendation

After careful review and consideration of the proposal and all supporting documentation, staff recommendation is for approval of the Associate in Applied Science in Laboratory Science at Northern Essex Community College.

One year after graduating the program’s first class, the institution shall submit to the Board a status report addressing its success in reaching program goals, as stated in the application, and in the areas of enrollment, curriculum, faculty, resources, and program effectiveness.

Attachment A – Curriculum Outline

Northern Essex Community College Laboratory Science Program

Required (Core) Courses (# Total Courses Required = 14)		
Course Number	Course Title	Credit Hours
CHM 121	General Chemistry I	4
CHM 201	Introduction to Organic and Biochemistry	4
CHM 203	Instrumental Analysis	4
CIS 110	Computer Applications	3
ENG 101	English Composition I	3
MAT 120	College Algebra	3
MAT 125	Statistics	4
SCI 103	Success in Science Seminar	1
SCI 104	Topics in Laboratory Science	3
SCI 105	Integrated Science I	4
SCI 106	Integrated Science II	4
SCI 281	Research Experience in Laboratory Science	4
SCI 291 or SCI 292	Externship in Laboratory Science	3* or 5
BIO 280, CHM 280, or ERS 280	Research Seminar in Biotechnology, Analytical Chemistry or Environmental Sciences	1
	Subtotal Required Credits	45* or 47
Elective Courses (# Total Courses Required = 4)		
Course Number	Course Title	Credit Hours
BIO215 or	General Ecology	4
BIO220 or	Microbiology	4
BIO230 or	Cell Biology	4
ERS125	Environmental Issues	4
General Education Elective	Humanities Elective	3
General Education Elective	Humanities Elective	3
General Education Elective	Social Science Elective	3
	Subtotal Elective Credits	13
Distribution of General Education Requirements Attach List of General Education Offerings (Course Numbers, Titles, and Credits)**		# of Gen Ed Credits

Arts and Humanities, including Literature and Foreign Languages	9
Mathematics and the Natural and Physical Sciences	15
Social Sciences	3
Subtotal General Education Credits	27

Curriculum Summary

Total number of courses required for the degree	18
Total credit hours required for degree	60

Prerequisite or Other Additional Requirements:

Prerequisite and co-requisite requirements:

- CHM 121: Prerequisite (SCI 105 with C or better) and co-requisite (MAT 120)
- CHM 201: Prerequisite (CHM 121 with C or better)
- CHM 203: Prerequisite (CHM 121 and MAT 120 with C or better)
- MAT 120: Prerequisite (MAT 022 Basic Algebra II with C or better or placement exam score)
- MAT 125: Prerequisite (MAT 120 with C or better or placement exam score)
- SCI 106: Prerequisite (SCI 150 with C or better)
- SCI 281: Prerequisites (CHM 203 and ENG 101) and co-requisite (BIO 280, CHM 280, or ERS 280)
- SCI 291: Prerequisite (CHM 203) and co-requisite (SCI 281). Students in SCI 291 must also take an additional 3 credit elective to graduate
- SCI 292: Prerequisite (CHM 203) and co-requisite (SCI 281)

Additional Concentration Requirements:

- Biotechnology: BIO 280 with prerequisites (CHM 203 and ENG 101) and co-requisite (SCI 281)
- Analytical Chemistry: CHM 280 with prerequisites (CHM 203 and ENG 101) and co-requisite (SCI 281)
- Environmental Sciences: ERS 280 with prerequisites (CHM 203 and ENG 101) and co-requisite (SCI 281)

*Students that take the three-credit SCI291 Externship in Laboratory Science course will need to take an additional 3-credit elective in order to graduate and will earn 61 credits.

**General Education Requirements

- ENG101 English Composition I 3 credits
- Humanities Elective 3 credits
- Humanities Elective 3 credits
- MAT120 College Algebra 3 credits
- MAT125 Statistics 4 credits
- Social Sciences Elective 3 credits
- CHM121 General Chemistry I 4 credits
- Science Elective: BIO215 General Ecology **or** BIO220 Microbiology **or** BIO230 Cell Biology **or** ERS125
- Environmental Issues: 4 credits

**Attachment B: Budget
Proposed Program**

The income projections below are based on current tuition and fees with no assumed annual increase. Values have been calculated assuming a cohort of 15 students in fall 2009 and an additional cohort of 20 students enrolled each year after. Potential part-time student enrollment is not included in the following calculations.

One-Time Start-Up Costs	Cost Categories	Annual Expenses			
		Year 1	Year 2	Year 3	Year 4
	Full-time Faculty	240,000	247,200	254,616	262,254
	Part-time/Adjunct Faculty				
	Staff (Lab Technician)	35,000	36,050	37,132	38,245
	General Administrative Costs	816	1,852	2,106	2,106
20,000	Instructional Materials	8,000	12,000	12,000	12,000
5,000	Library Acquisitions	1,500	1,500	1,500	1,500
90,000	Facilities/Space				
265,000	Equipment	15,250	10,000		
2,500	Field Resources				600
2,000	Marketing	1,000	750	500	250
	Other (student support and waste removal/equipment support program)	4,000	3,500	3,500	3,500
384,500	TOTALS:	305,566	312,852	311,354	320,455

One-Time Start-Up Costs	Revenue Sources	Annual Income			
		Year 1	Year 2	Year 3	Year 4
120,000	NSF ATE Grant	105,000	69,000		
119,000	FIPSE Grant				
62,000	Perkins Voc Ed Funds	40,000			
110,000	Northern Essex Capital Budget				
	Tuition	11,625	26,375	30,000	30,000
	Fees	42,780	97,060	110,400	110,400
	Reallocated Funds				
5,000	Other (donations)	45,000			
416,000	TOTALS:	244,405	192,435	140,400	140,400