

**BOARD OF HIGHER EDUCATION**  
**REQUEST FOR COMMITTEE AND BOARD ACTION**

**COMMITTEE:** Academic Affairs

**NO.:** AAC 12-01

**COMMITTEE DATE:** October 11, 2011

**BOARD DATE:** October 18, 2011

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**APPLICATION OF MASSACHUSETTS COLLEGE OF LIBERAL ARTS TO AWARD  
THE BACHELOR OF SCIENCE IN CHEMISTRY**

**MOVED:** The Board of Higher Education hereby approves the application of **Massachusetts College of Liberal Arts** to award the **Bachelor of Science in Chemistry**.

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.

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

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

## **BOARD OF HIGHER EDUCATION**

October 2011

### **Massachusetts College of Liberal Arts Bachelor of Science in Chemistry**

#### **INTENT and MISSION**

The Massachusetts College of Liberal Arts (MCLA) submitted an expedited proposal to offer a Bachelor of Science in Chemistry. MCLA's original chemistry major was discontinued in 1998 in order to use resources to support the chemistry minor as well as emerging science majors such as physics, environmental studies and biology. Over the last several years, there has been a student increase in STEM majors including more students electing the chemistry minor and expressing interest in a chemistry major. Further, the state has since implemented the STEM pipeline initiative and created the Governor's STEM Council to prepare students for the STEM workforce. MCLA is the home to and serves as the lead partner for the Berkshire STEM Network. The return of the chemistry major will serve as a link with and continue to foster the growth and support of the STEM initiatives in Berkshire County by increasing the number of students who participate in programs that support STEM careers, and also to increase the number of qualified STEM teachers in Berkshire County and beyond.

The overall purpose of the proposed chemistry major at MCLA is to provide students with a working knowledge of chemistry, both factual and theoretical. Graduates will understand the composition, structure, properties and reactions of matter; be able to apply critical thinking and problem-solving to everyday challenges they will encounter in both the classroom and laboratories; and acquire synthetic skills, laboratory techniques, technical report comprehension, and facility with laboratory instrumentation and chemical safety. A chemistry major will be prepared to begin a career in industry, education or even public service. The proposed chemistry degree articulates two tracks: preparation for careers as chemists and preparation for graduate school. In conjunction with the Education Department, the proposed curriculum has been designed so that students who wish to major in chemistry and education can accomplish both goals in four years and be prepared for licensure through the Massachusetts Department of Elementary and Secondary Education.

The proposal was approved by the MCLA Board of Trustees. MCLA submitted a Letter of Intent to the Massachusetts Board of Higher Education which was circulated to the public college and university presidents and chancellors. No comments were received.

#### **NEED AND DEMAND**

According to the Life Sciences Talent Initiative (LSTI)<sup>1</sup> the demand for life sciences workers is expected to grow nearly 45% faster than for workers in the state economy as a whole; and

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<sup>1</sup> Growing Talent: Meeting the Evolving Needs of the Massachusetts Life Sciences Industry Research Findings and Recommendations from the Life Sciences Talent Initiative Commissioned by: The Massachusetts Life Sciences Center The Massachusetts Biotechnology Council Prepared by: The University of Massachusetts Donahue Institute November 2008.  
2. Preliminary Report Presented to the Massachusetts Workforce Board Association, Based on the Interim Report of the Life Science Talent Initiative, The University of Massachusetts Donahue Institute, December 17, 2007.

occupations in the life sciences cluster are expected to grow at a 1.3% annual rate between 2006 and 2014.<sup>2</sup> If one considers that most of the students at MCLA are Massachusetts state residents, the proposed chemistry major will be training a Massachusetts-based workforce for jobs in state. LSTI also reports that almost 80% of the new life science jobs in the Commonwealth will require a 4-year degree at a minimum.

Further, The *Commonwealth of Massachusetts Employment Projections 2004-2014* predicts a 10.9% growth rate in chemist positions and a 17.7% growth rate in the need for post-secondary chemistry teachers.

In October 2010, a survey response by 66 students who are currently chemistry minors, biology majors and minors, and physics majors and minors at MCLA showed a strong interest in a chemistry major. In response to the question “If a Chemistry major had been offered at MCLA when you chose a major, would you have considered enrolling. One third (33.3%) answered “definitely yes” and almost another third (31.8%) answered “probably yes.” Of the 16 respondents who are chemistry minors, 92.3% answered “definitely yes” or “probably yes” to that same question.

The availability of a chemistry major in Berkshire County is currently limited to one private institution, Williams College. MCLA is the only four-year public liberal arts college in the county and the addition of a chemistry major will, therefore, be able to meet the anticipated growing demand for this program.

## ADMISSION AND ENROLLMENT

MCLA’s admission standards are selective and decisions are made on an individual basis after careful review of all academic credentials. Freshman applicants must meet the Massachusetts Board of Higher Education admission standards and possess a high school diploma or equivalency at the time of enrollment. In order to be considered for admission, applicants must meet the minimum eligibility index (a sliding scale based on high school grade point average and SAT I or ACT test scores) and successfully complete 16 academic units as specified in the academic catalogue of the college. Meeting the minimum standards does not guarantee admission to MCLA. All freshmen applicants must submit an official copy of their high school record, including at least the first quarter senior grades. Candidates for admission to the freshman class must submit official copies of the College Board Scholastic Aptitude Tests (SAT I) or the American College Testing scores (ACTs). There would be no special requirement for admission to the Chemistry major.

### *Enrollment Projection*

	# of Students Year 1	# of Students Year 2	# of Students Year 3	# of Students Year 4*
New Full Time	5	6	6	6
Continuing Full Time	0	4	9	14
New Part Time	0	0	0	0

Continuing Part Time	0	0	0	0
Totals	5	10	15	20

## **CURRICULUM (Attachment A)**

The proposed chemistry major intends to provide students with a well-rounded education, consistent with the liberal arts mission of MCLA requiring 60 credits of math, physics and biology requirements to earn the 120-credit B.S. degree. The remaining 60 credits will comprise general education requirements and electives. The proposed program will provide a solid foundation in chemistry and will also allow students to tailor their course of study to their individual needs. For example, a major seeking an education licensure will complete the 60 credit program, and not be required to take synthetic chemistry classes. The Education students will concentrate on Education courses as electives. The Chemistry student that is going into graduate programs or industry, however, will be advised to take additional Chemistry electives.

Some students may have to complete a "Math for College" course before enrolling in the required MATH-150 (pre-calculus). MCLA's Summer College program will offer math courses as well as the introductory chemistry courses so students can stay on track.

### Chemistry Learning Outcomes:

Students graduating with a degree in Chemistry will be able to:

1. Become skilled in using chemical fundamental concepts in problem solving
2. Develop critical and analytical thinking skills.
3. Design, conduct, record, analyze and discuss the results of chemical experiments
4. Use acquired research skills to seek information related to the field of chemistry.
5. Understand and follow the rules and regulations for the safe handling of chemicals and safe conduct in the chemistry laboratory
6. Communicate experimental results and new ideas to chemists and non-chemists both orally and in writing.

Although the program is not immediately seeking American Chemical Society (ACS) accreditation, the learning objectives of the program have been designed to be consistent with the ACS Guidelines.

## RESOURCES AND BUDGET (Attachment B)

### *Faculty and Administration*

MCLA's department of Chemistry currently offers a minor in Chemistry. Since this proposal is to re-establish the chemistry major, the department already has in place many of the resources required, including two full-time tenured faculty members, administrative support for the department as well as a full time chemistry technician. It is anticipated that additional full time faculty members are not required until year three of the proposed program. However, additional part time faculty members will be hired to cover some of the courses in year one and two of the program.

The proposed Chemistry major will be housed in the Chemistry department. Any budget and scheduling decisions will be made by the department in collaboration with Academic Affairs Office.

### *Library and Facilities*

The current resources at MCLA's Freel Library will support the proposed chemistry major:

- 13,238 books that fall under the Library of Congress (LC) classification of Q -- science
- 5,350 e-books with the LC classification of Q – science
- 1,048 books with the LC classification of QD – chemistry
- More chemistry books are found in other areas, such as R (medicine) or T (technology)
- 248 e-books in our catalog with the LC classification of QD – chemistry
- over 56 databases with key databases for chemistry including: Academic Search Premier, Academic OneFile, Environment Complete, Science Online, Health Source, Medline, GreenFile

In Fall 2010 MCLA had a site designation for the new center for Science and Innovation with anticipated completion date for construction by Fall 2013. The 65,000-square-foot facility will serve as the single location for all of MCLA's science programs, and will house laboratory and research spaces, classrooms, offices, a resource library, and conference and meeting rooms. The facility will provide a state of the art facility for the chemistry major.

## PROGRAM EFFECTIVENESS

MCLA submitted the following program goals:

Goal	Measurable Objective	Strategy for Achievement	Timetable
1. To increase the number of students enrolled in the chemistry major	Obtain a total of 20 chemistry majors (all years of study) in 5 years	Promote the program through admissions and college websites, creation of brochures and working directly with Berkshire high schools	Five years from program implementation
2. To increase the number of potential science teachers in MA	Increase the number of students at MCLA in the education program that will also major in chemistry (3 students per year in Education and Chemistry) - Double major.	Same strategy as above. Promote program in EDUC department.	Five years from program implementation
3. To produce	Strive for 100% placement	Network with local and MA	

graduates that are competitive in the job market and graduate studies	for students that complete licensure and 100% employment or graduate school.	school districts. Work with MCLA's career services office and the Alumni office. Connect with biotech companies across the state for job vacancies as well as work with UMass system for graduate studies	Ongoing from program implementation
4. To implement a system for monitoring program effectiveness	System will provide usable data on student learning, and post-graduation placements/achievement.	-Surveys to graduating seniors/alumnae to track placements -Direct course-embedded measures of student learning -Program review every 7 years	2 years - Design during year preceding program enrollment, implemented during first year of program

## EXTERNAL REVIEW

The proposed chemistry major was reviewed by David P. Richardson, Professor of Chemistry, Department Chair, Department of Chemistry, Williams College; and Gordon J. Leversee, Dean School of Sciences and Social Sciences, Keene State College. Both reviewers cited many strengths of the proposal and provided overall support. Dr. Richardson stated, "The proposed major will be an excellent foundation for both a high quality liberal arts-focused bachelor's degree and as a focal point for preparing to take on advanced training to become an elementary and/or secondary school science educator." Dr. Leversee wrote, "these degree requirements will produce graduates who are highly competitive in the field in terms of work or graduate or professional training."

Dr. Richardson requested that additional information be provided about program pre-requisites and Dr. Leversee suggested that the Advanced Lab and Senior Seminar courses both provide an opportunity for assessment of key program skills and knowledge outcomes and that a small visiting team be invited to campus as soon as the program begins. MCLA fully outlined pre-requisite requirements, will incorporate program assessment approaches into the above-mentioned courses, and will invite a review team during the first year of the program.

## STAFF ANALYSIS AND RECOMMENDATION

After careful review and consideration of the proposal and all supporting documentation, staff recommendation is for approval of the Bachelor of Science in Chemistry at the Massachusetts College of Liberal Arts.

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: Undergraduate Program Curriculum Outline: MCLA Art Major

<b>Required (Core) Courses in the Major (Total # courses required = 18)</b>		
Course Number	Course Title	Credit Hours
<a href="#">CHEM 150</a> + <a href="#">Lab</a>	Introduction to Chemistry I	4
<a href="#">CHEM 152</a> + <a href="#">Lab</a>	Introduction to Chemistry II	4
<a href="#">CHEM 201</a> + <a href="#">Lab</a>	Organic Chemistry I	4
<a href="#">CHEM 202</a> + <a href="#">Lab</a>	Organic Chemistry II	4
<a href="#">CHEM 250</a>	Inorganic Chemistry	3
<a href="#">CHEM 320</a> + <a href="#">Lab</a>	Analytical Chemistry	4
<a href="#">CHEM 301</a>	Physical Chemistry I	3
<a href="#">CHEM 302</a>	Physical Chemistry II	3
<a href="#">BIOL360</a>	Biochemistry	3
<a href="#">CHEM 401</a>	Advanced Lab	3
<a href="#">CHEM 410</a>	Instrumental Methods in Chemistry	3
<a href="#">CHEM 490</a>	Chemistry Seminar	1
<a href="#">MATH 150</a>	Pre-Calculus	3
<a href="#">MATH 220</a>	Calculus I	3
<a href="#">MATH 320</a>	Calculus II	3
<a href="#">PHYS 151</a> + <a href="#">Lab</a>	Physics I	4
<a href="#">PHYS 152</a> + <a href="#">Lab</a>	Physics II	4
<a href="#">BIOL 150</a> + <a href="#">Lab</a>	Intro Biology	4
	<b>Sub Total Required Credits</b>	<b>60</b>
<b>Elective Courses (Total # courses required= 0)</b>		
CHEM 380	Drug Chemistry	3
CHEM395	Organometallics	3
CHEM 405	Modern Synthetic Chemistry	3
CHEM420	Special Topics in Chemistry	3
CHEM440	Advanced Organic Chemistry	3
CHEM495	Teaching Assistantship in Chemistry	1-3
CHEM500	Research in Chemistry	3
CHEM540	Internship in Chemistry	3-15

	<b>Sub Total Elective Credits</b>	0
<b>Distribution of General Education Requirements</b> Attach List of General Education Offerings (Course Numbers, Titles, and Credits)		# of Gen Ed Credits
Critical Reading, Thinking, Writing		3
Quantitative reasoning		3*
Computing Technology/Problem Solving		3
Language Arts		3
Creative Arts		6
Human Heritage		6
Self and Society		6
Science and Technology		7*
Capstone Experience		3
<b>*Covered under major (10 credits) under</b>	<b>Subtotal of which 10 credits are covered under</b>	40
<b>Education Credits</b>	<b>major                      General</b>	
<b>Curriculum Summary</b>		
Total number of courses required for the degree		<b>28</b>
Total credit hours required for degree		120

**Attachment B:**

**NEW ACADEMIC PROGRAM BUDGET**

<b>One Time/ Start Up Costs</b>		<b>Annual Expenses</b>			
<b>\$0.00</b>	<b>Cost Categories</b>	<b>FY12</b>	<b>FY13</b>	<b>FY14</b>	<b>FY15</b>
<b>\$0.00</b>	*Full Time Faculty (Salary) Adding one faculty member FY14	\$142,281	\$144,831	\$197,831	\$203,765
<b>\$0.00</b>	35 % Fringe	\$69,513	\$70,635	\$89,595	\$92,232
<b>\$0.00</b>	Part Time/Adjunct Faculty (Salary & Fringe)  Need 2 part time faculty	\$4,152 x 2  \$8,304	\$4,152 x 4  \$16,608		
<b>\$0.00</b>	*Staff - Chemistry technician in place	\$46,800	\$48,200	\$48,200	\$49,650
<b>\$0.00</b>	Administrative support is also in place (.25) *	\$9,530	\$9,816	\$9,816	\$10,111
<b>\$0.00</b>	General Administrative Costs Included in the College Operator Budget	\$14,500	\$14,500	\$14,900	\$15,400
<b>\$0.00</b>	Instructional Materials, Library Acquisitions	\$2,000	\$2,000	\$2,000	\$2,000
<b>\$0.00</b>	Facilities/Space/Equipment Will move into new Center for Science and Innovation by Fall 2013 (FY14)		-	-	-
<b>\$0.00</b>	Field & Clinical Resources				
<b>\$0.00</b>	Marketing cost included in general college budget	-	-	-	-
<b>\$0.00</b>	Other (Specify)				
<b>\$0.00</b>	<b>TOTALS</b>	<b>\$292,928</b>	<b>\$306,590</b>	<b>\$362,342</b>	<b>\$373,158</b>

\*-positions funded through state appropriation

Most of the expenses are in place to support the minor. With the addition of the major, MCLA will add one full time position.

<b>One Time/Start-Up Support</b>	<b>Anticipated</b>	<b>Annual Income</b>			
	<b>Revenue Sources</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>
<b>\$0.00</b>	Grants	-	-	-	-
<b>\$0.00</b>	Tuition Based on 1 in 5 Students out of state	\$14,120	\$28,240	\$42,360	\$56,480
	Fees	\$32,725	\$65,450	\$98,175	\$130,900
	Departmental	<b>\$0.00</b>			
	<b>TOTALS</b>	<b>\$ 46,845</b>	<b>\$ 93,690</b>	<b>\$140,535</b>	<b>\$ 187,380</b>