



---

**TOPIC:** University of Maryland Eastern Shore: Bachelor of Science in Biochemistry

**COMMITTEE:** Education Policy

**DATE OF COMMITTEE MEETING:** June 1, 2011

**SUMMARY:** According to Chemical & Engineering News (May 21, 2007) "*The Prognosis for Chemistry*, "[t]he U.S. is clearly number one in chemical research worldwide..." although this advantage is shrinking due to a decline in U.S. citizens earning a Ph.D., the number of U.S. publications has not increased, and federal support of research struggles to keep pace with inflation. This "... slow decline of the U.S.'s dominance of science and engineering has been underway for some time" (approximately since 1988). This proposed program seeks to provide a rigorous educational opportunity that will prepare students for careers in research, industry, and for entrance into doctoral or professional degree programs.

The Maryland Workforce Exchange (2007) reports nearly 25% of all job openings projected through the year 2014 will be in occupations requiring a bachelor of science degree or higher, and these jobs currently offer, and will continue to offer, average annual wages above the average annual wage for all occupations in the state of Maryland (\$34,796). The projected job market increase for biochemists is approximately 23%. The current average annual wage for biochemists in Maryland is \$59,653 per year. Apart from higher wages, this program will prepare students to assume leadership roles in professional activities and organizations that advance the chemical sciences. The proposed program will also provide the educational basis for other professions such as physician, pharmacist, and life scientist. Hence the bioscience and health sectors of Maryland employment, as well as the economy, will benefit from graduates of this program.

*Rising Above the Gathering Storm*, the 2006 report by the National Research Council (NRC) "...calls for the U.S. to renew the commitment to education, research, and innovation...and failing to do so could leave the U.S. children, for the first time in generations, facing poorer prospects than did their parents and grandparents." This program will prepare its students to implement the skills necessary to succeed in academic, professional, and social environments that facilitate lifelong learning.

**ALTERNATIVE(S):** The Regents may not approve the program or may request further information.

**FISCAL IMPACT:** No additional funding is necessary. The program will be supported through tuition.

**CHANCELLOR'S RECOMMENDATION:** That the Committee on Education Policy recommend that the Board of Regents approve the proposal from the University of Maryland Eastern Shore to offer the Bachelor of Science in Biochemistry.

---

COMMITTEE RECOMMENDATION: Approval. DATE: June 1, 2011

---

BOARD ACTION: DATE:

---

SUBMITTED BY: Irwin Goldstein (301) 445-1992 irv@usmd.edu

---



UNIVERSITY SYSTEM OF MARYLAND INSTITUTION PROPOSAL FOR

- New Instructional Program  
 Substantial Expansion/Major Modification  
 Cooperative Degree Program

**University of Maryland Eastern Shore**  
Institution Submitting Proposal

**Bachelor of Science Degree Program in Biochemistry**  
Title of Proposed Program

**Bachelor of Science, Biochemistry**  
Degree to be Awarded

**Fall 2011**  
Projected Implementation Date

Proposed HEGIS Code

Proposed CIP Code

**Department of Natural Sciences**  
Department in which program will be located

**Dr. Joseph M. Okoh**  
Department Contact

**410-651-6015**  
Contact Phone Number

**JMOkoh@umes.edu**  
Contact E-Mail Address

Signature of President or Designee

Date

## Mission

The proposed B.S. Program in Biochemistry (subsequently referred to as "Program") provides the educational opportunity to prepare students; especially those from underrepresented minority groups and women, for employment and ensure that University of Maryland Eastern Shore (UMES) graduates are optimally equipped to succeed in their chosen professions. Thus, the proposed program conforms to the teaching and research mission of UMES.

UMES is a teaching, research, and doctoral institution that nurtures and prepares tomorrow's leaders in a student-centered environment, particularly from among minorities and women. Committed to providing high quality programs in an ethnically diverse environment, the University prepares students who will serve and shape the global economy. UMES is committed to its mission of learning, discovery, and engagement which is consistent with valuing and promoting the scholarship of faculty, the discovery and dissemination of new knowledge, and applying that knowledge to benefit the students, faculty, and community.

While the Carnegie Foundation classifies UMES as a Masters Comprehensive University, MA 1, the University aspires to achieve a Carnegie Doctoral/Research University-Intensive and Four-Year 3 classification.

The Program will expand academic course offerings and programs in the Department of Natural Sciences (DNS) and addresses the mission of the 2004 Maryland Higher Education Commission (MHEC) state plan for postsecondary education as stated in goals 2, 3, and 5 below.

Goal 2 - Achieve a system of postsecondary education that promotes accessibility and affordability for all Marylanders.

Goal 3 - Ensure equal educational opportunity for Maryland's diverse citizenry.

Goal 5 - Promote economic growth and vitality through the advancement of research and the development of a highly qualified workforce.

Currently, the science programs are the University's distinct academic emphases. The DNS offers rigorous curricula for students majoring in Biology, Chemistry, and Environmental Science. Science majors are exposed to the breadth and depth of knowledge needed to acquire scientific literacy, interpret scientific information, and think independently and critically. Several programs for undergraduate research opportunities have been implemented: the Minority Access to Research Careers Undergraduate Student Training in Academic Research (MARCUS\*STAR) and the Minority Biomedical Research Support (MBRS) programs are uniquely structured to prepare students for entry into doctoral programs, professional degree programs, and research-oriented professions. These programs introduce undergraduate students to the relevance of research for the betterment of society.

## Characteristics of the Proposed B.S. Program in Biochemistry

### Articulated Workforce Needs

According to Chemical & Engineering News (May 21, 2007) "*The Prognosis for Chemistry*, "[t]he U.S. is clearly number one in chemical research worldwide..." although this advantage is shrinking due to a decline in U.S. citizens earning a Ph.D., the number of U.S. publications has not increased, and federal support of research struggles to keep pace with inflation. This "... slow decline of U.S.'s dominance of science and engineering has been underway for some time" (approximately since 1988). This proposed program seeks to provide a rigorous educational opportunity that will prepare students for careers in research, industry, and for entrance into doctoral or professional degree programs.

The Maryland Workforce Exchange (2007) reports nearly 25% of all job openings projected through the year 2014 will be in occupations requiring a bachelor of science degree or higher, and these jobs currently offer, and will continue to offer, average annual wages above the average annual wage for all occupations in the state of Maryland (\$34,796). The projected job market increase for biochemists is approximately 23%. The current average annual wage for biochemists in Maryland is \$59,653.00 per year: this is well above the annual wage for jobs in Maryland. Apart from higher wages, this program will prepare students to assume a leadership role in professional activities and organizations that advance the

chemical sciences. The Program will also provide the educational basis for other professions such as physician, pharmacist, and life scientist. Hence the bioscience and health sectors of Maryland employment, as well as the economy, will benefit from graduates of this program.

*Rising Above the Gathering Storm*, the 2006 report by the National Research Council (NRC) "...calls for the U.S. to renew the commitment to education, research, and innovation...and failing to do so could leave the U.S. children, for the first time in generations, facing poorer prospects than did their parents and grandparents." This program will prepare its students to implement the skills necessary to succeed in academic, professional, and social environments that facilitate lifelong learning.

### **Admissions and Enrollment**

Applicants must meet the general requirements for undergraduate admission as outlined by UMES. Perspective students should have a total minimum score of 1250 on the "New" SAT or 850 on the "Old" SAT accompanied by a 2.5 grade point average. It is estimated that 10 full-time students will enroll in the Program during the first year of its offering. Enrollment will increase slowly through year five to reach the projected goal of 35 students entering into the program each academic year.

### **General Requirements of the Program**

Students will be assigned an advisor according to their major of study. The advisor and the student will develop a course of study in accordance to the University's requirements. The total number of required course credit hours will be 120 hours. Students must earn at least the grade of C for courses to be transferred and the transferable credit hours must be approved by UMES.

Students will be required to successfully complete at least 120 credit hours for the Program in the following areas: nine credits of Curriculum Area I Arts and Humanities, six credits of Curriculum Area II Social and Behavioral Sciences, eight credits of Curriculum Area III Biological and Physical Sciences, seven credits of Curriculum Area IV Mathematics, nine credits of Curriculum Area V English Composition, four credits of Curriculum Area VI Emerging Issues, 48 credits of Program Core Courses, 19 credits of Supportive Course Requirements, and seven/eight credits of program electives, and three/four credits of free electives. A sample curriculum is provided below.

A grade of C or better must be earned in the Program Core and Program Elective Courses to receive credit toward graduation. No grade of D or below will be accepted for credit in the Program. Students are expected to maintain a 2.0 GPA. A student learning outcome assessment examination will be administered during the spring semester of the students' senior year; a grade of C or higher will be required for graduation.

### **Required and Recommended courses for the B.S., Biochemistry Program**

#### **I. General Education Requirements**

##### **A. Curriculum Area I - Arts and Humanities (9 Credits)**

Students must select ENGL 203 plus two additional courses

ARTS: ARTS 101, ARTS 301, MUSI 100, MUSI101, MUSI109

HISTORY: HIST 201, HIST 202, HIST 333, HIST 334, HIST 341, HIST 360

LANGUAGE: FREN 101, FREN 102, SPAN 101, SPAN 102

LITERATURE: ENGL 204, ENGL 205, ENGL 206, ENGL 207, ENGL 215, ENGL 218, ENGL 327, ENGL 328, ENGL 329, ENGL 401

- Foreign language recommended

##### **B. Curriculum Area II - Social and Behavioral Sciences (6 Credits)**

Students must select one course in each of the two disciplines

SOCIAL SCIENCES: AGECE 213 or AGECE 213H, ECON 201 or ECON 201H, ECON 202 or ECON 202H, GEOG 201 or GEOG 202, HIST 101 or HIST 111H, HIST 102 or HIST 112H, POLI 200 or POLI 200H, POLI 342, SOCI 101 or SOCI 111H

BEHAVIORAL SCIENCES: CRJS 101, HUEC 203, HUEDC 220, HUEC 361, PSYC 200, SOCI 201, SOWK 200 or SOWK 200H

##### **C. Curriculum Area III - Biological and Physical Sciences (8 Credits)**

|                        |               |
|------------------------|---------------|
| General Physics I      | PHYS 121/181H |
| General Physics I Lab  | PHYS 123/183H |
| General Physics II     | PHYS 122/182H |
| General Physics II Lab | PHYS 124/184H |

- Calculus based physics recommended

#### D. Curriculum Area IV - Mathematics (7 Credits)

|                                      |          |
|--------------------------------------|----------|
| Trigonometry and Analytical Geometry | MATH 110 |
| Calculus I                           | MATH 112 |

#### E. Curriculum Area V - English Composition (9 Credits)

|                      |               |
|----------------------|---------------|
| Basic Composition I  | ENGL 101/101H |
| Basic Composition II | ENGL 102/102H |
| Technical Writing    | ENGL 305/W    |
| Advanced Composition | ENGL 310/W    |

#### F. Curriculum Area VI - Emerging Issues (4 Credits)

|                                |          |
|--------------------------------|----------|
| First Year Freshman Experience | DNSC 100 |
| Health and Wellness            | EDHE 111 |

### II. Program Core Courses (48 Credits)

|  |                   |
|--|-------------------|
| Principles of General Chemistry I        | CHEM 111          |
| Principles of General Chemistry I Lab    | CHEM 113          |
| Principles of General Chemistry II       | CHEM 112          |
| Principles of General Chemistry II Lab   | CHEM 114          |
| Principles of Biology I                  | BIOL 111          |
| Principles of Biology I Lab              | BIOL 113          |
| Fundamentals of Organic Chemistry I      | CHEM 211          |
| Fundamentals of Organic Chemistry I Lab  | CHEM 213          |
| Fundamentals of Organic Chemistry II     | CHEM 212          |
| Fundamentals of Organic Chemistry II Lab | CHEM 214          |
| Genetics                                 | BIOL 222          |
| Genetics Lab                             | BIOL 223          |
| Analytical Chemistry I                   | CHEM 311          |
| Biochemistry I                           | CHEM 341          |
| Biochemistry I Lab                       | CHEM 343          |
| Biochemistry II                          | CHEM 342          |
| Biochemistry II Lab                      | CHEM 344          |
| Physical Chemistry                       | CHEM 401          |
| Chemistry/Biology Seminar                | CHEM 497/BIOL 497 |
| Undergraduate Research                   | CHEM 499/BIOL 499 |
| **Intermediary Metabolism - 4 cr.        | CHEM 431          |

### III. Supportive Course Requirements (19 Credits)

|                                      |                   |
|--------------------------------------|-------------------|
| Introduction to Computer Programming | CSDP 220          |
| Instrumental Analysis                | CHEM 421          |
| Microbiology                         | BIOL 301          |
| Microbiology Lab                     | BIOL 303          |
| Cell Biology                         | BIOL 326          |
| Cell Biology Lab                     | BIOL 327          |
| Independent Study                    | CHEM 498/BIOL 498 |

\*CSDP 220 may be substituted with either CSDP 121 or BUED 212, 3 credits each and make up 1 credit elsewhere.

### IV. Program Electives (7/8 Credits: Two courses must be selected; one must have a laboratory component)

|                       |           |
|-----------------------|-----------|
| General Endocrinology | BIOL 436  |
| Biotechnology         | BIOL 426M |

|  |           |
|--|-----------|
| Bio-Inorganic Chemistry                  | CHEM 422M |
| Advanced Organic                         | CHEM 432  |
| Advanced Biochemistry                    | CHEM 670  |
| Analytical Chemistry II                  | CHEM 312  |
| **Protein Structure and Function - 3 cr. | CHEM 433  |
| **Immunology - 4 cr.                     | CHEM 435  |

\*\* Indicates courses that will be developed.

#### V. Free Electives (3/4 Credits)

#### Program and Support Faculty

The undergraduate faculty members are responsible for establishing an atmosphere that is conducive to learning. Most undergraduate faculty members possess a terminal degree that is representative of one of the traditional areas in chemistry.

| Faculty               | Rank                | Area of Expertise              |
|-----------------------|---------------------|--------------------------------|
| Dr. Joseph Okoh       | Professor           | Inorganic chemistry            |
| Dr. Kelly Mack        | Professor           | Endocrinology                  |
| Dr. Anthony Nyame     | Professor           | Biochemistry, Glycobiology     |
| Dr. Gurbax Singh      | Professor           | Physics: Spectroscopy, Nuclear |
| Dr. Yan Waguespack    | Professor           | Physical Chemistry             |
| Dr. Linda Johnson     | Associate Professor | Embryology                     |
| Dr. Jennifer Hearne   | Assistant Professor | Biochemistry, Enzymology       |
| Dr. Ghislain Mandouma | Assistant Professor | Organic Chemistry              |
| Dr. Joseph Pitula     | Assistant Professor | Molecular and Cellular Biology |
| Dr. Uche Udeochu      | Assistant Professor | Analytical Chemistry           |
| Dr. Joseph Doodoo     | Lecturer            | Physics: Kinetics              |
| Dr. Mobolaji Okulate  | Lecturer            | Zoology                        |
| Ms. Amelia Potter     | Lecturer            | General Chemistry              |
| Dr. Jeurel Singleton  | Lecturer            | Parasitology, embryology       |
| Dr. Jack Pinion       | Adjunct             | Organic chemistry              |
| Dr. Marcos Cheney     | Associate Professor | Surface Chemistry              |

The DNS maintains several modern research facilities and various types of instrumentation. The facilities are housed in Trigg Hall, George Washington Carver Hall, and Richard Hazel Hall. Instrumentation in these facilities includes: Gas Chromatograph Mass Spectrometer, Nuclear Magnetic Resonance Spectrophotometer, Ion Chromatograph, Inductively Coupled Plasma Mass Spectrometer, High Pressure Liquid Chromatograph with Diode Array and Fluorescence Detection, Solution Phase Synthesizer, Electrophoresis Equipment, Microtiter Plate Reader with Fluorescence Detector, DNA Analyzer, Thermogravimetric Analyzer, Laser Zee Meter, Differential Thermal Analyzer, Porosimeter, Fluorimeter, Infrared Spectrometer, UV-VIS Spectrophotometer, Atomic Absorption Spectrophotometer, X-Ray Diffractometer, Toxicity Analyzer, Scintillation Counter, Microarray Scanner, Scanning Electron Microscope, Matrix-Assisted Laser Desorption/Ionization Spectrometer, and Fluorescence-Activated Cell Sorter. The president assures that the institutional facilities meet the new program needs.

Students in the Program will be required to learn and become competent in programs commonly used in science such as Excel to process scientific data, SigmaPlot to produce graphs and develop calibration models, Microsoft PowerPoint for the development of quality presentations, Microsoft Publisher to create poster presentations, CHEMDRAW for the creation of molecular structures, and Microsoft Word in the preparation of manuscripts. Student must also be proficient in performing literature searches online using various databases and current computer programming languages. The president assures that the institutional library resources meet the new program goals.

#### Finances and Resources

It is anticipated that 10 students will enroll in the proposed program in its first year of existence. The

enrollment is predicted to increase by five students each year. Full-tuition and mandatory fees per academic year for an in-state, undergraduate student are \$5,808 and \$11,964 for an out-of-state undergraduate student. The current student population is approximately 70% in-state students.

Lab fees are assessed at \$25 per student per laboratory class, as each biochemistry major will take a minimum of 18 laboratory classes on the basis of their curriculum. It is not anticipated that funds will be needed or will need to be reallocated, with the exception of the laboratory fees. No new full-time equivalent faculty members, administrative staff, or support for present administrative staff is requested.

External funds in the amount of \$50,000/Year will be available through grants awarded to chemistry professors.



**TABLE 1: RESOURCES**

| Resources Categories                              | (Year 1)   | (Year 2)   | (Year 3)   | (Year 4)   | (Year 5)   |
|---|------------|------------|------------|------------|------------|
| 1. Reallocated Funds <sup>1</sup> (4.)            | 0          | 0          | 0          | 0          | 0          |
| 2. Tuition/Fee Revenue <sup>2</sup>               | \$76,548   | \$194,448  | \$347,544  | \$541,992  | \$736,440  |
| a. #F.T Students                                  | 10(10 new) | 25(15 new) | 45(20 new) | 70(25 new) | 95(35 new) |
| R=MD Resident                                     | R=7        | R=17       | R=31       | R=48       | R=65       |
| NR=Non-Resident of MD                             | NR=3       | NR=8       | NR=14      | NR=22      | NR=30      |
| b. Annual Tuition/Fee Rate                        |            |            |            |            |            |
| R=\$5,808/AY                                      | \$40,656   | \$98,736   | \$180,048  | \$278,784  | \$377,520  |
| NR=\$11,964/AY                                    | \$35,892   | \$95,712   | \$167,496  | \$263,208  | \$358,920  |
| c. Annual Full Time Revenue                       | \$76,548   | \$194,448  | \$347,544  | \$541,992  | \$736,440  |
| d. # Part Time Students                           | 0          | 0          | 0          | 0          | 0          |
| e. Credit Hour Rate                               | \$0        | \$0        | \$0        | \$0        | \$0        |
| f. Annual Credit Hours                            | 0          | 0          | 0          | 0          | 0          |
| g. Total Part Time Revenue                        | \$0        | \$0        | \$0        | \$0        | \$0        |
| 3. Grants, Contracts, &<br>Other External Sources | \$50,000   | \$50,000   | \$50,000   | \$50,000   | \$50,000   |
| 4. Other Sources: Lab Fees <sup>1</sup>           | \$750      | \$2,125    | \$4,500    | \$8,000    | \$10,000   |
| <b>TOTAL (Add 1 - 4)</b>                          | \$127,298  | \$246,573  | \$402,044  | \$599,992  | \$796,440  |

**TABLE 2: EXPENDITURES**

| Expenditure Categories                         | (Year 1) | (Year 2) | (Year 3) | (Year 4) | (Year 5) |
|--|----------|----------|----------|----------|----------|
| 1. Total Faculty Expenses (b + c)              | 0        | 0        | 0        | 0        | 0        |
| a. # FTE                                       | 0        | 0        | 0        | 0        | 0        |
| b. Total Salary                                | 0        | 0        | 0        | 0        | 0        |
| c. Total Benefits                              | 0        | 0        | 0        | 0        | 0        |
| 2. Total Administrative Staff Expenses (b + c) | 0        | 0        | 0        | 0        | 0        |
| a. # FTE                                       | 0        | 0        | 0        | 0        | 0        |
| b. Total Salary                                | 0        | 0        | 0        | 0        | 0        |
| c. Total Benefits                              | 0        | 0        | 0        | 0        | 0        |
| 3. Total Support Staff Expenses (b + c)        | 0        | 0        | 0        | 0        | 0        |
| a. # FTE                                       | 0        | 0        | 0        | 0        | 0        |
| b. Total Salary                                | 0        | 0        | 0        | 0        | 0        |
| c. Total Benefits                              | 0        | 0        | 0        | 0        | 0        |
| 4. Equipment                                   | 0        | 0        | 0        | 0        | 0        |
| 5. Library                                     | 0        | 0        | 0        | 0        | 0        |
| 6. New or Renovated Space                      | 0        | 0        | 0        | 0        | 0        |
| 7. Other Expenses                              | 0        | 0        | 0        | 0        | 0        |
| TOTAL (Add 1 - 7)                              | 0        | 0        | 0        | 0        | 0        |

