June 3, 2013

MEMORANDUM

TO: Jayanth Banavar  
Dean, College of Computer, Mathematical and Natural Sciences

FROM: Elizabeth Beise  
Associate Provost for Academic Planning and Programs

SUBJECT: Proposal to Modify the Curriculum of the Bachelor of Science in Biochemistry  
(PCC log no. 12050)

At its meeting on April 5, 2013, the Senate Committee on Programs, Curricula, and Courses approved your proposal to modify the curriculum of the Bachelor of Science in Biochemistry. A copy of the approved proposal is attached.

The change is effective Fall 2013. Please ensure that the change is fully described in the Undergraduate Catalog and in all relevant descriptive materials, including the program's four-year plan (contact Lisa Kiely at lkiely@umd.edu for more information), and that all advisors are informed.

MDC/

Enclosure

cc: William Idsardi, Chair, Senate PCC Committee  
Sarah Bauder, Office of Student Financial Aid  
Reka Montfort, University Senate  
Erin Howard, Division of Information Technology  
Pam Phillips, Institutional Research, Planning & Assessment  
Anne Turkos, University Archives  
Linda Yokoi, Office of the Registrar  
Robert Gaines, Undergraduate Studies  
Robert Infantino, College of Computer, Mathematical and Natural Sciences  
Michael Doyle, Chemistry & Biochemistry
THE UNIVERSITY OF MARYLAND, COLLEGE PARK
PROGRAM/CURRICULUM/UNIT PROPOSAL

Please email the rest of the proposal as an MSWord attachment to pcc-submissions@umd.edu.

Please submit the signed form to the Office of the Associate Provost for Academic Planning and Programs, 1119 Main Administration Building, Campus.

College/School:
Please also add College/School Unit Code-First 8 digits: 01203030
Unit Codes can be found at: https://hypprod.umd.edu/Html_Reports/units.htm

Department/Program:
Please also add Department/Program Unit Code-Last 7 digits: 1360701

Type of Action (choose one):

x Curriculum change (including informal specializations)
Renaming of program or formal Area of Concentration
Addition/deletion of formal Area of Concentration
Suspend/delete program

New academic degree/award program
New Professional Studies award iteration
New Minor
X Other Change Course Description
Italics indicate that the proposed program action must be presented to the full University Senate for consideration.

Summary of Proposed Action:
Change the requirements for BS in Biochemistry

Current requirement of Chem 147 or Chem 132 (1 credit introductory laboratory courses) will be eliminated and replaced with a requirement for Chem 177 (new 2 credit lab and seminar course).

(See attached description).

====================================================================================
Use additional lines for multi-unit programs.

APPROVAL SIGNATURES - Please print name, sign, and date. Use additional lines for multi-unit programs.

1. Department Committee Chair
   [Signature]       [Signature]       [Date]

2. Department Chair
   [Signature]       [Date]

3. College/School PCC Chair
   [Signature]       [Date]

4. Dean
   [Signature]       [Date]

5. Dean of the Graduate School (if required)
   [Signature]       [Date]

6. Chair, Senate PCC
   [Signature]       [Date]

7. University Senate Chair (if required)
   [Signature]       [Date]

8. Senior Vice President and Provost
   [Signature]       [Date]
A. Summary.

The Department of Chemistry and Biochemistry proposes to change current major requirements involving introductory laboratory courses. Specifically, Chemistry 147, Principles of Chemistry Laboratory (1 credit 4h lab), would be replaced by a new combined seminar/laboratory course, Chemistry 177, Introduction to Laboratory Practices and Research in the Chemical Sciences (2 credits 4h lab + 1 hr lecture). The new course will provide additional/enhanced instruction on issues relevant to those students interested in pursuing careers and advanced studies in chemistry, biochemistry and related areas. These issues include current research trends, laboratory safety, research ethics, the use of modern databases in research, and an overview of possible career paths. The proposed change would only pertain to students who major in chemistry and biochemistry (ca. 70-90/year). Students in other majors, such as biological sciences or engineering, would not be affected by this change.

B. Description of the Proposed Course.

A sample schedule with associated lecture and lab content for CHEM 177 is attached as Appendix A.

This 2-credit course will consist of a one-hour lecture given each week and a four-hour lab-to-follow it. The objective of the course design is to introduce Chemistry and Biochemistry majors to laboratory practices and techniques, to learn how these methods are applied to modern research problems, and to inculcate a culture of safety in the laboratory.

The laboratory portion will cover the themes currently addressed in CHEM 147. However the new course will have students initially gaining practical, hands-on experience with basic techniques in preliminary exercises. Then, in subsequent exercises, they will apply those fundamental skills to solve some question which can be answered from data gathered using them. [What does this mean?]

The lecture/seminar (see Appendix A for a schedule of topics) will present theory behind the experimental exercises, seminars in ethics, safety, and chemical informatics, as well as research seminars given by a select group of faculty committed to undergraduate education [and research?]. Students will receive an early introduction to the breadth of current research areas in the chemical and biochemical sciences.
C. How the Proposed Change Would Affect the Curriculum in Chemistry and Biochemistry

The following specific changes are proposed.

(1) Courses for which Chem 177 would serve as a prerequisite:

a. Current:

**CHEM231 Organic Chemistry I; (3 credits)** Grade Method: REG/P-F/AUD. 
Prerequisite: CHEM131 and CHEM132; or (CHEM135 and CHEM136); or (CHEM146 and CHEM147). And A grade of C- or better in the prerequisites is required of College of Computer, Mathematical, and Natural Sciences majors and recommended for all students.

**CHEM237 Principles of Organic Chemistry I; (4 credits)** Grade Method: REG/P-F/AUD. 
Prerequisite: Minimum grade of C- in CHEM131 and CHEM132; or minimum grade of C- in CHEM146 and CHEM147; or permission of CMNS-Chemistry & Biochemistry department. 
Restriction: Must be in one of the following programs (Chemistry; Biochemistry) ; or must be in a major in ENGR-A. James Clark School of Engineering.

b. Proposed

**CHEM231 Organic Chemistry I; (3 credits)** Grade Method: REG/P-F/AUD. 
Prerequisite: Minimum grade of C- in CHEM131 and CHEM132; or minimum grade of C- in CHEM146 and CHEM177; or minimum grade of C- in CHEM131 and CHEM177 or permission of CMNS-Chemistry & Biochemistry department. 

**CHEM237 Principles of Organic Chemistry I; (4 credits)** Grade Method: REG/P-F/AUD. 
Prerequisite: Minimum grade of C- in CHEM131 and CHEM132; or minimum grade of C- in CHEM146 and CHEM177; or minimum grade of C- in CHEM131 and CHEM177 or permission of CMNS-Chemistry & Biochemistry department. Restriction: Must be in one of the following programs (Chemistry; Biochemistry) ; or must be in a major in ENGR-A. James Clark School of Engineering.

(2) Students with Chemistry Advanced Placement (AP) Credit.

Under current policies, students with AP scores of 4 or higher are given credit for Chem 131/132. Under our proposal an AP score of 4 would still provide credit for Chem 131/132 but not for CHEM 177. This new lab course would be required for all Chemistry and Biochemistry majors, regardless of advanced placement.

(3) Students who transfer into the Chemistry or Biochemistry Major.

There will likely be a small number of students who transfer into the Chemistry or Biochemistry majors, from other majors on campus or from community colleges, who will have completed the non-majors first semester courses (CHEM 131/132 or their
equivalents). These students will be given the option of taking CHEM 177 or else continuing in the CHEM sequence but taking an additional upper-level elective in CHEM or BCHM.

Table 1. Current Introductory Sequence for Required Introductory Courses for Chemistry and Biochemistry Majors

<table>
<thead>
<tr>
<th>Semester</th>
<th>Students with no Chemistry AP Credit</th>
<th>Students with Chemistry AP Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CHEM 146 (3) CHEM 147 (1) MATH 140 (4) OTHER (8) Total 16</td>
<td>CHEM 231 (3) CHEM 232 (1) MATH 140 (4) OTHER (8) Total 16</td>
</tr>
<tr>
<td></td>
<td>CHEM 237 (4) MATH 141 (4) BSCI 105 (4) OTHER (3) Total 15</td>
<td>CHEM 241 (3) CHEM 242 (1) MATH 141 (4) BSCI 105 (4) OTHER (3) Total 15</td>
</tr>
<tr>
<td></td>
<td>CHEM 247 (4) PHYS 141 (4) OTHER (6) Total 14</td>
<td>CHEM 276 (2) CHEM 277 (3) PHYS 141 (4) OTHER (5) Total 14</td>
</tr>
<tr>
<td></td>
<td>CHEM 276 (2) CHEM 277 (3) PHYS 142 (4) OTHER (7) Total 16</td>
<td>PHYS 142 (4) OTHER (12) Total 16</td>
</tr>
</tbody>
</table>

Table 2. Proposed Introductory Sequence for Required Courses for Chemistry and Biochemistry Majors

<table>
<thead>
<tr>
<th>Semester</th>
<th>Students with no Chemistry AP Credit</th>
<th>Students with Chemistry AP Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CHEM 146 (3) CHEM 177 (2) MATH 140 (4)</td>
<td>CHEM 177 (2) MATH 140 (4) OTHER (8)</td>
</tr>
</tbody>
</table>
C. Benefits to Adopting the Proposed Course.

1. Many of our peer institutions (Michigan, UNC Chapel Hill, UC Berkeley) offer a class to first year chemistry majors that introduces them to concepts vital to the training of researchers in the chemical sciences: scientific ethics, modern database usage, as well as an introduction to scientific research provided by departmental faculty. The absence of such content is a shortcoming in our current curriculum.

2. Laboratory safety, including the safe handling and disposal of potentially hazardous materials, is a topic of increasing concern nationally. For example, a report from the American Chemical Society "Creating Safety Cultures in Academic Institutions" states that "Every chemist needs an in-depth knowledge of laboratory and chemical safety. He or she should acquire this safety knowledge and education continually through years of educational process." (http://tinyurl.com/d9mfjf6). The increased focus on laboratory safety in our own department is reflected in the department’s recently adopted LOA’s, which call for higher standards in student understanding of laboratory safety. An important objective of this course redesign is to emphasize the "culture of safety" by providing instruction early in the curriculum.

3. The Department of Chemistry and Biochemistry offers a series of majors-only classes consisting of the first four terms of chemistry study. These are small classes, taught by outstanding faculty, and contain a specialized laboratory experience which is more in
depth than those in the non-majors classes. Unfortunately, under the current system a substantial fraction of Chemistry and Biochemistry majors do not participate in this majors-only sequence. This is because those students who score a 4 or 5 on the Chemistry AP exam receive academic credit for General Chemistry I and its associated laboratory, putting them one semester ahead of the normal sequence. (See Table 1.) Because the majors-only courses are only taught “on sequence” (the first term of study is offered only in the fall, the second only in the spring, and so on), students with AP credit who start taking chemistry classes in their first semester tend not to take the majors-only courses, and they are separated from their peer group.

4. While students with chemistry AP credit who go directly into organic chemistry (CHEM 231/232) usually do well in the lecture part of the class, they are less well prepared for the laboratory material. Anecdotal evidence, provided by local high school teachers who take part in annual outreach programs offered by the Department (REACTS and CHEMATHON) supports the contention that the laboratory experience received by chemistry Advanced Placement students is highly variable across the state and across the country.

D. Costs Associated with the New Course.

All of the research faculty who were asked (>10) enthusiastically agreed to provide seminars and/or presentations in support of the lecture component of the course, above and beyond their current teaching duties. This should not be onerous given the small number of additional lectures to be provided by a large number of faculty. The current laboratory instructor for Chem 147 will take responsibility for coordinating and scheduling these presentations as well as providing the lectures associated with the laboratory experiments. Thus the new course would not reduce our ability to staff current courses.

The effects of adding a requirement for CHEM177 to the curriculum would be to (a) shift ca. 50 students/year from CHEM147 into the new course and (b) require students who currently use AP credit in place of the first semester laboratory course (ca. 50) to now take an additional semester of lab in the Fall Semester. The Department currently has ca. 3000 students taking introductory lab courses each Fall Semester. Thus, the projected increase, while not negligible, is small relative to the size of the program.
<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture</th>
<th>Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(9/3-6) Course Design and Structure, Policies (lab coordinator)</td>
<td>Accuracy and Precision in Measurement Determining Density</td>
</tr>
<tr>
<td>2</td>
<td>(9/9-13) Safety (lab coordinator)</td>
<td>Physical and Chemical Methods of Separation to Analyze Three Component Mixture of Solutes</td>
</tr>
<tr>
<td>3</td>
<td>(9/16-20) Expt Review: Expts 3-6 (lab coordinator)</td>
<td>Introduction to Reaction Stoichiometry: Synthesis of Nickel-Ethylenediamine Coordination Complexes</td>
</tr>
<tr>
<td>4</td>
<td>(9/23-27) Research I</td>
<td>Intro to Titration: Complexation to determine empirical formula of zinc chloride; Standardization of NaOH titrant</td>
</tr>
<tr>
<td>5</td>
<td>(9/30-10/4) Library Skills I (Svetla Baykoucheva)</td>
<td>Ions and Color: Visible Absorption Spectra; Stock Solution Prep; Serial Dilution; Beer’s Law; Standard Curve Prep</td>
</tr>
<tr>
<td>6</td>
<td>(10/7-11) Research II</td>
<td>Analysis of Coordination Complex: Acid Titration of ethylene-diamine content; Colorimetric analysis of Ni Content</td>
</tr>
<tr>
<td>8</td>
<td>(10/21-25) Mid-term Exam</td>
<td>Solutions: Polarity, Solubility, Conductivity; Determination of Solution Concentration</td>
</tr>
<tr>
<td>9</td>
<td>(10/28-11/1) Ethics (DeShong)</td>
<td>Oxidation/Reduction Rxns: Relative reactivity of Metals and Halogens/Halide Ions</td>
</tr>
<tr>
<td>12</td>
<td>(11/18-22) Research IV</td>
<td>Equilibrium: LeChatelier’s Principle and Check-out</td>
</tr>
<tr>
<td>13</td>
<td>(11/25-29) Undergraduate Research (Montague-Smith)</td>
<td>(if lecture is on M, Tu, or W) Thanksgiving Week: No Lab</td>
</tr>
<tr>
<td>14</td>
<td>(12/2-6) Library II</td>
<td>Lab Practical Exam</td>
</tr>
<tr>
<td>15</td>
<td>(12/9-11) Research V</td>
<td>(None if lab meets on Th, F)</td>
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