Department of Biomedical Sciences

Proposed Revision to the Masters Program

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Proposal: The Department of Biomedical Sciences proposes to increase the number of required course credits for the Masters program from a maximum of 15 to a maximum of 17. This change is requested because we have also proposed that the BMS 590 Lab Rotations course be increased from 1 credit to 3 credits (see below), as part of proposed curriculum changes for the Biomedical Sciences Doctoral program. A total of 22 course credits (15 required & 7 elective) are currently required for the Masters program, in addition to a minimum of 14 credits of Master’s thesis research (BMS 699), and this total number will not change under this proposal. We also propose to eliminate the requirement for either BMS504b – Molecular Biology and Genetics or BMS 500b – Biochemistry, since these courses have been eliminated from the Doctoral program. These credits will be replaced by electives. Overall there will be a net increase of 1 credit in the number of electives and the total required course credits will not change.

We have already submitted a course action proposal to change BMS 590 Laboratory Rotations from a 1 credit course to a 3 credit course (Appendix I), based on substantive changes in the learning objectives and course design. The lab rotations have been shortened from semester long rotations to 7 weeks, with two mandatory 7-week rotations completed in the first semester of the Ph.D. program. Each of the mandatory rotations requires 10 hours of mentored laboratory research per week for a total of 140 hours per semester. In addition, students are expected to attend 12 one-hour meetings with the course director. This meeting introduces students to prospective mentors and monitors their progress in the rotations, from design of the rotation projects to written and oral presentation of their results. Because ~150 hours of student participation is required, it is appropriate to increase the number of credits for BMS 590 to 3, based on SUNY’s policy of assigning 1 credit for every 3 hours per week in a laboratory course. The proposed changes in BMS 590 also reflect a change in the major learning objective from one of teaching the students techniques to one of exposing students to different scientific approaches so that they can make an informed choice about their research specialty.

A change in the PhD Program requirements has been approved (Appendix II) and eliminates two 3-credit courses (BMS 504b – Molecular and Cell Biology and BMS 500b – Biochemistry), one of which was previously required of students in the Masters Degree program. Since neither of these courses will be taught in the future, we propose to replace this requirement with elective courses. The PhD program has also been changed to replace BMS 504a – Comprehensive Biochemistry with
BMS 502 – Macromolecular Structure and Function. We are proposing to make this change in the Masters program as well.

With these revisions in **BMS 590**, the required courses for the Masters program will be:

1) BMS 500: Molecular Biology (4 credits)
2) BMS 502: Macromolecular Structure and Function (4 credits)
3) **BMS 590:** Lab Rotations (3 credits) – previously 1 credit
4) BMS 601: Introduction to Biomedical Sciences (3 credits)
5) BMS 665: Journal Club (participation begins in spring semester; must be taken every semester thereafter for 0 or 1 credit; can be taken for credit a maximum of 2 times)
6) BMS 670: Responsible Conduct of Scientific Research (1 credit)

**Required course credits:** maximum of 17 credits (decrease of 1 credit)
**Elective course credits:** minimum of 5 credits (increase of 1 credit)
**Total course credits (required and elective):** 22 course credits minimum (unchanged)
**Research credits required:** minimum of 14 credits (unchanged)
**Total course and research credits:** 36 credits minimum (unchanged)

### Summary of current and proposed course requirements for the Masters program:

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Current</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) BMS 500: Molecular Biology</td>
<td>4 credits</td>
<td>4 credits (no change)</td>
</tr>
<tr>
<td>2) BMS 502: Macromolecular Structure &amp; Function</td>
<td>-</td>
<td>4 credits (new course)</td>
</tr>
<tr>
<td><strong>vs.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) BMS 504a: Comprehensive Biochemistry</td>
<td>4 credits</td>
<td>- (old course)</td>
</tr>
<tr>
<td>3) BMS 590: Lab Rotations</td>
<td>1 credit</td>
<td>3 credits (increase of 2)</td>
</tr>
<tr>
<td>4) BMS 601: Introduction to Biomedical Sciences</td>
<td>3 credits</td>
<td>3 credits (no change)</td>
</tr>
<tr>
<td>5) BMS 665: Journal Club</td>
<td>maximum of 2 credits</td>
<td>2 credits (no change)</td>
</tr>
<tr>
<td>6) BMS 670: Responsible Conduct of Scientific Research</td>
<td>1 credit</td>
<td>1 credit (no change)</td>
</tr>
<tr>
<td>7) BMS 500b: OR BMS 504b: Molecular Genetics vs. Biochemistry</td>
<td>3 credits</td>
<td>- (eliminated)</td>
</tr>
</tbody>
</table>

**Required:**
- maximum of 18 credits 17 credits (decrease of 1)

**Electives:**
- minimum of 4 credits 5 credits (increase of 1)

**Total course credits**
- minimum of 22 credits 22 credits (no change)

**Research credits**
- minimum of 14 credits 14 credits (no change)

**Total research and course credits**
- minimum of 36 credits 36 credits (no change)
APPENDIX I

COURSE ACTION PROPOSAL FORM
University at Albany, State University of New York
School of Public Health

Proposal #

_____ New Course

Revision of:

_____ Number

_____ Title

_____ Description

_____ Mode of Course delivery (e.g., distance learning)

_____ Credits

_____ Grading System

_____ Prerequisites

Estimated enrollment for this course (best guess): 8-10

Department  Biomedical Sciences

Course Title  Laboratory Rotations in Biomedical Sciences

Course#  New  Old  590

Credits: 3

Prerequisites  Permission of Course Director

Has this course been taught previously?  X  yes  no

If yes, give title and course number:  X  BMS 590a,b,c Laboratory Rotations in Biomedical Sciences

If yes, how many times has it been taught?  more than 40

Course description to appear in catalog: (Please do not exceed 50 words)

Introduction to different aspects of biomedical research ongoing in the department; introducing students to various faculty members and a variety of experimental methodologies and research approaches. Prerequisite: Permission of course director.

Justification of Proposal: For justification, please address in detail the reasons for offering this new course or the course revision. These reasons should address one or more of the following: curriculum enhancement, new program or concentration development, new student recruitment (esp. for distance learning courses), target audience(s) for course, and “other justification”. Please be as specific as possible in describing the overriding justification for offering this course.

BMS 590 Lab Rotations is a required 1-credit course for all students in the MS and PhD programs, and is typically taken in the first semester. The current requirements of the course are two laboratory rotations of 7 weeks, each under different research advisors, plus attendance of 12 1-hour mandatory meetings with the course director to monitor the student’s progress. The students are expected to spend a minimum of 10 hours per week performing research in the laboratory in which they are rotating. Therefore, the total requirements are approximately 160 hours of student participation for one credit. The current set of expectations was developed by the faculty last year and instituted this fall. However, this level of participation for a one credit hour course is not consistent with the University’s policy of assigning one credit per semester for every three course-hours per week in a laboratory course. Therefore, it is now appropriate to increase the number of credits for BMS590 to three, which accurately reflects the required level of student effort in the course.

This change will benefit the students in two important ways. First of all, students who are funded on training grants are sometimes required to carry 12 credits each semester, but our first semester curriculum is currently only 10 credits, so students are forced to take on an additional course above what is already a very challenging course load. This change would bring our first semester course load to 12 credits. Second, more and more students are being funded off of individual grants because of the lack of available funding for graduate assistantships. However, the PIs of these grants are having difficulty justifying the funding of a first year student to work in another lab because the student is not receiving course credits for this level of effort. Therefore, this change will make it easier to accommodate a variety of funding sources for incoming graduate students.

Attach course syllabus to this form. (All proposals must contain a complete or nearly complete syllabus (including listing the learning objectives). Otherwise, they will be returned unreviewed to the department and instructor)

Course presented for S-U grading:  X  yes  no  Semester Effective:  Fall 2011

Justification for S-U grading:
For new courses or revised courses in which core content, mode of delivery, or learning objectives have changed:

1. Approximate percentage of class which will be conducted “on site”, i.e., students attending SPH classrooms to take the course: 100%

Note: If on-site percentage is less than 75% of total class hours please provide a brief rationale for the off-site time. The strength and detail of the rationale should be in proportion to the off-site component. If this is a distance learning new or revised course, please explain any on-site component more fully or, if there is no on-site component at all, please provide a rationale for teaching the entire course without an on-site component.

2. Please identify all computer software or hardware student needs for this course. Please make sure that any “above average” needs in these areas (e.g., a special type of hardware configuration, a laptop, costly software, etc.) are explained in relation to course learning objectives listed on the syllabus.

None

3. Please identify any additional equipment to be used in the course (e.g., microscopes, etc.) and how students will be able to access this technology.

All necessary equipment provided by laboratory.

4. Chair’s statement/endorsement (required): Please provide additional information on the need for/value of proposed new course/course revision from department chair and/or curriculum committee.

I fully support the proposal to increase BMS590: Laboratory Rotations in Biomedical Sciences to 3 credits. This change is extremely important because it will allow students to receive a fair and reasonable number of course credits for the number of contact hours that they are required to spend in the course.
Department of Biomedical Sciences
School of Public Health
Proposal to Reduce the Ph.D. Program of Study and Research to 60 credits

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Introduction

The Department of Biomedical Sciences proposes to reduce the number of credits required to complete the PhD degree from a total of 66 credits to a total of 60 credits. The faculty unanimously approved this change at a department retreat held on April 16, 2010. Our goals are to train self-reliant innovators through individualized practice-based instruction, improve the quality of our training program and reduce the time to degree to a maximum of 5 years. To facilitate these goals, we propose reducing the minimum number of required didactic course credits from 38 to 30 and increasing the minimum number of research credits from 28 to 30.

Proposed Curriculum Changes

1. Reduce the total number of didactic course credits required for the Ph.D. degree from 38 to 30.
   a. Reduce the core course requirements from a maximum of 11 credits to a maximum of 10 credits.
      i. Change BMS 590 Laboratory Rotations from a 1 credit course to a 3 credit course
      ii. Reduce the number of times a student may register for BMS 665 Journal Club for credit from a maximum of 5 credits to a maximum of 3 credits, and change the semester that students must begin registering for BMS 665 Journal Club from the first semester to the second semester.
   b. Reduce the minimum number of elective credits from 27 to 20.

2. Increase the minimum number of doctoral research credits from 28 to 30.

Table 1 provides a comparison of the credits requirements for the current program of study with the proposed program of study.
Table 1: Current versus Proposed Ph.D. Program of Study

<table>
<thead>
<tr>
<th>Current Requirements</th>
<th>Credits</th>
<th>Proposed Requirements</th>
<th>Credits</th>
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</thead>
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<td>BMS 590 Laboratory Rotations</td>
<td>3</td>
</tr>
<tr>
<td>BMS 665 Journal Club</td>
<td>0-5</td>
<td>BMS 665 Journal Club</td>
<td>0-3</td>
</tr>
<tr>
<td>BMS 670 Responsible Conduct</td>
<td>1</td>
<td>BMS 670 Responsible Conduct</td>
<td>1</td>
</tr>
<tr>
<td>BMS 601 Intro to Biomedical Sciences</td>
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<td>BMS 601 Intro to Biomedical Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Elective Coursework</td>
<td>27</td>
<td>Elective Coursework</td>
<td>20</td>
</tr>
<tr>
<td>BMS 899 Dissertation Research</td>
<td>28</td>
<td>BMS 899 Dissertation Research</td>
<td>30</td>
</tr>
<tr>
<td><strong>Total Credits Required for Degree</strong></td>
<td><strong>66</strong></td>
<td><strong>Total Credits Required for Degree</strong></td>
<td><strong>60</strong></td>
</tr>
</tbody>
</table>

Proposal 1: Reduce the total number of didactic course credits for the Ph.D. degree from 38 to 30.

The reduction in the total number of course credits required for the Ph.D. degree will involve minor changes in required coursework, as well as a reduction in the number of elective courses students must complete.

Proposal 1.a: Reduce the core course requirements from a maximum of 11 credits to a maximum of 10 credits.

Ph.D. students are currently required to complete a maximum of 11 credits of core coursework, comprised of:

- BMS 601 Introduction to Biomedical Sciences (3 credits)
- BMS 590 Laboratory Rotations in Biomedical Sciences (2-3 credits)
- BMS 665 Journal Club (taken every semester, 0 or 1 credit, maximum of 5 credits)
- BMS 670 Responsible Conduct of Scientific Research (1 credit)

The reduction in core course requirements from 11 credits to 10 credits will be accomplished by i) changing BMS 590 Laboratory Rotations to a 3 credit course; and ii) reducing the number of times a student may take BMS 665 for credit, while also making journal club optional in the first semester.

Proposal 1.a.i: Increase BMS 590 Laboratory Rotations to 3 credits

We have submitted a course proposal to change BMS 590 Laboratory Rotations from a 1 credit course to a 3 credit course (Appendix I), based on substantive changes in the learning objectives and
course design. The lab rotations have been shortened from semester long rotations to 7 weeks, with two mandatory 7-week rotations completed in the first semester of the Ph.D. program. Each of the mandatory rotations requires 10 hours of mentored laboratory research per week for a total of 140 hours per semester. In addition, students are expected to attend 12 one-hour meetings with the course director. This meeting introduces students to prospective mentors and monitors their progress in the rotations, from design of the rotation projects to written and oral presentation of their results. Because ~150 hours of student participation is required, it is appropriate to increase the number of credits for BMS 590 to 3, based on SUNY’s policy of assigning 1 credit for every 3 hours per week in a laboratory course. The proposed changes in BMS 590 also reflect a change in the major learning objective from one of teaching the students techniques to one of exposing students to different scientific approaches so that they can make an informed choice about their research specialty. Our incoming students have increasingly stronger research credentials because of earning an M.S. degree or participating in undergraduate research programs, and therefore require less basic technical training. Thus, the new rotation plan accommodates our more experienced students. In addition, the new course design encourages students to choose their dissertation mentor at the end of the first semester, which will shorten the total time it takes to acquire the Ph.D. degree. This goal is a critical one for improving the quality and competitiveness of our Ph.D. program.

Proposal 1.a.ii: Reduce the number of times a student may register for BMS 665 Journal Club for credit from a maximum of 5 credits to a maximum of 3 credits

The reduction in required credits for BMS 665 Journal Club from a maximum of 5 to a maximum of 3 will allow students to finish their course requirements and enter candidacy earlier, after two years of full-time study in the Ph.D. program. Incoming students currently take a journal club in their first semester to prepare them for the Qualifying Exam Part I, which is taken in June of their 1st year. The Qualifying Exam journal club will now be offered in the Spring semester, and no journal club will be required in the first semester, which eliminates 1 credit. By relying more on the scientific literature, the first semester courses (BMS 500 Molecular Cell Biology and BMS 502 Macromolecular Structure and Function) are explicitly training students how to read journal articles critically. This training is necessary to prepare students for active participation in journal club. This will also allow the Qualifying Exam journal club to provide more focused preparation for the Qualifying Exam Part I in June. Although the number of credits that students can earn by attending journal club will be reduced by
two, students will still be expected to register for journal club every semester, except for their first.

Proposal 1.b: Reduce the number of elective credits from 27 to 20

The department has modified the curriculum in response to changes and advances in the biomedical research field. These changes will reduce the unnecessary depth and increase the breadth of knowledge needed for students to become successful, independent scientists in the biomedical sciences. The curriculum changes result in a reduction of elective coursework from 27 credits to 20. To achieve this reduction of 7 credits, the curriculum has been revised as follows:

1. First-year students in all track concentrations were previously required to take BMS 504a Biochemistry I (4 credits) and BMS 504b Biochemistry II (3 credits). This sequence of courses has now been replaced with one 4-credit course, BMS502 Macromolecular Structure and Function. This practice-based course introduces students to biochemical, biophysical, computational and statistical principles that are utilized in virtually all sub-specialties of biomedical research.

2. First year students in all track concentrations were previously required to take BMS 500 Molecular and Cellular Biology (4 credits) and BMS 500b Molecular Biology and Genetics (3 credits). This sequence of courses has been replaced with a 4-credit course, BMS 500 Molecular Biology and Genetics. BMS 500 emphasizes innovative and logical approaches in Molecular Biology and Genetics through the analysis and critique of scientific literature. Cell Biology is now being offered as an elective.

3. The one credit course, BMS 510 Communication is Science, will no longer be offered because the level of instruction is too elementary for the majority of our incoming students, who typically have experience with scientific writing and presentations. Moreover, students are now receiving more in-depth and advanced instruction in writing and preparing NIH pre-doctoral grant applications in BMS 601 Introduction to Biomedical Sciences. This instruction reflects the absolute necessity of strong grant-writing skills to prepare students for careers in the Biomedical Sciences and encourages our students to apply for pre-doctoral fellowships.

The changes in departmental requirements eliminate 8 credits of coursework and therefore, the number of electives that students take in their chosen specialty will not change. Moreover, the new departmental requirements have reduced passive lecture-style coursework that has not engaged students or prepared
them for self-directed laboratory research. In most cases, students will be able to complete the required 30 credits of course work within 2 years, and can begin full-time research by the summer of their second year in the program. Initiation of full-time research would then coincide with the defense of the research plan (Qualifying Exam II).

Proposal 2: Increase the minimum number of doctoral research credits from 28 to 30.

The other aspect of our proposed change in reducing total course credits from 66 to 60 is that students will be required to take 2 additional hours of dissertation research credits. This proposed change reflects an anticipated increase in the amount of time that students will need to spend conducting full-time dissertation research in the laboratory. This change allows students to spend more time in practice-based learning exercises that will improve their intellectual and technical mastery of their scientific field. To support this stronger focus on laboratory-based research, we expect students to put more effort into preparing for annual dissertation committee meetings and annual departmental seminar presentations and provide more structured opportunities for faculty to monitor the progress of students and provide feedback. For example, we have recently begun requiring that students submit a 4-5 page summary of their research prior to the annual committee meeting in the format of an NIH progress report, which, along with the oral presentation, will be evaluated by the Dissertation committee.

Rationale

The goals of our training program have shifted significantly since the development of the current program of study 25 years ago, but the curriculum has not undergone significant change since that time. A major factor in this shift is the growth in faculty-directed research areas in the BMS department. Twenty-five years ago, biochemistry and cellular and molecular biology encompassed most of the research specialties. Since that time, there has been a tremendous expansion to include bioinformatics, systems biology, genomics, proteomics, biomedical engineering, and other emerging fields on the interface of biology, math and engineering. The growth in BMS parallels a global expansion in biomedical research fields, driven by the “information explosion”, i.e., a seismic shift in the methods used to collect, organize, analyze and disseminate information and a dramatic increase in published research data. Our current curriculum is of insufficient breadth and unnecessary depth to prepare students for research in current areas encompassed by biomedical sciences. The course work has traditionally focused on having the students memorize large amounts of information until they gain a certain level of knowledge in a limited number of areas. This passive learning approach demanded a
large amount of contact hours and reliance on faculty expertise but did little to prepare students for creative problem solving in a research environment. We now seek to move to an active learning model to train self-reliant scholars who possess the tools to acquire and assimilate information on their own or through interdisciplinary collaboration throughout their careers. Through student centered learning exercises and project-based course work, students will gain experience in experimental design, analysis and interpretation. They will be able to identify significant problems and find innovative solutions to challenges in the biomedical sciences. Since students will be working on challenging problems during class time, faculty will be able to provide rapid feedback to the students in their first semester courses and more effectively guide students along the path to become independent scientists.

In their 2010 report, The Path Forward (www.fgereport.org), the Commission on the Future of Graduate Education in the United States recommended that graduate schools reduce the time to completion of the Ph.D. degree to a maximum of 5 years. The Commission argued that a reasonable time to degree completion was essential to reduce attrition in graduate programs and attract a more diverse student population. Our plan to reduce general course requirements in BMS will allow students to begin classes in their chosen specialties earlier, and this will engage them earlier and speed their progress in the program. Didactic education in specialized areas will be provided through track-specific elective courses. Elective courses in BMS are being developed and revised continuously, driven by scientific developments in biomedical research. Many other existing training opportunities for Ph.D. candidates—such as participation in departmental seminar series and journal clubs and yearly dissertation committee meetings—have traditionally been underutilized in BMS because we lacked a coordinated assessment plan. We are now implementing systematic faculty and peer assessment of student performance in dissertation committee meetings, journal clubs and departmental seminar presentations. As a consequence, students will receive more effective feedback about their self-directed research projects, and we will meet learning objectives more efficiently. Overall, reducing course credits will allow us to shift our reliance on faculty-centered passive learning experiences to student-centered active learning experiences that will train students to become independent researchers.

Graduate students in our program currently complete the required 38 credits of course work in 2.5 to 3 years. We have investigated the course requirements of other Ph.D. programs in biomedical sciences and related sub-specialties at other institutions throughout the country, and we have yet to find an example of a graduate program that requires as much course work as we currently do in BMS (Appendix II). This puts us at a tremendous competitive disadvantage for several reasons. First, it is an
impediment to completion of the Ph.D. degree in a timely manner. Second, it is a major factor in the
dissatisfaction of our current students, which negatively affects our recruiting efforts. Our strongest
students express dissatisfaction with the amount of course work because they feel that they cover much
of the same material in their undergraduate courses. Moreover, lecture-based courses do not push them
to move beyond memorizing or prepare them to use their knowledge as innovators. Third, our unusually
heavy course load is a disincentive for highly qualified applicants who have strong undergraduate or
masters level backgrounds in biomedical sciences, or previous experience in biomedical research, to join
our program. Compared to two decades ago, there are many more opportunities for undergraduate
students to participate in laboratory research at their college or university or through “Research
Experience for Undergraduates” program such as those funded by the NSF. Therefore, the average
student enters the program with better scientific training and does not require as many course credits to
reach Ph.D. level competency as they did two decades ago. In summary, reducing our course work
requirements will improve the ability of our program to compete with other Biomedical Sciences
programs for highly qualified applicants.