

2013-2014 LONG SIGNATURE SHEET

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10/18/13



UNC CHARLOTTE

Proposal Number: BIO 4-1-13

Proposal Title: Revisions to the Curriculum for the Biology PhD and MS Programs, Including the Establishment of Five New Courses

Originating Department: BIOLOGY

TYPE OF PROPOSAL: UNDERGRADUATE _____ GRADUATE XX UNDERGRADUATE & GRADUATE _____
(Separate proposals sent to UCCC and Grad. Council)

DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
10-14-13	10-14-13	10-15-13	Approved	DEPARTMENT CHAIR Martin Klotz [print name here:] Dr. Martin G. Klotz
10-14-13	11-1-13	11-1-13	Approved	COLLEGE CURRICULUM COMMITTEE CHAIR [print name here:] Oscar Hansen
			Approved	COLLEGE FACULTY CHAIR (if applicable) [print name here:] STEVEN SABOZ
12/6/13		12/6/13	Approved	COLLEGE DEAN [print name here:] C. BEADY
			Approved	GENERAL EDUCATION (if applicable; for General Education courses) [print name here:]
			Approved	UNDERGRADUATE COURSE & CURRICULUM COMMITTEE CHAIR (for undergraduate courses only)
12-9-13	1-14-14	2-10-14	Approved	GRADUATE COUNCIL CHAIR (for graduate courses only) ALAN R. FREITAG
				FACULTY GOVERNANCE ASSISTANT (Faculty Council approval on Consent Calendar)
				FACULTY EXECUTIVE COMMITTEE (if decision is appealed)

University of North Carolina at Charlotte

New and Revised: Graduate Degree Program

Proposal from: Department of Biology

Title: *Revisions to the Curriculum for the Biology PhD and MS Programs, including the Establishment of Five New Courses*

A. Proposal Summary and Catalog Copy

1. Summary

The Department of Biology proposes to revise the core requirements for the PhD and MS in Biology programs, as well as establish concentration requirements for doctoral students who choose to follow the Molecular, Cellular and Developmental Biology (MCD) concentration and the Ecology, Evolution and Environmental Biology (E3B) concentration. The proposed changes will involve creating five new 6000/8000-level courses:

- BIOL 6101/8101 Hypothesis Testing (a core requirement of all PhD and MS students) (see pages 14-23 for course proposal)
- BIOL 6140/8140 Evolutionary Biology (a core requirement of all PhD and MS students) (see pages 24-31 for course proposal)
- BIOL 6241/8241 Environmental Biology (required of PhD students choosing the E3B concentration; elective for MS and other PhD students) (see pages 32-42 for course proposal)
- BIOL 6270/8270 Biological Pathways and Metabolism (required of PhD students choosing the MCD concentration; elective for MS and other PhD students) (see pages 43-52 for course proposal)
- BIOL 6260/8260 Careers in Bioscience: Professional Development and Responsible Conduct (elective course for MS and PhD students to satisfy training in the Responsible Conduct of Research) (see pages 53-69 for course proposal)

2. Proposed Catalog Copy

Copy edits to show proposed changes to existing catalog copy

Please note: We include only those sections of the catalog copy that will be affected by the proposed changes. Existing sections in the catalog which are not included below remain unchanged. Catalog copy edits for the individual courses are also presented in sections of the proposal that describe each proposed course.

PhD in Biology

Degree Requirements

The Ph.D. acknowledges the value of coursework as background and preparation for research, but the primary emphasis of the program is on the development of research skills and the completion of a research project on a significant problem in the biological sciences or related biotechnology.

Total Hours Required

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The program requires 72 post-baccalaureate credit hours. All students are required to take a general curriculum that includes a sequence of required courses as shown below.

Required Courses:

- [BIOL 8101 Hypothesis Testing \(3\) \(suggested year 1\)](#)
- [BIOL 8102 Cellular and Molecular Biology \(3\) \(suggested year 1\)](#)
- [BIOL 8140 Evolutionary Biology \(3\) \(suggested year 1\)](#)
- [Concentration Requirement \(suggested year 2\):](#)
 - [BIOL 8241 Environmental Biology \(3\) \(required for students pursuing the Ecology, Evolution and Environmental Biology \(E3B\) concentration\)](#)
 - [BIOL 8270 Biological Pathways and Metabolism \(3\) \(required for students pursuing the Molecular, Cellular and Developmental Biology \(MCD\) concentration\)](#)
- [BIOL 8201 Seminar \(2 hours total; 1 hour per year in years 1 and 2\)](#)
- [BIOL 8260 Careers in Bioscience: Professional Development and Responsible Conduct \(2\), or GRAD 8002 Responsible Conduct of Research \(2\), or PHIL 8240 Research Ethics in the Biological and Behavioral Sciences \(3\) \(suggested year 2\)](#)

Elective courses: 9 hours minimum; to be determined in consultation with the student's Dissertation Committee, but typically will consist of at least three 3-hour courses from either the MCD or E3B tracks. At least half the total elective/concentration hours, including the concentration requirement must be at the 8000 level.

Dissertation Research: minimum of 18 hours of BIOL 8999

BIOL 8101. Hypothesis Testing. (3) Prerequisite: Admission to the PhD in Biology program or permission of Department. Design and analysis of biological experiments and critical analysis of experimental design in pertinent biological literature. (Fall)

BIOL 8140. Evolutionary Biology. (3) Prerequisite: Admission to the PhD in Biology program or permission of Department. Fundamental evolutionary forces of mutation, genetic drift, natural selection, and gene flow; mechanisms generating biological diversity in molecules, genomes, and populations; relationship of micro-evolutionary change and macro-evolutionary patterns. (Spring)

BIOL 8241. Environmental Biology. (3) Prerequisite: Admission to the PhD in Biology program or permission of Department. An overview of ecological principles as they apply to relationships and interactions between organisms and their environment, with investigation of current research topics and issues related to impacts of human activities on environmental processes. (Fall)

BIOL 8260. Careers in Bioscience: Professional Development and Responsible Conduct (2) Hybrid course composed of class meetings and MOODLE tasks. Prerequisites: Admission to the PhD in Biology program or permission of Department. Professional development for Ph.D. students and postdoctoral fellows. The focus will be on teaching toward the Broadening Experiences in Scientific Training (BEST) initiative and the Responsible Conduct of Research (RCR) directive. (Fall or Spring)

BIOL 8270. Biological Pathways & Metabolism. Prerequisite: Admission to PhD in Biology program or permission of Department. An overview of biological pathways and metabolism principles as they apply to cell biology, relationships and interactions between cell and/or organisms and their environment, with investigation of current research topics. (Spring)

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Deleted: Required Courses (suggested year 1): 8 semester hours. -
Laboratory Research Rotations - ... [1]

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Deleted: Laboratory Research Rotations ... [2]

Masters of Science in Biology

Degree Requirements

All M.S. students must complete 30 semester hours of course work [approved by the Supervisory Committee, including the following required courses:](#)

- [BIOL 6101 Hypothesis Testing \(3\)](#)
- [BIOL 6102 Cellular and Molecular Biology \(3\)](#)
- [BIOL 6140 Evolutionary Biology \(3\)](#)

Students may choose the Molecular, Cellular and Developmental Biology (MCD) concentration or the Ecology, Evolution and Environmental Biology (E3B) concentration when selecting elective courses, although selection of a concentration is not required. In addition to coursework, each degree candidate must pass an oral candidacy examination administered by the Supervisory Committee.

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BIOL 6101. Hypothesis Testing. (3) Prerequisite: Admission to the MS in Biology program or permission of department. Design and analysis of biological experiments and critical analysis of experimental design in pertinent biological literature. (Fall)

BIOL 6140. Evolutionary Biology. (3) Prerequisite: Admission to the MS in Biology program or permission of department. Fundamental evolutionary forces of mutation, genetic drift, natural selection, and gene flow; mechanisms generating biological diversity in molecules, genomes, and populations; relationship of micro-evolutionary change and macro-evolutionary patterns. (Spring)

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BIOL 6260. Careers in Bioscience: Professional Development and Responsible Conduct (2) Hybrid course composed of class meetings and MOODLE tasks. Prerequisites: Admission to MS in Biology program or permission of Department. Professional development for Master's students. The focus will be on teaching toward the Broadening Experiences in Scientific Training (BEST) initiative and the Responsible Conduct of Research (RCR) directive. (Fall or Spring)

BIOL 6270. Biological Pathways and Metabolism. (3) Prerequisite: Admission to the MS in Biology program or permission of Department. An overview of biological pathways and metabolism principles as they apply to cell biology, relationships and interactions between cell and/or organisms and their environment, with investigation of current research topics. (Spring)

Proposed new catalog copy

PhD in Biology

Degree Requirements

The Ph.D. acknowledges the value of coursework as background and preparation for research, but the primary emphasis of the program is on the development of research skills and the completion of a research project on a significant problem in the biological sciences or related biotechnology.

Total Hours Required

The program requires 72 post-baccalaureate credit hours. All students are required to take a general curriculum that includes a sequence of required courses as shown below.

Required Courses:

- BIOL 8101 Hypothesis Testing (3) (suggested year 1)
- BIOL 8102 Cellular and Molecular Biology (3) (suggested year 1)
- BIOL 8140 Evolutionary Biology (3) (suggested year 1)
- Concentration Requirement (suggested year 2):
 - BIOL 8241 Environmental Biology (3) (required for students pursuing the Ecology, Evolution and Environmental Biology (E3B) concentration)
 - BIOL 8270 Biological Pathways and Metabolism (3) (required for students pursuing the Molecular, Cellular and Developmental Biology (MCD) concentration)
- BIOL 8201 Seminar (2 hours total; 1 hour per year in years 1 and 2)
- BIOL 8260 Careers in Bioscience: Professional Development and Responsible Conduct (2), or GRAD 8002 Responsible Conduct of Research (2), or PHIL 8240 Research Ethics in the Biological and Behavioral Sciences (3) (suggested year 2)

Elective courses: 9 hours minimum; to be determined in consultation with the student's Dissertation Committee, but typically will consist of at least three 3-hour courses from either the MCD or E3B tracks. At least half the total elective/concentration hours, including the concentration requirement must be at the 8000 level.

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BIOL 8241. Environmental Biology. (3) Prerequisite: Admission to the PhD in Biology program or permission of Department. An overview of ecological principles as they apply to relationships and interactions between organisms and their environment, with investigation of current research topics and issues related to impacts of human activities on environmental processes. (Fall)

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BIOL 8270. Biological Pathways & Metabolism. Prerequisite: Admission to PhD in Biology program or permission of Department. An overview of biological pathways and metabolism principles as they apply to cell biology, relationships and interactions between cell and/or organisms and their environment, with investigation of current research topics. (Spring)

Masters of Science in Biology

Degree Requirements

All M.S. students must complete 30 semester hours of course work approved by the Supervisory Committee, including the following required courses:

- BIOL 6101 Hypothesis Testing (3)
- BIOL 6102 Cellular and Molecular Biology (3)
- BIOL 6140 Evolutionary Biology (3)

Students may choose the Molecular, Cellular and Developmental Biology (MCD) concentration or the Ecology, Evolution and Environmental Biology (E3B) concentration when selecting elective courses, although selection of a concentration is not required. In addition to coursework, each degree candidate must pass an oral candidacy examination administered by the Supervisory Committee.

BIOL 6101. Hypothesis Testing. (3) Prerequisite: Admission to the MS in Biology program or permission of Department. Design and analysis of biological experiments and critical analysis of experimental design in pertinent biological literature. (Fall)

BIOL 6140. Evolutionary Biology. (3) Prerequisite: Admission to the MS in Biology program or permission of Department. Fundamental evolutionary forces of mutation, genetic drift, natural selection, and gene flow; mechanisms generating biological diversity in molecules, genomes, and populations; relationship of micro-evolutionary change and macro-evolutionary patterns. (Spring)

BIOL 6241. Environmental Biology. (3) Prerequisite: Admission to the MS in Biology program or permission of Department. An overview of ecological principles as they apply to relationships and interactions between organisms and their environment, with investigation of current research topics and issues related to impacts of human activities on environmental processes. (Fall)

BIOL 6260. Careers in Bioscience: Professional Development and Responsible Conduct (2) Hybrid course composed of class meetings and MOODLE tasks. Prerequisites: Admission to the MS in Biology program or permission of Department. Professional development for Master's students. The focus will be on teaching toward the Broadening Experiences in Scientific Training (BEST) initiative and the Responsible Conduct of Research (RCR) directive. (Fall or Spring)

BIOL 6270. Biological Pathways & Metabolism. Prerequisite: Admission to MS in Biology program or permission of Department. An overview of biological pathways and metabolism principles as they apply to cell biology, relationships and interactions between cell and/or organisms and their environment, with investigation of current research topics. (Spring)

B. Justification

1. Identify the need addressed by the proposal and explain how the proposed action meets the need.

The Department of Biology is currently reevaluating its graduate curricula in association with developing and implementing Student Learning Outcomes. During this process, we became aware that revisions to both the PhD and MS in Biology programs were necessary for five main reasons.

First, our PhD program curriculum has not been substantially revisited since its creation in 1998, despite the fact that the scope and breadth of the program, as well as the nature of biological research, have changed considerably. The initial PhD curriculum was designed rather narrowly for a more-or-less uniform group of students with interests in the biomedical sciences and biotechnology. Since then, the areas of expertise in the Biology faculty and the research interests of our doctoral students have expanded, especially within the areas of developmental biology, environmental science and evolutionary biology. For example, since the inception of the PhD program, the Department of Biology has hired six new faculty members in environmental and evolutionary biology (Dr. Martin Klotz, Dr. Inna Sokolova, Dr. Adam Reitzel, Dr. Bao-Hua Song, Dr. Amy Ringwood, and Dr. Molly Redmond). We have recently established two concentrations within our graduate programs, the Molecular, Cellular and Developmental Biology (MCD) concentration and the Ecology, Evolution and Environmental Biology (E3B) concentration, to reflect these changes and facilitate the recruitment and advising of graduate students. The existing PhD curriculum, with its narrow focus on biomedical training, is not well suited for students directed by a growing number of our faculty members, which hinders the ability to recruit and properly train the array of doctoral candidates our program can accommodate.

Second, there is growing concern among the Biology Graduate Faculty about the quality of student performance on Candidacy Exams for both the PhD and MS programs. Common complaints are that our students do not have the breadth or depth of knowledge we expect of graduate students, especially with respect to their ability to place their general area of interest and particular research project within a broader, evolutionary context. Evolution is the basis of all of biology and knowledge of evolution is essential for understanding all areas of biological research.

Third, we currently have no established core of required courses for the MS program. This undoubtedly contributes to poor performance on the Candidacy exam.

Fourth, we have recently established Student Learning Outcomes for both the PhD and MS programs that require demonstration of depth and breadth of biological knowledge in general, and at a level appropriate for the student's particular area of interest. The existing PhD curriculum and the lack of a required core for the MS curriculum are not consistent with our stated SLOs.

Fifth, all STEM doctoral students are currently required to take either GRAD 8002 or PHIL 8240 to satisfy Responsible Conduct of Research (RCR) training. Because the GRAD and PHIL courses must address the needs of a broad array of students from many disciplines, the courses must take a "generic" approach to addressing RCR issues and we wish to provide training that is more specifically tailored to graduate training in biology. We have therefore initiated a special topics course for Fall 2013 that is tailored specifically for Biology graduate students. We have received approval from the Graduate School to have the course satisfy RCR training requirements. We now propose to establish the special topics course as a permanent class, BIOL 6260/8260, to provide a biology-tailored option for satisfying RCR training requirements.

The changes we propose to the Biology graduate curricula are summarized as follows:

1. All PhD and MS students will be required to take a core of three required courses:

- BIOL 6101/8101 *Hypothesis Testing*, to provide background in statistics and experimental design
- BIOL 6102/8102 *Cellular and Molecular Biology*, to provide background in the molecular, genetic and cellular mechanisms that underpin living systems
- BIOL 6140/8140 *Evolutionary Biology*, to give all students background in evolutionary theory sufficient for placing their particular area of interest and research project within a broader biological context.

BIOL 6102/8102 *Cellular and Molecular Biology* are existing courses. BIOL 8102 is currently required of all PhD students, but BIOL 6102 is not a required course for MS students. BIOL 6101/8101 *Hypothesis Testing* has been taught each year for over a decade as a special topics course open to all graduate students, but which has not been proposed as a formal course. BIOL 6140/8140 *Evolutionary Biology* is a newly proposed course.

2. **All PhD students will be required to take either BIOL 8241 *Environmental Biology* or BIOL 8270 *Biological Pathways and Metabolism*, to provide a foundation for the E3B and MCD concentrations, respectively.** Both are newly proposed courses. Both courses can also be taken as electives by doctoral student pursuing the alternate concentration, provided the major advisor and Dissertation Committee approve (i.e. a student pursuing the MCD track may take Environmental Biology as an elective if deemed appropriate for his/her area of study). The courses will also be offered at the 6000-level (BIOL 6241 and BIOL 6270) so that MS students can take them as electives.
3. **BIOL 8260 *Careers in Bioscience: Professional Development and Responsible Conduct* will provide our PhD students with a third option (in addition to GRAD 8002 and PHIL 8240) for satisfying RCR training requirements, which is customized for biology graduate students.** Biology doctoral students may take any of the available options to meet RCR training; BIOL 8280 will not be required, but will probably be preferred by our students because of the specific biological focus. We will cross-list the course at the 6000 level (BIOL 6260) to serve as another elective for our MS students.

These first three changes address all of the concerns listed above. Additionally, we are proposing three additional changes to streamline our PhD curriculum, allow for greater customization of the curriculum to meet individual student interests, and reduce the total number of formal course hours required for the degree, thereby freeing up time for students to focus on the required core and their individual research.

4. **BIOL 8200 *Interdisciplinary Colloquium* will no longer be required of all PhD students, although it will continue to be offered as an elective.** Individual major advisors may require their particular students to take Colloquium, if the topics covered during a given offering are relevant to the student's research interests.
5. **BIOL 8800 *Laboratory Rotations* will no longer be required of all PhD students, although it will continue to be offered as an elective.** Rotations may be required by individual major advisors if deemed necessary for the training of students working under their direction.
6. **CHEM 8101 *Biochemical Principals* will no longer be required of all PhD students, although it will continue to serve as an elective for all doctoral students.** Training in biochemistry remains necessary for some of our students and a number of faculty members will continue to require their students to take CHEM 8101. However, the growing diversity in faculty and student research interests makes it unnecessary to require all doctoral students to take the same biochemistry course.

2. Discuss prerequisites/co-requisites for courses including class standing.

All proposed courses, both required and elective, will have the prerequisite of admission into a biology graduate program (MS or PhD) or permission of the Department (see also the individual course proposals, pages 14-60). The remaining course required for PhD and MS students, BIOL 6102/8102 *Cellular and Molecular Biology*, already exists in the catalog with stated pre- and co-requisites.

3. Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended.

Please see the individual course proposals for explanations of course numbering.

4. In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction?

The proposed changes will establish a common core of required courses for PhD and MS students that will provide background in experimental design and data analysis, cellular and molecular mechanisms, and evolutionary theory. This background will prepare our students for their individual research areas, as well as elective courses. The establishment of concentration requirements for doctoral students through the creation of BIOL 8241 *Evolutionary Biology* and BIOL 8270 *Biological Pathways and Metabolism* will further unify and standardize background training. This level of background instruction will better prepare students for the Candidacy Exam and provide training consistent with our established Student Learning Outcomes. In addition, the proposed changes free up more time for doctoral students to focus on their dissertation research, which should enhance the quality of the research produced and reduce time to degree. BIOL 6260/8260 *Careers in Bioscience* will provide more options for graduate students to meet RCR training requirements in a manner specifically tailored for biological research.

5. If the course has been offered previously under special topics numbers, give details of experience including number of times taught and enrollment figures.

- The proposed course BIOL 6101/8101 *Hypothesis Testing* has been taught as a Special Topics course each year for at least 10 years, with a typical enrollment of 15-20 students each offering. The objectives and content of the course are firmly established and the course provides our students with a basic background in experimental design and data analysis.
- BIOL 6102/8102 has not been taught as a Special Topics. It is an existing course offered each year since 1998, with a typical enrollment of 8-12 students each year.
- The proposed course BIOL 6260/8260 *Careers in Bioscience* will be offered during Fall 2013 as a 6000/8000 Special Topics class. Currently, 12 students are enrolled for Fall 2013.
- The remaining proposed courses, BIOL 6140/8140 *Evolutionary Biology*, BIOL 6241/8241 *Environmental Biology*, and BIOL 6270/8270 *Biological Pathways and Metabolism*, are new courses that have not been offered previously as special topics.

C. Impact

1. What group(s) of students will be served by this proposal? Describe how you determined which students will be served.

Students in the PhD in Biology program and the MS in Biology program will benefit from the proposed changes. The existing course BIOL 6102/8102 *Cellular and Molecular Biology*, and the newly proposed courses BIOL 6101/8101 *Hypothesis Testing* and BIOL 6140/8140 *Evolutionary Biology*, will be required of all Biology graduate students. The newly proposed courses, BIOL 6241/8241 *Environmental Biology* and BIOL 6270/8270 *Biological Pathways and Metabolism*, will serve as concentration requirements for PhD students and elective courses for MS students. BIOL 6260/8260 *Careers in Bioscience* will provide more options for graduate students to meet RCR training requirements in a manner customized for biological research. No other graduate programs will be directly affected, although several of the courses may be of interest to graduate students in Geography and Earth Sciences, Chemistry and Bioinformatics and Genomics.

2. What effect will this proposal have on existing courses and curricula?

- a. *When and how often will the added course be taught?*

The existing course, BIOL 6102/8102 *Cellular and Molecular Biology*, will continue to be taught once each year (typically in the spring), as it is now. The newly proposed courses, BIOL 6101/8101 *Hypothesis Testing* and BIOL 6241/8241 *Environmental Biology* will be offered once each year in the Fall; BIOL 6140/8140 *Evolutionary Biology* and BIOL 6270/8270 *Biological Pathways and Metabolism* will be offered once each year in the spring. BIOL 6260/8260 *Careers in Bioscience* will be taught once each year (on demand, but typically in the Fall). In this manner, we will typically offer three required core/concentration courses each semester, as follows:

- Fall: *Hypothesis Testing; Environmental Biology; Careers in Bioscience*
- Spring: *Cellular and Molecular Biology; Evolutionary Biology; Biological Pathways and Metabolism*

Note: Although we plan to offer the courses once each year as shown, we may have to offer some once every other year as dictated by enrollment and demand.

b. *How will the content and/or frequency of offering of other courses be affected.*

BIOL 6102/8102 *Cellular and Molecular Biology* is already required of all PhD students, is also taken by many of our MS student, and is offered once each year. *Hypothesis Testing* is currently offered as a special topics course once each year and is required of all doctoral and most MS students. The newly proposed courses, *Evolutionary Biology, Environmental Biology, Biological Pathways and Metabolism, and Careers in Bioscience* will offer novel content. Thus, the required core courses and concentration requirements should not strongly influence the content of other courses, other than the courses should enhance and build upon one another. Nevertheless, in conjunction with developing this proposal, we reexamined the syllabus of BIOL 6102/8102 *Cellular and Molecular Biology* to ensure that course content would be well coordinated with our newly proposed courses.

Within the Department of Biology, establishing three core courses required of all PhD and MS students will necessitate careful scheduling of our proposed concentration requirements and existing elective courses. We will need to ensure that we do not offer too many elective courses in a given semester, such that enrollment in each is diluted and the courses do not make. The Department of Biology already does this by offering no more than two-to-three 6000/8000 courses per semester. We will need to continue to project enrollment each semester and adjust required and elective course offerings accordingly to ensure we provide students with sufficient class offerings to promote timely completion of the degree.

Outside the Department of Biology, the proposed changes may affect the frequency of offering of CHEM 8101. Currently, this course is required of all Biology PhD students and is offered once each year. We propose eliminating CHEM 8101 as a requirement of all Biology PhD students; however, the effect this will have on the enrollment and frequency of offering of CHEM 8101 is difficult to predict. Although enrollment by Biology PhD students will undoubtedly decline to some extent, some major advisors will continue to require their students to take CHEM 8101 and Chemistry graduate students also take the course. We predict that CHEM 8101 will continue to have sufficient enrollment to be offered once each year, and at the very least once every other year. Biology will need to coordinate carefully with Chemistry to prevent scheduling conflicts between CHEM 8101 and our BIOL required and elective courses.

The proposed course BIOL 6260/8260 *Careers in Bioscience* may influence the enrollment in GRAD 8002 and PHIL 8240, but it is unlikely it would affect the frequency with which the GRAD and PHIL courses are offered. If we are approved to use BIOL 8260 course as a substitute for RCR training, some (but not all) of our Biology PhD students will opt to take BIOL 8260 instead of the GRAD or PHIL courses. However, given that the GRAD and PHIL courses are required of all STEM doctoral students, it is unlikely the new course will decrease enrollment sufficiently to alter the frequency of offering GRAD 8002 or PHIL 8240.

c. *What is the anticipated enrollment in the courses added?*

We anticipate that the vast majority of PhD and MS students taking the three required core courses (*Hypothesis Testing, Evolutionary Biology, Cellular and Molecular Biology*) will be newly entering students, because it is suggested the core be completed during year 1 (see catalog copy). Over the past three-year period, we have admitted an average of 6 doctoral students and 8 MS students each year. We therefore anticipate an enrollment of 12-14 graduate students in the three required core courses each year. At present, about 2/3 of our graduate students are in the MCD concentration and 1/3 in the E3B concentration. We therefore anticipate that approximately 9 students will enroll in the proposed concentration requirement BIOL 6270/8270 *Biological Pathways and Metabolism* and 5 in the proposed concentration requirement BIOL 6241/8241 *Environmental Biology*. We anticipate enrollments of 8-10 students in BIOL 6260/8260 each year it is offered. These are minimum anticipated enrollments, because BIOL 6270/8270, BIOL 6241/8241 and BIOL 6260/8260 can be taken as electives and/or concentration requirements by biology graduate students, as well as graduate students from Chemistry, Bioinformatics and Genomics and Geography and Earth Science.

d. *How will enrollment in other courses be affected? How did you determine this?*

Enrollment in other BIOL courses is expected to be little affected by the proposed changes. Enrollment will obviously increase in all of the courses proposed as core requirements or concentration requirements. As explained above, we will carefully schedule our offerings of other elective BIOL 6000/8000 level courses to minimize competition for students and maximize the likelihood that each course will make, to ensure timely progression of students through our graduate programs.

Enrollment in CHEM 8101 will undoubtedly decline somewhat if the course is no longer required of all Biology PhD students. Our understanding is that the typical total enrollment in CHEM 8101 during the past few years was 8-10 students, about 50% of which were Biology PhD students, although in some semesters Biology students made up most of the class. Given that some Biology PhD students will still be required by their major advisors to take CHEM 8101, we anticipate that eliminating the course as a requirement for all Biology PhD students will lower enrollment, but will not prevent the course from making when offered.

e. *Identify other areas of catalog copy that would be affected, e.g., curriculum outlines, requirements for degree, etc.*

The changes to catalog copy associated with revising the PhD and MS curricula will be as indicated in **2. Proposed Catalog Copy** and in each of the individual course proposals.

D. RESOURCES REQUIRED TO SUPPORT PROPOSAL

1. Personnel

a. *New faculty...*

No new faculty are required.

b. *Qualified faculty members interested in teaching the course.*

- BIOL 6101/8101 *Hypothesis Testing* will continue to be taught by Dr. Mark Clemens and Dr. Larry Leamy, who have taught the course as a Special Topics course in alternate years for at least a decade. In addition, Dr. Stan Schneider and Dr. Bao-Hua Song can teach the course.
- BIOL 6102/8102 *Cellular and Molecular Biology* is currently taught by Dr. Shan Yan. The course can also be taught or team-taught by Dr. Valery Grdzlishvili, Dr. Adam Reitzel, and Dr. Christine Richardson
- BIOL 6140/8140 *Evolutionary Biology* can be taught or team-taught by Dr. Martin Klotz, Dr. Larry Leamy, Dr. Adam Reitzel, Dr. Amy Ringwood, Dr. Inna Sokolova, and Dr. Bao-Hua Song,
- BIOL 6241/8241 *Environmental Biology* can be taught or team-taught by Dr. Matt Parrow, Dr. Molly Redmond, Dr. Adam Reitzel, Dr. Amy Ringwood, Dr. Bao-Hua Song and Dr. Inna Sokolova.

- BIOL 6270/8270 *Biological Pathways and Metabolism* can be taught or team-taught by Dr. Mark Clemens, Dr. Didier Dréau, Dr. Valery Grzelishvili, Dr. Martin Klotz, Dr. Adam Reitzel, Dr. Christine Richardson, Dr. Inna Sokolova and Dr. Shan Yan.
- BIOL 6260/8260 *Careers in Bioscience: Professional Development and Responsible Conduct* will be taught by Dr. Ken Bost.

2. **Physical Facility**

None required beyond existing classrooms.

3. **Equipment and Supplies**

No additional equipment and supplies are required.

4. **Computer**

No additional computing resources are required.

5. **Audio**

No equipment or services will be needed from Media Services

6. **Other Resources**

None

7. **Sources of Funding**

No new funding required.

E. CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS/UNITS

1. **Library Consultation**

Library consultations were initiated for each of the five proposed courses. Holding were indicated as adequate for each course (please see individual course proposals).

2. **Consultation with Other Departments and Units**

Several of the proposed courses may be of interest to students in Geography and Earth Science and Bioinformatics and Genomics. We therefore requested input from these two departments for the proposed changes on (date).

The Ph.D. in Biology program has an interdisciplinary approach that involves faculty from the departments of Chemistry, Kinesiology, Mechanical Engineering, Public Health Sciences, Anthropology, Physics and Optical Sciences, and the Carolinas Medical Center. We have a Doctoral Advisory Panel composed of faculty representatives from the participating units, which functions to provide input to the Biology Graduate Committee about doctoral program matters. The members of the Advisory Panel (Dr. Jerry Troutman, Chemistry; Dr. Farah Bahrani, CMC; Dr. Eric Wikstrom, Kinesiology; Dr. Gloria Elliott, Mechanical Engineering; Dr. Andrew Harver, Public Health Sciences; Dr. Diane Brockman, Anthropology; and Dr. Irina Nesmelova; Physics and Optical Sciences) were informed of the proposed revisions to the PhD curriculum on (date). Five outside units (Bioinformatics & Genomics; Physics and Optical Science; Engineering; Kinesiology; Chemistry) provided written input.

F. INITIATION, ATTACHMENTS AND CONSIDERATION OF THE PROPOSAL

1. **Originating Unit**

The Biology Graduate Faculty initiated discussions for revising the graduate curricula during Fall 2012. A series of meetings of the Graduate Faculty-as-a-Whole were held throughout Fall 2012 and Spring 2013, which culminated in two motions: one to revise the PhD curriculum and the other to revise the MS curriculum. Ballots for the two motions were distributed to the 21 tenure-track members of the Biology Graduate Faculty on March 26, 2013. Both motions passed with only one dissenting vote.

2. **Credit Hour:** please see credit hour statements in each individual course proposal

3. Attachments

a. *Consultation with other units*

Copies of the email responses received from the outside departments and Doctoral Advisory Panel are attached in Appendix I (pages 70-71).

b. *Course syllabus*

The syllabi for the propose courses are included in the individual course proposals, as follows:

- BIOL 6101/8101 *Hypothesis Testing*: pages 20-22
- BIOL 6140/8140 *Evolutionary Biology*: pages 29-30
- BIOL 6241/8241 *Environmental Biology*: pages 39-41
- BIOL 6270/8270 *Biological Pathways and Metabolism*: pages 49-51
- BIOL 6260/8260 *Careers in Bioscience: Professional Development and Responsible Conduct*: pages 62-65

University of North Carolina at Charlotte

New: Graduate Course

Course and Curriculum Proposal from: Department of Biology

Title: Establishment of a Graduate Course in Hypothesis Testing

A. Proposal Summary and Catalog Copy

1. **Summary.** The Biology Department proposes to add one new required course to the graduate curriculum: BIOL 6101/8101 Hypothesis Testing.

2. PROPOSED CATALOG COPY

For a new course or revisions to an existing course, check all the statements that apply:

This course will be cross listed with another course: 6101 and 8101 designations

There are prerequisites for this course: Admission to graduate school in Biology or permission from the Department

There are corequisites for this course.

This course is repeatable for credit.

This course will increase/decrease the number of credits hours currently offered by its program.

This proposal results in the deletion of an existing course(s) from the degree program and/or catalog.

BIOL 6101. Hypothesis Testing. (3) Prerequisite: Admission to the MS in Biology program or permission of Department. Design and analysis of biological experiments and critical analysis of experimental design in pertinent biological literature. (Fall)

BIOL 8101. Hypothesis Testing. (3) Prerequisite: Admission to the PhD in Biology program or permission of Department. Design and analysis of biological experiments and critical analysis of experimental design in pertinent biological literature. (Fall)

B. Justification

1. Identify the need addressed by the proposal and explain how the proposed action meets the need.

Modern experimental biology is becoming ever more dependent on quantitative analysis of experimental data. Although an undergraduate statistics course is a requirement for admission to our graduate programs, very few of our students come to us with any practical ability in data analysis. In addition, few undergraduate programs provide training in elements of experimental design. Thus there is a clear need for a course to provide an integration of design of biological experiments and the analysis of the data in a manner appropriate for publication in the biological literature. The proposed Hypothesis Testing course will be a required course of all graduate students in Biology.

2. Discuss prerequisites/corequisites for courses including class standing.

Admission in the MS or PhD in Biology programs.

3. Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended.

The numbering for BIOL 6101/8101 was chosen as follows:

1st digit: designates graduate level course work (6 open to MS students; 8 open to PhD students)

2nd digit: 1 indicates a required core course; 2 indicates a concentration course

3rd digit: consistent with established numbering systems:

- 2 - Plant Biology
- 3 - Animal Biology
- 4 - Ecology and Behavior
- 5 - Microbiology/Immunology/Virology
- 6 - Biotechnology
- 7- Physiology
- 8- Developmental Biology
- 9- Anatomy & Morphology

4th digit: at the discretion of the individuals who developed the specific proposals

4. In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction?

As a required course for all biology graduate students, Hypothesis Testing will ensure that all of our students acquire core knowledge regarding the design of biological experiments and the analysis of the data. In addition, an important component of the course is the presentation by the students of critical analyses of the design and analysis of articles in the current biological literature.

Please note that Hypothesis Testing has been taught as BIOL 6000/8000 Special Topics every year since about 2004 and has been required of all MS and PhD students throughout this time (i.e. it was taught as a required Special Topics class). The contributions of the course to the scope, quality and efficiency of our graduate programs in biology have been well established. We now want to formally establish Hypothesis Testing as a separate course.

C. Impact

1. What group(s) of students will be served by this proposal? Describe how you determined which students will be served.

This course will serve Biology Masters and PhD students as a required core course. Hypothesis Testing has been part of the required core curriculum for both the MS and PhD programs since about 2004, taught as BIOL 6000/8000 Special Topics, and we now wish to formally establish it as a separate course. Typically the required core courses for our graduate programs are taken only by students who have been admitted into the MS and PhD programs in Biology. Nevertheless, the course has occasionally been taken by graduate students from other program and may continue to serve graduate students in Bioinformatics and Genomics and Genomics, Chemistry, and Geography and Earth Sciences.

2. What effect will this proposal have on existing courses and curricula?

a. *When and how often will the added course be taught?*

The course will be offered once each year in the Fall semester.

b. *How will the content and/or frequency of offering of other courses be affected.*

No effects on other courses are foreseen. Hypothesis Testing is the only required graduate course offered by Biology that covers experimental design and statistics and, as such, it has little overlap with the

content of any other graduate course. It is a standard offering for each fall semester. No other graduate courses are offered at the same time as Hypothesis Testing and thus there are no scheduling conflicts.

c. *What is the anticipated enrollment in the courses added?*

Anticipated enrollment will depend on the number of graduate students in our programs. Students typically take hypothesis testing in their first or second year of study. Past experience indicates typical enrollment of 10-15 students per year.

d. *How will enrollment in other courses be affected? How did you determine this?*

Since this class is required for all graduate students and does not duplicate any existing course, no effect is anticipated. The Department of Biology has offered Hypothesis Testing as BIOL 6000/8000 since 2004. Because we schedule the class to prevent conflicts with other courses, we know Hypothesis Testing does not influence enrollment in other graduate courses.

e. *If the course has been offered previously under special topics numbers, give details of experience including number of times taught and enrollment figures.*

Hypothesis testing has been previously taught as Special Topics in Biology (BIOL6000/8000) since about 2004. During this time it has developed into its current form as a 3 credit hour core course. Enrollment ranges from approximately 10 – 15 students (taught annually).

f. *Identify other areas of catalog copy that would be affected, e.g., curriculum outlines, requirements for degree, etc.*

Because the proposed course will become part of the required core for both the PhD and MS programs, the catalog copies for degree requirements will be changed as indicated below (please see also pages 2-4 of the proposal packet). The changes associated with this particular proposed course (BIOL 6101/8101 are shown in red).

PhD in Biology

Total Hours Required

The program requires 72 post-baccalaureate credit hours. All students are required to take a general curriculum that includes a sequence of required courses as shown below.

Required Courses:

- BIOL 8101 Hypothesis Testing (3) (suggested year 1)
- BIOL 8102 Cellular and Molecular Biology (3) (suggested year 1)
- BIOL 8140 Evolutionary Biology (3) (suggested year 1)
- Concentration Requirement (suggested year 2):
 - BIOL 8241 Environmental Biology (3) (required for students pursuing the Ecology, Evolution and Environmental Biology or E3B concentration)
 - BIOL 8270 Biological Pathways and Metabolism (3) (required for students pursuing the Molecular, Cellular and Developmental Biology or MCD concentration)
- BIOL 8201 Seminar (2 hours total; 1 hour per year in years 1 and 2)

- BIOL 8260 Careers in Bioscience: Professional Development and Responsible Conduct (2), or GRAD 8002 Responsible Conduct of Research (2), or PHIL 8240 Research Ethics in the Biological and Behavioral Sciences (3) (suggested year 2)

Masters of Science in Biology

Degree Requirements

All M.S. students must complete 30 semester hours of course work approved by the Supervisory Committee, including the following required courses:

- **BIOL 6101 Hypothesis Testing (3)**
- BIOL 6102 Cellular and Molecular Biology (3)
- BIOL 6140 Evolutionary Biology (3)

D. RESOURCES REQUIRED TO SUPPORT PROPOSAL

1. Personnel

a. *New faculty*

No new faculty are required.

b. *Qualified faculty members interested in teaching the course.*

Instruction will be by existing tenure track faculty. The course is currently being taught by either Mark Clemens or Larry Leamy. In addition Stan Schneider and Bao-Hua Song are also qualified to teach the course.

2. Physical Facility

None required beyond existing classrooms.

3. Equipment and Supplies

No additional equipment and supplies are required.

4. Computer

No additional computing resources are required. Students are required to solve analysis problems using statistical software. SPSS and SAS are adequate.

5. Audio

No additional equipment or services will be needed from Media Services. Standard classroom podium is adequate.

6. Other Resources

None

7. Sources of Funding

No new funding required.

E. **CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS/UNITS**

1. Library Consultation

Attached (page 23)

2. Consultation with Other Departments and Units

The entire long-form proposal to change degree requirements and establish the individual courses was distributed to the Departments of Chemistry, Geography and Earth Science, Bioinformatics and Genomics and Genomics, and to each member of the Doctoral Advisory Panel for the Ph.D. in Biology, as described in section E-2, page 12.

F. **INITIATION, ATTACHMENTS AND CONSIDERATION OF THE PROPOSAL**

1. Originating Unit

The Biology Graduate Faculty approved the proposed course on March 26, 2013.

2. **CREDIT HOUR. (Mandatory if new and/or revised course in proposal)**

Review statement and check box once completed:

The appropriate faculty committee has reviewed the course outline/syllabus and has determined that the assignments are sufficient to meet the University definition of a [credit hour](#).

The Graduate Committee of the Department of Biology has reviewed the course syllabus for Hypothesis Testing and has approved the new course for 3 credit hours

3. Attachments

a. *Consultation with other units*

The input received from other units for the entire proposal and each individual proposed course are attached (pages)

b. *Course syllabus*

A sample syllabus from a previous offering of Hypothesis Testing is attached (pages 20-22)

4. Student Learning Outcomes

Please indicate what SLOs are supported by this course or courses or whether this curricular change requires a change in SLOs or assessment for the degree program.

SLOs for the Biology MS and PhD programs are listed below. Those highlighted in yellow will be supported by the proposed BIOL 6101/8101 course.

Biology MS Program SLOs	Biology PhD Program SLOs
<p>Candidates for the <i>Masters of Science in Biology</i> (thesis option) are expected to meet the following learning outcomes:</p> <ol style="list-style-type: none"> 1) Demonstrate breadth in knowledge about general biological principles. 2) Demonstrate depth in knowledge about the specific sub-discipline related to the MS thesis research topic. 3) Conduct independent research capable of generating at least one peer-reviewed publication. 4) Develop presentation and communication skills. 	<p>Candidates for the <i>Doctor of Philosophy in Biology</i> are expected to meet the following learning outcomes:</p> <ol style="list-style-type: none"> 1) Demonstrate breadth in knowledge about general biological principles related to the required advanced graduate core courses. 2) Demonstrate depth of knowledge about the specific sub-discipline related to the dissertation research topic. 3) Conduct independent research capable of generating multiple peer-reviewed publications and presentations at national and international meetings. 4) Develop advanced presentation, communication and networking skills.

5. **STUDENT COMPETENCIES:** Graduate students completing BIOL 6101/8101 will gain the following competencies related to professional development:

- The ability to design a biological experiment including the application of appropriate controls.
- The ability to integrate analytic approaches, including statistical analysis, into the experimental design.
- Competence with available statistical software to be able analyze and interpret data sets.
- An understanding of which statistical tests to apply to biological experimental designs.
- An understanding of the limitations of various statistical approaches.
- The ability to critically analyze experimental design and statistical analysis of original research papers from the biological literature.
- The ability to present an analysis of experimental design in a clear and concise manner to an audience of biologists with diverse backgrounds.

6. **TEXTBOOK COSTS:** It is the policy of the Board of Governors to reduce textbook costs for students whenever possible. Have electronic textbooks, textbook rentals, or the buyback program been considered and adopted?

The course uses the text, *The Analysis of Biological Data*. Whitlock and Schluter. Roberts & Co Publishers. Students are encourage to purchase used copies or rent the text when possible. Other materials are provided through Moodle.

BIOLOGY 6101/8101 – HYPOTHESIS TESTING

Fall Semester, 2012
Dr. Clemens, x 78682
mgclemen@email.uncc.edu
Office hours: Tues, 3:30-5

Overall format: This is not a statistics course, but rather one that focuses on the design and analysis of experiments for testing hypotheses in Biology. A necessary part of the analysis of any experiment that is not purely descriptive in nature is the use of appropriate statistical analysis. Our emphasis will be on application of statistical approaches to experimental biology with minimal emphasis on derivation of computational formulas. We will assume that you will always have a computer with a point and click statistical package available for actually performing any tests. Nevertheless, you are expected to develop a good fundamental understanding of what the tests do and when they are appropriate. The format will be primarily lecture at the beginning with student presentations toward the end of the semester. In the lectures, students are expected to be active participants. The dates and topics listed below are tentative and subject to change depending on how much time we need for each topic.

Prerequisites: Admission to the PhD or MS program in Biology or permission of Department.

Text: *The Analysis of Biological Data. Whitlock and Schluter. Roberts & Co Publishers.* This will be the main reference for the course and the source of most homework problems. We will not cover everything that is in the text. We will also supplement the text with additional material (especially in analysis of variance).

Homework: You will regularly be given homework assignments with a specific due date. Assignments must be turned in during class on the due date. The homework problems will count for a total of 100 points.

Grading for Hypothesis Testing

Final grades in Hypothesis Testing will be based on 300 total possible points from 3 exams (each worth 100 points) plus 100 points from an oral presentation/participation, and another 100 points from homework assignments = 500 total points.

Grading Scheme: A = 90-100, B = 80-89, C = 70-79, U < 70

Oral Presentation Guidelines

Each student is required to give an oral presentation, and will be given approximately one-half of the 75 minute period for this presentation. Presentations should be timed to last no more 20 minutes so that at least 15 minutes are available for questions. All presentations should be given in PowerPoint with a **limit of 20 slides** for each presentation. All PowerPoint files should be loaded on the computer before the time of presentation. You need to email your power point to me at least one day prior to the presentation. I will post it on the class Moodle page so that the class has access to it.

The basic idea of these presentations will be to outline the planning that is done for a proposed experiment. The experiment may be based on actual thesis work being carried out, or on any other topic of relevance to each student's planned or existing thesis work.

All presentations should follow this format:

- Background

- Biological Hypotheses
- Experimental Design
- Statistics
- Expectations

The introduction should provide sufficient background to justify why the study should be done. The introductory slides then should be followed by a separate slide clearly stating one or more biological hypotheses. The experimental design section should outline the particular biological sample to be used, including the number in each group that is justified by a power analysis if possible. Consideration should be given to extraneous or nuisance variables and how they will be controlled or eliminated. This section also should include a description and justification of the biological traits to be analyzed, and what sorts of tests/procedures will be used and what the null and alternate statistical hypotheses are. If an ANOVA of some sort is to be used, each student should provide explanation as to whether the factors are fixed or random, whether there are interactions, whether multiple comparisons will be used, etc. In the expectations section, significant/non-significant statistical results should be related back to the biological hypotheses. That is, what statistical outcomes would support or not support the biological hypotheses? Finally, clearly state how this experimental design (including statistical analysis) directly tests the stated hypothesis.

All presenters should be willing to entertain questions from other students at any time. In addition, all students will be asked to rate each presenter using a standard form that will be provided.

Academic Integrity: Students have the responsibility to know and observe the requirements of the UNCC Code of Student Academic Integrity, outlined in the catalog and summarized below:

CODE OF STUDENT ACADEMIC INTEGRITY

THE UNC CHARLOTTE CODE OF STUDENT ACADEMIC INTEGRITY governs the responsibility of students to maintain integrity in academic work, defines violations of the standards, describes procedures for handling alleged violations of the standards, and lists applicable penalties. The following conduct is prohibited in that Code as violating those standards:

- A. Cheating. Intentionally using or attempting to use unauthorized materials, information, notes, study aids or other devices in any academic exercise. This definition includes unauthorized communication of information during an academic exercise.
- B. Fabrication and Falsification. Intentional and unauthorized alteration or invention of any information or citation in an academic exercise. Falsification is a matter of altering information, while fabrication is a matter of inventing or counterfeiting information for use in any academic exercise.
- C. Multiple Submission. The submission of substantial portions of the same academic work (including oral reports) for credit more than once without authorization.
- D. Plagiarism. Intentionally or knowingly presenting the work of another as one's own (i.e., without proper acknowledgment of the source). The sole exception to the requirement of acknowledging sources is when the ideas, information, etc., are common knowledge.
- E. Abuse of Academic Materials. Intentionally or knowingly destroying, stealing, or making inaccessible library or other academic resource material.
- F. Complicity in Academic Dishonesty. Intentionally or knowingly helping or attempting to help another to commit an act of academic dishonesty.

A full explanation of these definitions, and a description of procedures used in cases where student violations are alleged, is found in the complete text of The UNC Charlotte Code of Student Academic Integrity. This Code may be modified from time to time. Students are advised to contact the Office of the Dean of Students or go online to ensure they consult the most recent edition.

Date	Topic	Text*
August 20	Introduction:	Chapter 1
August 22	Anatomy of an experiment	Lecture
August 27	Experimental Design	Chapter 14
August 29	Descriptive statistics and presentation of data	Chapter 2-5
September 3	Labor Day	
September 5	Descriptive statistics/ probability	
September 10	Probability; Categorical data	Chapter 6-9
September 12	Sampling distributions: Central Limit	Chapter 10
September 17	Statistical Inference	Chapter 11-12
September 19	Statistical Inference	
September 24	Statistical Inference	
September 26	Exam 1	
October 1	Analysis of Variance	Chapter 15
October 3	Analysis of Variance	
October 8	Fall break	
October 10	Analysis of Variance	
October 15	Regression & Correlation	Chapter 16-17
October 17	Regression & Correlation	
October 22	Nonparametric tests	Chapter 13
October 24	Sample size and power analysis	
October 29	review	
October 31	Exam 2	
November 5	Student presentation	Brian, Jeremy
November 7	Student presentation	Ian, Marcus
November 12	AASLD meeting: no class	
November 14	Student presentation	Kevin, Eric
November 19	Student presentation	Nicole, Cuyler
November 21	Thanksgiving Holiday	
November 26	Student presentation	Michelle, Erica
November 28	Student presentation	Phu, Lin
December 3	Student presentation	Sebastien, Mike
December 5	Student presentation	Tamara, Chris
December 10	Final exam	



J. Murrey Atkins Library

Consultation on Library Holdings

To: Dr. Stan Schneider
From: Dr. Melanie Sorrell

Date: 8/16/013

Subject: BIOL 6101/8101 Hypothesis Testing

Summary of Librarian's Evaluation of Holdings:

Evaluator: Melanie Sorrell Date: 8/16/13

Check One:

1. Holdings are superior _____
2. Holdings are adequate x
3. Holdings are adequate only if Dept. purchases additional items. _____
4. Holdings are inadequate _____

Comments:

This is a proposal for a new graduate level course, which requires one major presentation assignment. Library holdings should be adequate to support student research for this course (see list of items held by subject heading below). Students will have access to relevant databases including PubMed, Science Direct, Web of Science, Science Reference Center, and Wiley Online Library.

LC Subject Heading	Total items held
Experimental design	188 monographs
Biometry	160 monographs
Analysis of variance	102 monographs
Statistical design	104 monographs
Probability	97 monographs
Journal of Research Practice	Journal title
Experimental Biology and Medicine	Journal title

Melanie Sorrell

Evaluator's Signature

8/16/13

Date

University of North Carolina at Charlotte

New: Graduate Course

Title: Establishment of a Graduate Course in Evolutionary Biology

A. Proposal Summary and Catalog Copy

1. **Summary.** The Biology Department proposes to add one new required course to the graduate curriculum: BIOL 6140/8140 Evolutionary Biology.

a. PROPOSED CATALOG COPY

For a new course or revisions to an existing course, check all the statements that apply:

- This course will be cross listed with another course: 6140 and 8140 designations
- There are prerequisites for this course: Admission to graduate school in Biology or permission from the instructor
- There are corequisites for this course.
- This course is repeatable for credit.
- This course will increase/decrease the number of credits hours currently offered by its program.
- This proposal results in the deletion of an existing course(s) from the degree program and/or catalog.

BIOL 6140. Evolutionary Biology. (3) Prerequisite: Admission to the MS in Biology program or permission of Department. Fundamental evolutionary forces of mutation, genetic drift, natural selection, and gene flow; mechanisms generating biological diversity in molecules, genomes, and populations; relationship of micro-evolutionary change and macro-evolutionary patterns. (Spring)

BIOL 8140. Evolutionary Biology. (3) Prerequisite: Admission to the PhD in Biology program or permission of Department. Fundamental evolutionary forces of mutation, genetic drift, natural selection, and gene flow; mechanisms generating biological diversity in molecules, genomes, and populations; relationship of micro-evolutionary change and macro-evolutionary patterns. (Spring)

B. Justification

1. Identify the need addressed by the proposal and explain how the proposed action meets the need.

Graduate students need a thorough understanding of evolutionary biology as part of their training in a biology program. This course will serve to introduce students to the general principles of evolution as well as their application in all facets of biology.

2. Discuss prerequisites/corequisites for courses including class standing.

Admission in the MS or PhD program.

3. Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended.

The numbering for BIOL 6140/8140 was chosen as follows:

- 1st digit: designates graduate level course work (6 open to MS students; 8 open to PhD students)
- 2nd digit: 1 indicates a required core course; 2 indicates a concentration course
- 3rd digit: consistent with established numbering systems:
- 2 - Plant Biology

- 3 - Animal Biology
- 4 - Ecology and Behavior
- 5 - Microbiology/Immunology/Virology
- 6 - Biotechnology
- 7- Physiology
- 8- Developmental Biology
- 9- Anatomy & Morphology

4th digit: at the discretion of the individuals who developed the specific proposals

4. In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction?

This course will introduce students to the principles and practices of evolutionary biology. Currently, students in the Biology graduate programs do not have a formal course in evolution, despite the central position of this discipline in all aspects of biology. Furthermore, during the process of developing Student Learning Outcomes for our graduate programs, we realized that our graduate students often show a limited ability to explain biological phenomena, as well as their own specific research interests, within an evolutionary framework during the candidacy exam. Requiring a graduate-level evolution class of all biology graduate students will help to address this identified deficiency.

C. Impact

1. What group(s) of students will be served by this proposal? Describe how you determined which students will be served.

This course will serve Masters and PhD students in the Department of Biology. The proposed course will become part of the required core curriculum for both the MS and PhD programs and typically the required core is taken only by students who have been admitted into our graduate programs. Nevertheless, the course may also be of potential interest to graduate students in Bioinformatics and Genomics, Chemistry, and Geology and Earth Sciences.

2. What effect will this proposal have on existing courses and curricula?

a. *When and how often will the added course be taught?*

The course will be offered in the spring semester, once each year or once every other year depending on demand.

b. *How will the content and/or frequency of offering of other courses be affected.*

We do not expect this course to influence offering of other courses. We will carefully schedule courses to avoid conflict. We limit our graduate course offerings each semester to prevent scheduling conflicts and to maximize the likelihood that we will have sufficient enrollment for all offered courses to make.

c. *What is the anticipated enrollment in the courses added?*

We anticipate 8-10 students.

d. *How will enrollment in other courses be affected? How did you determine this?*

We do not expect this course to influence offering of other courses. We will carefully schedule courses to avoid conflict.

e. *If the course has been offered previously under special topics numbers, give details of experience including number of times taught and enrollment figures.*

The proposed course has not been offered previously as a Special Topics.

f. *Identify other areas of catalog copy that would be affected, e.g., curriculum outlines, requirements for degree, etc.*

Because the proposed course will become part of the required core for both the PhD and MS programs, the catalog copies for degree requirements will be changed as indicated below (please see also pages 2-4 of the proposal packet). The changes associated with this particular proposed course (BIOL 6140/8140 are shown in red).

PhD in Biology

Total Hours Required

The program requires 72 post-baccalaureate credit hours. All students are required to take a general curriculum that includes a sequence of required courses as shown below.

Required Courses:

- BIOL 8101 Hypothesis Testing (3) (suggested year 1)
- BIOL 8102 Cellular and Molecular Biology (3) (suggested year 1)
- **BIOL 8140 Evolutionary Biology (3) (suggested year 1)**
- Concentration Requirement (suggested year 2):
 - BIOL 8241 Environmental Biology (3) (required for students pursuing the Ecology, Evolution and Environmental Biology or E3B concentration)
 - BIOL 8270 Biological Pathways and Metabolism (3) (required for students pursuing the Molecular, Cellular and Developmental Biology or MCD concentration)
- BIOL 8201 Seminar (2 hours total; 1 hour per year in years 1 and 2)
- BIOL 8280 Careers in Bioscience: Professional Development and Responsible Conduct (2), or GRAD 8002 Responsible Conduct of Research (2), or PHIL 8240 Research Ethics in the Biological and Behavioral Sciences (3) (suggested year 2)

Masters of Science in Biology

Degree Requirements

All M.S. students must complete 30 semester hours of course work approved by the Supervisory Committee, including the following required courses:

- BIOL 6101 Hypothesis Testing (3)
- BIOL 6102 Cellular and Molecular Biology (3)
- **BIOL 6140 Evolutionary Biology (3)**

D. RESOURCES REQUIRED TO SUPPORT PROPOSAL

1. Personnel

a. *New faculty*

No new faculty are required.

b. *Qualified faculty members interested in teaching the course.*

Dr. Bao-Hua Song, Dr. Adam Reitzel, Dr. Matt Parrow, and Dr. Larry Leamy.

2. Physical Facility

None required beyond existing classrooms.

3. Equipment and Supplies

No additional equipment and supplies are required.

4. Computer

No additional computing resources are required.

5. Audio

No equipment or services will be needed from Media Services

6. Other Resources

None

7. Sources of Funding

No new funding required.

E. CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS/UNITS

1. Library Consultation

See page 31

2. Consultation with Other Departments and Units

The entire long-form proposal to change degree requirements and establish the individual courses was distributed to the Departments of Chemistry, Geography and Earth Science, Bioinformatics and Genomics and Genomics, and to each member of the Doctoral Advisory Panel for the Ph.D. in Biology, as described in section E-2, page 12.

F. INITIATION, ATTACHMENTS AND CONSIDERATION OF THE PROPOSAL

1. Originating Unit

The Biology Graduate Faculty approved the proposed course on March 26, 2013.

2. CREDIT HOUR. (Mandatory if new and/or revised course in proposal)

Review statement and check box once completed:

The appropriate faculty committee has reviewed the course outline/syllabus and has determined that the assignments are sufficient to meet the University definition of a [credit hour](#).

The Graduate Committee of the Department of Biology has reviewed the course syllabus for Evolutionary Biology and has approved the new course for 3 credit hours

3. Attachments

a. Consultation with other units

The inputs received from other units for the entire proposal and each individual proposed course are attached (pages)

b. Course syllabus

A sample syllabus is attached (pages 29-30)

4. Student Learning Outcomes

Please indicate what SLOs are supported by this course or courses or whether this curricular change requires a change in SLOs or assessment for the degree program.

SLOs for the Biology MS and PhD programs are listed below. Those highlighted in yellow will be supported by the proposed BIOL 6140/8140 course.

Biology MS Program SLOs	Biology PhD Program SLOs
<p>Candidates for the Masters of Science in Biology (thesis option) are expected to meet the following learning outcomes:</p> <ol style="list-style-type: none"> 1) Demonstrate breadth in knowledge about general biological principles. 2) Demonstrate depth in knowledge about the specific sub-discipline related to the MS thesis research topic. 3) Conduct independent research capable of generating at least one peer- reviewed publication. 4) Develop presentation and communication skills. 	<p>Candidates for the Doctor of Philosophy in Biology are expected to meet the following learning outcomes:</p> <ol style="list-style-type: none"> 1) Demonstrate breadth in knowledge about general biological principles related to the required advanced graduate core courses. 2) Demonstrate depth of knowledge about the specific sub-discipline related to the dissertation research topic. 3) Conduct independent research capable of generating multiple peer-reviewed publications and presentations at national and international meetings. 4) Develop advanced presentation, communication and networking skills.

5. **STUDENT COMPETENCIES:** Graduate students completing BIOL 6140/8140 (Evolutionary Biology) will gain the following competencies:

- An understanding of the fundamental principles and theories in evolutionary biology and their central position in the biological sciences.
- The ability to conduct and evaluate computational and statistical techniques for evolutionary inference.
- Improved skills in oral communication and scientific writing, including grantsmanship.
- The ability to critically analyze and interpret data from the primary scientific literature.
- An understanding of the position of evolutionary biology in general society, including controversies in modern culture.

6. **TEXTBOOK COSTS:** It is the policy of the Board of Governors to reduce textbook costs for students whenever possible. Have electronic textbooks, textbook rentals, or the buyback program been considered and adopted?

The course will use the required text, *The Elements of Evolutionary Genetics*, 1st Ed. B. Charlesworth & D. Charlesworth, Roberts & Company Publishers, 2010. Student will be encouraged to purchase used copies or rent texts when possible. Additional primary literature will be assigned weekly during the semester and made available by the instructor.

Title: Evolutionary Biology

TBD, Instructor (Office Hours by appointment)

BIOL 6140/8140

Time: XXXX Location: Woodward Room XXXX

Credit: 3 hours

(2 Lectures per week)

Course Goals: The intent of this course is to provide Master's and, Ph.D. students with:

- 1) introduction and in-depth understanding of evolutionary biology;
- 2) ability to critically read primary scientific literature;
- 3) comprehension and writing skills developed through a writing assignment summarizing a particular topic in evolutionary biology;
- and
- 4) grant writing skills and strategies by writing a mock grant proposal to the National Science Foundation.

Format: The course will have regularly scheduled classes held twice per week.**Prerequisites:** Admission in the PhD or MS program in Biology or permission of Department**What you will need for this course:** Required textbook (below). Ideally, access to a personal computer for writing assignments.**Grading for the course:** Your course grade will be determined based on three exams and two writing assignments.**Grades for each task will be assigned as follows:**

Exam 1 :	25% of your grade
Exam 2:	25% of your grade
Exam 3:	25% of your grade
Literature Paper:	10% of your grade
Mock Grant Proposal:	15% of your grade

Grading Scheme: A = 90-100, B = 80-89, C = 70-79, U <70**University Integrity Policy:** Students will adhere to the University Integrity standards as described at:<http://legal.uncc.edu/policies/up-407>.**Attendance:** Attendance is highly recommended for all students.**Textbooks:** Required textbook: *Elements of Evolutionary Genetics*, 1st Ed. B. Charlesworth & D. Charlesworth, Roberts & Company Publishers, 2010.

Additional primary literature will be assigned weekly during the semester and made available by the instructor.

Detailed Course Topics and Tasks

Week	Topic	Reading	Tasks
1	Genetic and Phenotypic Variability	Chapter 1	
2	Natural Selection: History, Theory, and Measurement	Chapter 2	
3	Adaptation from Directional Selection	Chapter 3	
4	Mutation: Mechanisms and Consequences	Chapter 4	
5	Evolution of Novelty	Supp Reading	
6	Migration, Gene Flow, and Evolution in Populations of Different Sizes	Chapter 4/5	Exam 1
7	Molecular Evolution	Chapter 6	
8	Molecular Phylogenetics: Methods and Interpretation	Chapter 6; Supp Reading	Literature Paper Due
9	Spatial Population Structure and Adaptation	Chapter 7	
10	Quantitative Genetics: Simple and Complex Phenotypes	Chapter 8	
11	Evolution of Sex and Sex Ratios	Chapter 9	Exam 2
12	Evolution of Complex Life Histories	"	
13	Speciation	Supp Reading	
14	Genome Evolution and Bioinformatics Approaches in Evolution	Chapter 10; Supp Reading	Mock Grant Proposal Due
15	Mathematical Methods in Evolution: The Evolutionary Stable Strategy	"	
			Exam 3



**J. Murrey Atkins Library
Consultation on Library Holdings**

To: Dr. Stan Schneider
From: Dr. Melanie Sorrell
Date: 7/19/13

Subject: BIOL 6140/8140 Evolutionary Biology

Summary of Librarian's Evaluation of Holdings:

Evaluator: Melanie Sorrell Date: 7/19/13

Check One:

5. Holdings are superior _____
 6. Holdings are adequate x
 7. Holdings are adequate only if Dept. purchases additional items. _____
 8. Holdings are inadequate _____

Comments:

This is a proposal for a new graduate level course, which requires major writing assignments. Library holdings should be adequate to support student research for this course (see list of items held by subject heading below). Students will have access to relevant databases including PubMed, Science Direct, Web of Science, Bacteriology Abstracts, and Science Reference Center.

LC Subject Heading	Total items held
Evolutionary genetics	71 monographs
Molecular genetics	232 monographs
Evolutionary science	78 monographs
Natural selection	133 monographs
Swarm and evolutionary computation	Journal title
Molecular genetics and genomics	Journal title
Human molecular genetics	Journal title

Melanie Sorrell

Evaluator's Signature

7/19/13

Date

University of North Carolina at Charlotte

New: Graduate Course

Course and Curriculum Proposal from: Department of Biology

Title: Establishment of a Graduate Course in Environmental Biology

A. Proposal Summary and Catalog Copy

1. **Summary.** The Biology Department proposes to add one new course to the graduate curriculum: BIOL 6241/8241 Environmental Biology.

2. **PROPOSED CATALOG COPY**

For a new course or revisions to an existing course, check all the statements that apply:

This course will be cross listed with another course: 6241 and 8241 designations

There are prerequisites for this course: Admission to graduate school in Biology or permission from the instructor

There are corequisites for this course.

This course is repeatable for credit.

This course will increase/decrease the number of credits hours currently offered by its program.

This proposal results in the deletion of an existing course(s) from the degree program and/or catalog.

BIOL 6241. Environmental Biology. (3) Prerequisite: Admission to the MS in Biology program or permission of Department. An overview of ecological principles as they apply to relationships and interactions between organisms and their environment, with investigation of current research topics and issues related to impacts of human activities on environmental processes. (Fall)

BIOL 8241. Environmental Biology. (3) Prerequisite: Admission to the PhD in Biology program or permission of Department. An overview of ecological principles as they apply to relationships and interactions between organisms and their environment, with investigation of current research topics and issues related to impacts of human activities on environmental processes. (Fall)

B. Justification

1. Identify the need addressed by the proposal and explain how the proposed action meets the need.

The Department of Biology has recently established the Ecology, Evolution, and Environmental Biology (E3B) concentration for our MS and PhD students. Students pursuing this concentration require graduate instruction/training in environmental biology to improve foundational biological understanding and learn specific principles related to their graduate research. Currently, the Department of Biology offers no such course at the graduate level, nor are similar courses providing the necessary level of training currently offered at UNC Charlotte. The proposed action of establishing a new graduate course in Environmental Biology will help meet our educational/professional needs by introducing students to the advanced principles and applications of environmental science as applied to Biology.

2. Discuss prerequisites/corequisites for courses including class standing.

Admission in the MS program for enrollment in BIOL 6241, or admission into the PhD program for enrollment in BIOL 8241. Both BIOL 6241 and BIOL 8241 will be offered as electives for all MS and PhD

students, respectively. However, BIOL 8241 will be a required course for doctoral students choosing to follow the E3B concentration of the Biology PhD program.

Qualified non-degree seeking students may obtain permission by the Department for enrollment, for instance, post-baccalaureate students with prior undergraduate coursework in Ecology, Evolution or Environmental Biology may be admitted into BIOL 6241.

3. Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended.

The numbering for BIOL 6241/8241 was chosen as follows:

1st digit: designates graduate level course work (6 open to MS students; 8 open to PhD students)

2nd digit: 1 indicates a required core course; 2 indicates a concentration course

3rd digit: consistent with established numbering systems:

- 2 - Plant Biology
- 3 - Animal Biology
- 4 - Ecology and Behavior
- 5 - Microbiology/Immunology/Virology
- 6 - Biotechnology
- 7- Physiology
- 8- Developmental Biology
- 9- Anatomy & Morphology

4th digit: at the discretion of the individuals who developed the specific proposals

4. In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction?

The proposed course will introduce students to core and advanced principles and practices of environmental biology. Currently, our program does not have a formal course in Environmental Biology, and our graduate faculty agrees that the proposed course will improve the scope and quality of education in our E3B concentration in particular and in our graduate educational program in general by providing advanced instruction in a critical but currently lacking area of Biology.

The proposed course will help prepare our graduate students for success related to our established **Comprehensive Standard 3.6.1 Post-Baccalaureate Program Rigor Learning Outcome 1: "Demonstrate breadth in knowledge about general biological principles."** Assessment of **learning outcome 1** takes the form of The Candidacy Exam, which focuses on 4 major areas in Biology: Evolution, Cellular Biology & Genetics, Physiology, and Ecology & **Environmental Biology**.

The proposed course is intended to increase graduate student competency to achieve Learning Outcome 1, by providing fundamental knowledge in a major area of Biology (Environmental Biology) identified in our established standards, which is currently lacking as a specific graduate course in our curriculum.

C. Impact

1. What group(s) of students will be served by this proposal? Describe how you determined which students will be served.

This course will serve Masters and PhD students in the Department of Biology. The proposed course will serve as an elective both the MS and PhD programs, and will be required of all doctoral students who choose to pursue the E3B concentration. The course may also be of potential interest to graduate students in the Bioinformatics and Genomics, Chemistry, Geology and Earth Sciences, and Environmental Engineering programs.

2. What effect will this proposal have on existing courses and curricula?

a. *When and how often will the added course be taught?*

The course will be offered in the Fall semester.

b. *How will the content and/or frequency of offering of other courses be affected.*

We do not expect this course to influence offering of other courses. We will carefully schedule courses to avoid conflict. We limit our graduate course offerings each semester to prevent scheduling conflicts and to maximize the likelihood that we will have sufficient enrollment for all offered courses to make.

c. *What is the anticipated enrollment in the courses added?*

We anticipate 8-10 students.

d. *How will enrollment in other courses be affected? How did you determine this?*

Our current graduate course offerings in “environmental” topics are relatively few compared to the number of molecular/cellular courses. However we have a growing number of graduate students engaged in environmentally-related research and training. We do not expect this course to influence enrollment in other courses, since we believe our current offerings underserve our graduate students and no existing course significantly overlaps the topics of the proposed course. We will carefully schedule courses to avoid conflict.

e. *If the course has been offered previously under special topics numbers, give details of experience including number of times taught and enrollment figures.*

The proposed course has not be offered as a special topics class.

f. *Identify other areas of catalog copy that would be affected, e.g., curriculum outlines, requirements for degree, etc.*

Because the proposed course will be required of doctoral students pursuing the E3B concentration, the catalog copies for PhD degree requirements will be changed as indicated below (please see also pages 2-4 of the proposal packet). The changes to the PhD requirements associated with BIOL 8241 are shown below in **red**. BIOL 6241 will be an elective course for MS students and no other areas of catalog copy for the MS degree are affected.

PhD in Biology

Total Hours Required

The program requires 72 post-baccalaureate credit hours. All students are required to take a general curriculum that includes a sequence of required courses as shown below.

Required Courses:

- BIOL 8101 Hypothesis Testing (3) (suggested year 1)
- BIOL 8102 Cellular and Molecular Biology (3) (suggested year 1)
- BIOL 8140 Evolutionary Biology (3) (suggested year 1)

- Concentration Requirement (suggested year 2):
 - BIOL 8241 Environmental Biology (3) (required for students pursuing the Ecology, Evolution and Environmental Biology or E3B concentration)
 - BIOL 8270 Biological Pathways and Metabolism (3) (required for students pursuing the Molecular, Cellular and Developmental Biology or MCD concentration)
- BIOL 8201 Seminar (2 hours total; 1 hour per year in years 1 and 2)
- BIOL 8280 Careers in Bioscience: Professional Development and Responsible Conduct (2), or GRAD 8002 Responsible Conduct of Research (2), or PHIL 8240 Research Ethics in the Biological and Behavioral Sciences (3) (suggested year 2)

D. RESOURCES REQUIRED TO SUPPORT PROPOSAL

1. Personnel

a. *New faculty*

No new faculty are required.

b. *Qualified faculty members interested in teaching the course.*

Dr. Amy Ringwood, Dr. Inna Sokolova, Dr. Molly Redmond, Dr. Matt Parrow.

2. Physical Facility

None required beyond existing classrooms.

3. Equipment and Supplies

No additional equipment and supplies are required.

4. Computer

No additional computing resources are required.

5. Audio

No equipment or services will be needed from Media Services

6. Other Resources

None.

7. Sources of Funding

No new funding required.

E. CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS/UNITS

1. Library Consultation

See attached (page 41)

2. Consultation with Other Departments and Units

The entire long-form proposal to change degree requirements and establish the individual courses was distributed to the Departments of Chemistry, Geography and Earth Science, Bioinformatics and Genomics and

Genomics, and to each member of the Doctoral Advisory Panel for the Ph.D. in Biology, as described in section E-2, page 12.

F. INITIATION, ATTACHMENTS AND CONSIDERATION OF THE PROPOSAL

1. Originating Unit

The Biology Graduate Faculty approved the proposed course on March 26, 2013.

2. CREDIT HOUR. (Mandatory if new and/or revised course in proposal)

Review statement and check box once completed:

The appropriate faculty committee has reviewed the course outline/syllabus and has determined that the assignments are sufficient to meet the University definition of a [credit hour](#).

The Graduate Committee of the Department of Biology has reviewed the course syllabus for Environmental Biology and has approved the new course for 3 credit hours

3. Attachments

a. *Consultation with other units*

The entire long-form proposal to change degree requirements and establish the individual courses was distributed to the Departments of Chemistry, Geography and Earth Science, Bioinformatics and Genomics, and to each member of the Doctoral Advisory Panel for the Ph.D. in Biology, as described in section E-2, page 12. We received written input from Bioinformatics and Genomics, Engineering, Kinesiology, and Physics & Optical Science (see attachment), all of whom support the proposed changes and the proposed courses.

Dr. Craig Allen, Dept. of Geography and Earth Science, met with members of the Graduate Committee of the Department of Biology on Sept. 27 and expressed concerns that some of the content proposed for BIOL 6241/8241 Environmental Biology may overlap with **ESCI 6202/INES8090 Earth Systems Analysis and Biogeochemical Cycles**. Although no written concerns were provided, Dr. Allen did provide the syllabus for ESCI 6202/INES 8090. As with our proposed course, ESCI 6202/INES 8090 also covers biogeochemical cycles (i.e. nitrogen cycle; carbon cycle), as well as anthropogenic effects on the environment (i.e. human activity and climate change). However, we do not see this as redundancy of coverage. Courses in related disciplines often cover similar broad topics, but do so in a manner geared toward a particular student audience. Our proposed Environmental Biology course is geared toward graduate students in the biological sciences, especially those in the Ecology, Evolution and Environmental Biology concentration of the program, whereas ESCI 6202/INES 8090 is geared toward students in geography and earth science. Similarly, many graduate programs at UNCC (including Biology and Geography & Earth Sciences) offer statistics courses that cover many of the same statistical tests and procedures. However, each is geared toward students and research practices within a particular discipline. Also, we have several faculty in Biology (Dr. Martin Klotz; Dr. Inna Sokolova; Dr. Amy Ringwood; Dr. Matthew Parrow; Dr. Adam Reitzel; Dr. Bao-Hua Song) whose research deals directly with nutrient cycling and/or anthropogenic effects on biological systems. The students of these faculty in particular, and our E3B graduate students in general, must have access to this faculty expertise in the form of formal coursework. Dr. Allen also expressed concerns about overlap between our proposed graduate-level Environmental Biology course and several Geography and Earth Science courses at the 4000/5000 level. We find these concerns puzzling. We would not allow our graduate students to satisfy the proposed area requirement with a 4000/5000 level course. Also, our proposed Environmental Biology course has broad topic overlap with several of our *own* BIOL 4000/5000 courses, just as our graduate level physiology, genetics, cellular and statistical courses have broad topic overlap with our own courses at the 4000/5000 level, and we feel confident this sort of “overlap” occurs in virtually all programs. While there may be overlap for general topics, the actual material covered in BIOL 6241/8241 will

be at the advanced graduate level, with a corresponding emphasis on the current literature, experimental design, data analysis and interpretation, synthesis and application.

b. *Course syllabus*

A sample syllabus is attached (pages 39-41)

4. **Student Learning Outcomes**

Please indicate what SLOs are supported by this course or courses or whether this curricular change requires a change in SLOs or assessment for the degree program.

SLOs for the Biology MS and PhD programs are listed below. Those highlighted in yellow will be supported by the proposed BIOL 6241/8241 course.

Biology MS Program SLOs	Biology PhD Program SLOs
<p>Candidates for the Masters of Science in Biology (thesis option) are expected to meet the following learning outcomes:</p> <ol style="list-style-type: none"> 1) Demonstrate breadth in knowledge about general biological principles. 2) Demonstrate depth in knowledge about the specific sub-discipline related to the MS thesis research topic. 3) Conduct independent research capable of generating at least one peer-reviewed publication. 4) Develop presentation and communication skills. 	<p>Candidates for the Doctor of Philosophy in Biology are expected to meet the following learning outcomes:</p> <ol style="list-style-type: none"> 1) Demonstrate breadth in knowledge about general biological principles related to the required advanced graduate core courses. 2) Demonstrate depth of knowledge about the specific sub-discipline related to the dissertation research topic. 3) Conduct independent research capable of generating multiple peer-reviewed publications and presentations at national and international meetings. 4) Develop advanced presentation, communication and networking skills.

5. **STUDENT COMPETENCIES:** Graduate students completing BIOL 6241/8241 (Environmental Biology) will gain the following competencies:

- An understanding of how fundamental ecological principles can be applied scientifically to quantify relationships and interactions between organisms and their environment.
- The ability to critically analyze and interpret data from original research papers and relate such findings to current issues surrounding the impact of human activities on the environment.
- The ability to distinguish scientifically-justifiable observations and conclusions from popular media interpretations of environmental issues.
- An understanding of the interplay between science and society in human affairs that impact the environment.
- Improved skills in the scholarship of scientific writing, including literature review, thesis construction, and grant writing.

6. **TEXTBOOK COSTS:** It is the policy of the Board of Governors to reduce textbook costs for students whenever possible. Have electronic textbooks, textbook rentals, or the buyback program been considered and adopted?

The course will use the required text:

- *Environmental Science: Foundations and Applications*, 1st Ed. A. Friedland et al., W.H. Freeman Press, 2012:
<http://www.whfreeman.com/Catalog/product/environmentalsciencefoundationsandapplications-firstedition-friedland>
- *Community Ecology*, 1st Ed. G.G. Mittelbach, Sinauer Publishers, 2012:
<http://www.sinauer.com/detail.php?id=5093>
- *Other Resources*: scientific literature; natural resource, government, and educational websites as provided.

Student will be encouraged to purchase used texts or rent texts when possible.

Title: *Environmental Biology*

TBD, Instructor (Office Hours by appointment)

BIOL 6241/8241

Time: XXXX Location: Woodward Room XXXX

Credit: 3 hours

(2 Lectures per week)

Course Description: This course presents an overview of ecological principles as they apply to relationships and interactions between organisms and their environment. Specific emphasis will be placed on the biological processes that govern the distribution of organisms and the flow of energy and nutrients through the environment in space and time. Current research topics and emerging issues related to impacts of human activities on global and biological processes will be investigated and discussed.

Course Objectives: At the end of the course, students will be expected to understand the fundamental forces that govern the distribution of life in ecosystems and the interactions between biotic and abiotic processes that modulate the structure and function of local and global environments. An appreciation of the effects of recent human activities on these processes will also be gained.

Specific objectives include:

- 1) Tracing biogeochemical nutrient cycles as they affect the composition and balance of the biotic and abiotic environment
- 2) Tracing energy flow into life, and through food chains and food webs in relation to their natural habitats and the ecosystem they form
- 3) Understanding the growth of populations and the factors influencing abundance and distribution of organisms
- 4) Understanding major biotic communities and their interrelationships within ecosystems.
- 5) Relating the environment with human activities and their influence on one another
- 6) Appreciating the scope of current environmental problems such as climate change, loss in biodiversity, degradation of the environment, toxicology and environmental health.

Prerequisites: Admission to the PhD or MS program in Biology or permission of Department

Grading for the course: Your course grade will be determined based on 3 Exams and 1 writing assignments (Literature Review Paper for Masters Students, Mock Grant Proposal for PhD Students).

The grading structure (below) places higher standards of competency on PhD students (enrolled in 8241), as they will be expected to prepare an NSF-style mock grant proposal on an environmental biology topic that combines literature review with original hypotheses and experimental design (no budget required). Masters students will be expected to prepare a literature review synthesis (ca. 10 page) on a chosen topic in environmental biology.

Grades for each task will be assigned as follows:

Exam 1:	25% of grade
Exam 2:	25% of grade

Exam 3:	25% of grade
Literature Paper (MS students):	25% of grade
Mock Grant Proposal (PhD students):	25% of grade

Grading Scheme: A = 90-100, B = 80-89, C = 70-79, U < 70 with final course scores rounded up if >0.5

University Integrity Policy: Students will adhere to the University Integrity standards as described at: <http://legal.uncc.edu/policies/up-407>.

Attendance: Attendance is required for all students, exceptions must be approved in advance by the instructor.

Required Resources:

1. *Environmental Science: Foundations and Applications*, 1st Ed. A. Friedland et al., W.H. Freeman Press, 2012: <http://www.whfreeman.com/Catalog/product/environmentalsciencefoundationsandapplications-firstedition-friedland>

2. *Community Ecology*, 1st Ed. G.G. Mittelbach, Sinauer Publishers, 2012: <http://www.sinauer.com/detail.php?id=5093>

3. *Other Resources:* scientific literature; natural resource, government, and educational websites as provided.

Detailed Course Topics and Tasks

Week	Topic	Reading	Tasks
1-2	Biological Productivity and Energy Flow <ul style="list-style-type: none"> Sources of energy for life (light versus chemical bond energy) Primary and secondary productivity, trophies and trophic levels Energy flow through ecosystems, sources and sinks 	1. Chapters 1-2	
3-4	Nutrient Cycles <ul style="list-style-type: none"> C, N, P, S, metal cycles Major reservoirs and processes Metabolomics 	1. Chapter 3, 8	
5-6	Biological Diversity <ul style="list-style-type: none"> Major groups of life Species concepts Biodiversity as factor in ecological stabilization Threats to biodiversity 	1. Chapter 5 2. Chapter 2	Exam 1
7-8	Ecosystems and Communities	1. Chapter 4	

	<ul style="list-style-type: none"> Major ecosystems – coastal ocean, open ocean, deep ocean, terrestrial, freshwater Tolerance limits Food webs and Species interactions Ecological succession Invasive species 	2. Chapter 3	
9-10	Population Biology <ul style="list-style-type: none"> Dynamics of population growth – doubling times and exponential growth Biotic potential and carrying capacity Factors that regulate (cell and population) growth 	1. Chapter 6 2. Chapter 4, 7	Exam 2
11-12	Pollution, Toxicology, and Environmental Health <ul style="list-style-type: none"> Major metal and organic pollutants – sources, sinks and biological activities Endocrine disruptors and emerging pollutants Dose response, acute and chronic effects Environmental Disasters and Long Term Impacts 	1. Chapter 14-17	
13-14	Climate and Global Warming <ul style="list-style-type: none"> Greenhouse gases and effect on climate Changes in biosphere – migration and extinctions Marine Ecosystems - Hypoxia and Acidification 	1. Chapter 19	Writing Assignment Due
15-16	Sustainable Ecosystems and the Future <ul style="list-style-type: none"> Fisheries and population sustainability Conservation Biology Biofuels and renewable resources 	1. Chapter 18, 20	Exam 3



J. Murrey Atkins Library

Consultation on Library Holdings

To: Dr. Stan Schneider
From: Dr. Melanie Sorrell

Date: 7/18/13

Subject: **BIOL 6241/8241 Environmental Biology**

Summary of Librarian's Evaluation of Holdings:

Evaluator: Melanie Sorrell Date: 7/18/13

Check One:

9. Holdings are superior _____
10. Holdings are adequate x
11. Holdings are adequate only if Dept. purchases additional items. _____
12. Holdings are inadequate _____

Comments:

This is a proposal for a new graduate level course, which requires one major writing assignment. Library holdings should be adequate to support student research for this course (see list of items held by subject heading below). Students will have access to relevant databases including Environment Complete, PubMed, Science Direct, Web of Science, and Science Reference Center.

LC Subject Heading	Total items held
Biotic communities	261 monographs
Ecological communities	31 monographs
Biodiversity conservation	212 monographs
Ecology= Research	5,519 monographs
Biodiversity and Conservation	Journal title
Ecosystems	Journal title
Environmental Bioindicators	Journal title

— *Melanie Sorrell* _____
Evaluator's Signature

7/18/13

Date

University of North Carolina at Charlotte

New: Graduate Course

Course and Curriculum Proposal from: Department of Biology

Title: Establishment of a Graduate Course in Biological Pathways & Metabolism

A. Proposal Summary and Catalog Copy

1. **Summary.** The Biology Department proposes to add one new required course to the graduate curriculum: BIOL 6270/8270 Biological Pathways & Metabolism.

3. PROPOSED CATALOG COPY

For a new course or revisions to an existing course, check all the statements that apply:

This course will be cross listed with another course: 61270 and 8270 designations

There are prerequisites for this course: Admission to graduate school in Biology or permission from the instructor

There are co-requisites for this course.

This course is repeatable for credit.

This course will increase/decrease the number of credits hours currently offered by its program.

This proposal results in the deletion of an existing course(s) from the degree program and/or catalog.

BIOL 6270. Biological Pathways & Metabolism. Prerequisite: Admission to the MS in Biology program or permission of Department. An overview of biological pathways and metabolism principles as they apply to cell biology, relationships and interactions between cell and/or organisms and their environment, with investigation of current research topics. (Spring)

BIOL 8270. Biological Pathways & Metabolism. Prerequisite: Admission to the PhD in Biology program or permission of Department. An overview of biological pathways and metabolism principles as they apply to cell biology, relationships and interactions between cell and/or organisms and their environment, with investigation of current research topics. (Spring)

B. Justification

1. Identify the need addressed by the proposal and explain how the proposed action meets the need.

Modern experimental biology is becoming ever more dependent on a clear understanding of the use of metabolites and the cellular and molecular pathways involved. Although undergraduate courses including the cell biology course are requirements for admission to our graduate programs, very few of our students come to us with a clear understanding of the biological pathways and metabolism critical to the understanding and analyses of the multiple biological research areas developed in the department and entities partnering with the department. In addition, few undergraduate programs provide detailed and comprehensive essential information on metabolic pathways. Finally, a major unifying theme of the Biology is the role of evolution in the development of biological regulatory mechanisms. There is no current graduate course with an evolutionary emphasis related to biological molecules and metabolic regulation. Therefore, there is clear need for a course providing an integrative view of the biological pathways and metabolism critical for any graduate students that in the course of her/his research project must develop or implement biological assays that rely on metabolic pathways. The course is also essential to students whose research projects directly involve the analyses of one or more specific metabolic or metabolic-related pathway(s). Further, all graduate students in biological-sciences related programs will benefit from an in-depth exposure to principles of biological pathways and metabolism. The Biological

Pathways and Metabolism course will be a concentration course required of all doctoral students pursuing the concentration in Molecular, Cellular and Developmental Biology, and will serve as an elective to all other graduate students in Biology.

2. Discuss prerequisites/co-requisites for courses including class standing.

Admission in the MS or PhD in Biology programs.

3. Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended.

The numbering for BIOL 6270/8270 was chosen as follows:

1st digit: designates graduate level course work (6 open to MS students; 8 open to PhD students)

2nd digit: 1 indicates a required core course; 2 indicates a concentration course

3rd digit: consistent with established numbering systems:

- 2 - Plant Biology
- 3 - Animal Biology
- 4 - Ecology and Behavior
- 5 - Microbiology/Immunology/Virology
- 6 - Biotechnology
- 7- Physiology
- 8- Developmental Biology
- 9- Anatomy & Morphology

4th digit: at the discretion of the individuals who developed the specific proposals

4. In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction?

As a concentration course required for all PhD students pursuing the Molecular, Cellular and Developmental Biology concentration, and as an elective course for all other graduate students, Biological Pathways & Metabolism will provide training for all of our students in the fundamental principles governing structure and function of biological molecules in the context of cell physiology, the evolutionary diversity of biological solutions, the current methods in biochemistry and biophysics used to study the structure and function of biological molecules, and the problem-solving skills in applying biochemical knowledge to problems, examples and case studies in cell physiology. In addition, an important component of the course is the presentation by the students of critical analyses of the relevant articles from the current biological literature.

Please note that Biological Pathways & Metabolism is a new graduate course that arose from curriculum discussions of the Biology Graduate Faculty and was developed by a resulting ad-hoc committee. Although the course is designed as a required concentration course for students pursuing the MCD concentration, many MS and PhD students will be encouraged to take Biological Pathways & Metabolism as an elective course a solid basis in their research endeavors. The course is expected to contribute to the scope, quality and efficiency of our graduate programs in biology.

C. Impact

1. What group(s) of students will be served by this proposal? Describe how you determined which students will be served.

This course will serve Biology Masters and PhD students as a concentration course. Typically, the concentration courses for our graduate programs are taken only by students who have been admitted into the MS and PhD programs in Biology. Nevertheless, the course may be taken by graduate students from other programs and may serve graduate students in Bioinformatics and Genomics, Kinesiology, and Chemistry.

2. What effect will this proposal have on existing courses and curricula?

a. *When and how often will the added course be taught?*

The course will be offered once each year in the Spring semester.

b. *How will the content and/or frequency of offering of other courses be affected.*

No effects on other courses are foreseen. Biological Pathways and Metabolism is the only concentration graduate course offered by Biology that covers metabolic pathways in depth with emphasis on the evolutionary aspects of cellular regulation, complementing the newly proposed core course BIOL 6140/8140 Evolutionary Biology. The focus of the Biological Pathways and Metabolism course on evolutionary aspects of cellular regulation markedly differs from current offerings, although a few topics are also covered in a Biochemistry course taught by the Chemistry department. We will carefully schedule Biological Pathways and Metabolism to prevent time conflicts with other courses.

c. *What is the anticipated enrollment in the courses added?*

Anticipated enrollment will depend on the number of graduate students in our programs. Students typically will take Biological Pathways & Metabolism in their first or second year of study. Past experience suggest a typical enrollment of 6-10 students per year for the course.

d. *How will enrollment in other courses be affected? How did you determine this?*

Since this class will be required for the MCD concentration students and will also serve many of the EEE concentration PhD students and MS students and does not duplicate any existing course, no effect is anticipated. Because we will schedule the class to prevent conflicts with other courses, Biological Pathways and Metabolism should not influence enrollment in other graduate courses.

e. *If the course has been offered previously under special topics numbers, give details of experience including number of times taught and enrollment figures.*

Biological Pathways and Metabolism is a new course and has not been taught previously

f. *Identify other areas of catalog copy that would be affected, e.g., curriculum outlines, requirements for degree, etc.*

Because the proposed course will become part of the concentration courses for both the PhD and MS programs, the catalog copies for degree requirements will be changed as indicated below (please see also pages 2-4 of the proposal packet). The changes associated with BIOL 8270 are shown below in red. BIOL 6270 will be an elective course for MS students and thus no additional catalog changes are needed other than the course description listed above.

PhD in Biology

Total Hours Required

The program requires 72 post-baccalaureate credit hours. All students are required to take a general curriculum that includes a sequence of required courses as shown below.

Required Courses:

- BIOL 8101 Hypothesis Testing (3) (suggested year 1)

- BIOL 8102 Cellular and Molecular Biology (3) (suggested year 1)
- BIOL 8140 Evolutionary Biology (3) (suggested year 1)
- Concentration Requirement (suggested year 2):
 - BIOL 8241 Environmental Biology (3) (required for students pursuing the Ecology, Evolution and Environmental Biology or E3B concentration)
 - **BIOL 8270 Biological Pathways and Metabolism (3) (required for students pursuing the Molecular, Cellular and Developmental Biology or MCD concentration)**
- BIOL 8201 Seminar (2 hours total; 1 hour per year in years 1 and 2)
- BIOL 8260 Careers in Bioscience: Professional Development and Responsible Conduct (2), or GRAD 8002 Responsible Conduct of Research (2), or PHIL 8240 Research Ethics in the Biological and Behavioral Sciences (3) (suggested year 2)

D. RESOURCES REQUIRED TO SUPPORT PROPOSAL

1. Personnel

a. *New faculty*

No new faculty is required.

b. *Qualified faculty members interested in teaching the course.*

Instruction will be by existing tenure-track faculty. To provide graduate students with in depth knowledge on the topics developed, the course will likely be team-taught by a team of 3-4 instructors. The course will draw especially but not solely on expertise from Drs. Clemens, Dréau, Grdzlishvili, Reitzel, Richardson, Sokolova and Yan.

2. Physical Facility

None required beyond existing classrooms.

3. Equipment and Supplies

No additional equipment and supplies are required.

4. Computer

No additional computing resources are required.

5. Audio

No additional equipment or services will be needed from Media Services. Standard classroom podium is adequate.

6. Other Resources

None

7. Sources of Funding

No new funding required.

E. CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS/UNITS

1. Library Consultation

Attached (page 51)

2. Consultation with Other Departments and Units

The entire long-form proposal to change degree requirements and establish the individual courses was distributed to the Departments of Chemistry, Geography and Earth Science, Bioinformatics and Genomics and Genomics, and to each member of the Doctoral Advisory Panel for the Ph.D. in Biology, as described in section E-2, **page 12**.

F. INITIATION, ATTACHMENTS AND CONSIDERATION OF THE PROPOSAL

1. Originating Unit

The Biology Graduate Faculty approved the proposed course on March 26, 2013.

2. CREDIT HOUR. (Mandatory if new and/or revised course in proposal)

Review statement and check box once completed:

The appropriate faculty committee has reviewed the course outline/syllabus and has determined that the assignments are sufficient to meet the credit hour definition of the University.

The Graduate Committee of the Department of Biology has reviewed the course syllabus for Biological Pathways & Metabolism and has approved the new course for 3 credit hours

3. Attachments

a. *Consultation with other units*

The input received from other units for the entire proposal and each individual proposed course are attached (pages)

b. *Course syllabus*

A sample syllabus is attached (pages 48-50)

4. Student Learning Outcomes

Please indicate what SLOs are supported by this course or courses or whether this curricular change requires a change in SLOs or assessment for the degree program.

SLOs for the Biology MS and PhD programs are listed below. Those highlighted in yellow will be supported by the proposed BIOL 6270/8270 course.

Biology MS Program SLOs	Biology PhD Program SLOs
<p>Candidates for the <i>Masters of Science in Biology</i> (thesis option) are expected to meet the following learning outcomes:</p> <p>1) Demonstrate breadth in knowledge about general biological principles.</p> <p>2) Demonstrate depth in knowledge about the specific sub-discipline related to the MS thesis research topic.</p> <p>3) Conduct independent research capable of generating at least one peer-reviewed publication.</p> <p>4) Develop presentation and communication skills.</p>	<p>Candidates for the <i>Doctor of Philosophy in Biology</i> are expected to meet the following learning outcomes:</p> <p>1) Demonstrate breadth in knowledge about general biological principles related to the required advanced graduate core courses.</p> <p>2) Demonstrate depth of knowledge about the specific sub-discipline related to the dissertation research topic.</p> <p>3) Conduct independent research capable of generating multiple peer-reviewed publications and presentations at national and international meetings.</p> <p>4) Develop advanced presentation, communication and networking skills.</p>

6. **STUDENT COMPETENCIES:** Graduate students completing BIOL 6270/8270 will gain the following competencies related to professional development:

- Have an understanding of the fundamental principles governing structure and function of biological (macro) molecules in the context of cell physiology
- Be able to demonstrate evolutionary diversity of biological solutions to common problems
- Be able to discuss current methods in biochemistry and biophysics used to study the structure and function of biological molecules and their regulation
- Have developed the problem-solving skills in applying biochemical knowledge to problems, examples and case studies in cell biology
- An understanding of the limitations of various experimental approaches.
- The ability to critically analyze experimental design of original research papers from the biological literature.
- The ability to present an analysis of experimental design in a clear and concise manner to an audience of biologists with diverse backgrounds.

6. **TEXTBOOK COSTS:** It is the policy of the Board of Governors to reduce textbook costs for students whenever possible. Have electronic textbooks, textbook rentals, or the buyback program been considered and adopted?

The course uses the textbooks **Biochemistry** Jeremy M. Berg , John L. Tymoczko , Lubert Stryer (7th Ed W. H. Freeman editor 2010 **ISBN-10:** 1429229365 **ISBN-13:** 978-1429229364) or **Lehninger Principles of Biochemistry** David L. Nelson, Michael M. Cox (6th Ed., W.H. Freeman editor 2012 **ISBN-10:** 1429234148 **ISBN-13:** 978-1429234146). Students are encouraged to purchase used copies or rent the text when possible. Other materials are provided through Moodle.

BIOLOGY 6270/8270 – Biological Pathways & Metabolism

Overall goals of the course:

The following are the main objectives of this in-depth course:

- 1) Provide an overview of biochemical principles focusing on those topics that are most likely to be applicable to the students' research, based on the diversity of research topics in the department;
- 2) Give students up-to-date information on the current techniques in biochemical analyses including methods that apply biochemical principles for detection and characterization of biological molecules (such as enzymatic assays, PCR, ELISA);
- 3) Offer elements of comparative biochemistry and illustrate evolutionary diversity as well as conservation of the major biochemical pathways;

Specifically the students should

- Have developed an understanding of the fundamental principles governing structure and function of biological (macro) molecules in the context of cell physiology
- Be able to demonstrate evolutionary diversity as well as conservation of biological solutions to common problems
- Be able to discuss current methods in biochemistry and biophysics used to study the structure and function of biological molecules
- Have developed the problem-solving skills in applying biochemical knowledge to problems, examples and case studies in cell physiology.

Overall format: The emphasis of this course will be on both the understanding and knowledge of the metabolic pathways and of current biochemical principles and techniques commonly used in Biology. The format will be primarily lecture at the beginning with student presentations toward the end of the semester. In the lectures, students are expected to be active participants. The dates and topics listed below are tentative and subject to change depending on how much time we need for each topic.

Prerequisites: Admission to the PhD or MS program in Biology or permission of Department

Textbook(s): Either of the following textbook will serve as reference of the course:

Biochemistry Jeremy M. Berg, John L. Tymoczko, Lubert Stryer; (7th Ed) W. H. Freeman editor 2010 **ISBN-10:** 1429229365 **ISBN-13:** 978-1429229364

Lehninger Principles of Biochemistry David L. Nelson, Michael M. Cox (6th Ed) W.H. Freeman editor 2012 **ISBN-10:** 1429234148 **ISBN-13:** 978-1429234146

Electronic and earlier editions of these textbooks may also be appropriate please contact the instructor for further detail regarding that option.

Please note that the purpose of the course is not to cover everything that is in the textbook. Rather the textbook(s) should be viewed as a reference and support material for the course. Furthermore, additional material will be posted on Moodle.

Homework: You will regularly be given homework assignments with a specific due date. Assignments must be turned in through Turnitin on the due date. The homework will count for a total of 100 points.

Grading

Final grades in Metabolism will be based on 300 total possible points from 3 exams (each worth 100 points) plus 100 points from an oral presentation/participation, and another 100 points from homework assignments = 500 total points.

Grading Scheme: A = 100-90, B = 89-80, C = 79-70, U < 70

Oral Presentation Guidelines

Presentations should be timed to last no more 20 minutes so that at least 15 minutes are available for questions. All presentations should be given using MS PowerPoint with a **limit of 15 slides** for each presentation. Please email me your pptx file at least one day prior to the presentation for loading on Moodle giving access to all. In these presentations, you will be to outline the metabolic pathways involved and the techniques used in either experiments you are conducting, planning to conduct or extracted from the current literature.

All presentations should follow the following format:

- Background
- Metabolic pathways involved
- Experimental Design
- Results/Expectations
- Conclusions/future directions

All presenters should be willing to entertain questions from other students at any time. In addition, all students will be asked to rate each presenter using a standard form that will be provided.

Academic Integrity: Students have the responsibility to know and observe the requirements of the UNCC Code of Student Academic Integrity, outlined in the catalog and summarized below:

CODE OF STUDENT ACADEMIC INTEGRITY

THE UNC CHARLOTTE CODE OF STUDENT ACADEMIC INTEGRITY governs the responsibility of students to maintain integrity in academic work, defines violations of the standards, describes procedures for handling alleged violations of the standards, and lists applicable penalties. The following conduct is prohibited in that Code as violating those standards:

- A. Cheating. Intentionally using or attempting to use unauthorized materials, information, notes, study aids or other devices in any academic exercise. This definition includes unauthorized communication of information during an academic exercise.
- B. Fabrication and Falsification. Intentional and unauthorized alteration or invention of any information or citation in an academic exercise. Falsification is a matter of altering information, while fabrication is a matter of inventing or counterfeiting information for use in any academic exercise.
- C. Multiple Submission. The submission of substantial portions of the same academic work (including oral reports) for credit more than once without authorization.
- D. Plagiarism. Intentionally or knowingly presenting the work of another as one's own (i.e., without proper acknowledgment of the source). The sole exception to the requirement of acknowledging sources is when the ideas, information, etc., are common knowledge.
- E. Abuse of Academic Materials. Intentionally or knowingly destroying, stealing, or making inaccessible library or other academic resource material.
- F. Complicity in Academic Dishonesty. Intentionally or knowingly helping or attempting to help another to commit an act of academic dishonesty.

A full explanation of these definitions, and a description of procedures used in cases where student violations are alleged, is found in the complete text of The UNC Charlotte Code of Student Academic Integrity. This Code may be modified from time to time. Students are advised to contact the Office of the Dean of Students or go online to ensure they consult the most recent edition.

Week Topic

Week #1	Biochemical evolution and diversity (introduction)
Week #2	Nucleic acids structure and synthesis
Week #3	Protein structure and function
Week #4	Enzymes/ catalysis/ kinetics
Week #5	Protein interactions

1st exam

Week 6	Membrane proteins (including channels and receptors) I
Week 7	Antibodies & Antigens
Week #8	Hormones & Hormone receptors
Week#9	Transcription factors / cell signaling
Week #10	Redox signaling and cell defense mechanisms

2st exam

Week#11	Energy metabolism
Week#12	Alternative pathways of energy transduction (evolutionary and functional diversity of energy metabolism)
Week#13	Aerobic / anaerobic metabolism; alternate electron acceptors
Week#14	Adenylates and other high-energy phosphates
Week#15	Carbohydrate/lipid metabolism

Final Exam

Students' presentations will start on week#6



J. Murrey Atkins Library

Consultation on Library Holdings

To: Dr. Stan Schneider

From: Dr. Melanie Sorrell

Date: 9/12/13

Subject: BIOL 6270/8270: Biological Pathways and Metabolism

Summary of Librarian's Evaluation of Holdings:

Evaluator: Melanie Sorrell **Date:** 9/12/13

Check One:

1. Holdings are superior
2. Holdings are adequate
3. Holdings are adequate only if Dept. purchases additional items.
4. Holdings are inadequate

Comments:

This is a proposal for a new graduate level course, which includes application of knowledge to a research project, a presentation, critical analysis of original research publications, and homework assignments. Library holdings should be adequate to support student research for this course (see list of items held by subject heading below). Students will have access to relevant databases including Biological Sciences, PubMed, Science Direct, Web of Science, Springer Link, and Science Reference Center.

LC Subject Heading	Total items held
Biochemistry	498 monographs
Microbial metabolism	16 monographs
Biophysics	144 monographs
Polymerase chain reaction	15 monographs
Analytical Biochemistry	Journal title
BMC Biochemistry	Journal title
Experimental Cell Research	Journal title

Melanie Sorrell

Evaluator's Signature

9/12/13

Date

University of North Carolina at Charlotte

New: Graduate Course

Proposal from: Department of Biology

Title: Establishment of a new course, **BIOL 6260/8260 *Careers in Bioscience: Professional Development and Responsible Conduct***

A. Proposal Summary and Catalog Copy

1. SUMMARY.

The Biology Department proposes a new course, **BIOL 6260/8260 *Careers in Bioscience: Professional Development and Responsible Conduct*** that will provide Biology MS and PhD students with professional skills for developing successful careers in the biological sciences, as well as qualify for the Broadening Experiences in Scientific Training (BEST) initiatives and satisfy the Responsible Conduct in Research (RCR) requirements. This new course has been taught each year for the past 7 years as a BIOL 8000 special topics class entitled "How to be a Professional Scientist". One purpose of this new course is to make it inclusive to the professional development of Master's students (6000 level), as well as Ph.D. students and postdoctoral fellows (8000 level) in the Biosciences. Presently no such course for MS students exists on the UNCC campus.

If the course is approved, we will petition the Graduate School to have it approved as a substitute for GRAD 8002 Responsible Conduct of Research and PHIL 8240 Research Ethics in the Biological and Behavioral Sciences, which are currently required of all STEM doctoral students. This will provide our students with additional avenues for meeting current RCR requirements.

2. PROPOSED CATALOG COPY

For a new course or revisions to an existing course, check all the statements that apply:

This course will be cross listed with another course: 6260 and 8260 designations

There are prerequisites for this course: Admission to graduate school in Biology or permission from the instructor

There are corequisites for this course.

This course is repeatable for credit.

This course will increase/decrease the number of credits hours currently offered by its program.

This proposal results in the deletion of an existing course(s) from the degree program and/or catalog.

BIOL 6260. *Careers in Bioscience: Professional Development and Responsible Conduct (2)* Hybrid course composed of class meetings and MOODLE tasks. Prerequisites: Admission to MS in Biology program or permission of Department. Professional development for Master's students. The focus will be on teaching toward the Broadening Experiences in Scientific Training (BEST) initiative and the Responsible Conduct of Research (RCR) directive. *(Fall or Spring)*

BIOL 8260. *Careers in Bioscience: Professional Development and Responsible Conduct (2)* Hybrid course composed of class meetings and MOODLE tasks. Prerequisites: Admission to the PhD in Biology program or permission of Department. Professional development for Ph.D. students and postdoctoral fellows. The focus will be on teaching toward the Broadening Experiences in Scientific Training (BEST) initiative and the Responsible Conduct of Research (RCR) directive. *(Fall or Spring)*

B. JUSTIFICATION

1. Identify the need addressed by the proposal and explain how the proposed action meets the need.

Federal granting agencies (e.g. NIH) are beginning to formalize requirements for Professional Development. One such initiative, designated the “**Broadening Experiences in Scientific Training (BEST)**” program, is described in detail in two attached PDF documents (see BEST_grant and BESTreport). Providing graduate students and postdoctoral fellows with formalized training focused on professional development are not only necessary goals for competitive employment in the Biosciences, but documenting such efforts will become a necessity in the near future. This need for such education, coupled with federal initiatives that are developing, make establishing a new course timely and necessary. Furthermore, since many of the topics presently required for Responsible Conduct in Research (RCR) are extensions of professional development training, it is logical to include all such content into a single course for graduate students and postdoctoral fellows in the Biosciences. Note, however, that merely teaching to the RCR requirements will not satisfy the professional development initiatives, such as **BEST**, that are presently being developed by federal granting agencies. Stated simply, a course satisfying only the RCR requirements will not be sufficient to fulfill the range of topics necessary for graduate and post-graduate professional development in the Biosciences. Finally, as noted in the BEST documents, professional development training at all levels of graduate and post-graduate education (Master’s, Ph.D., and postdoctoral) are indicated. Our existing professional development course, which has been taught for the past 7 years as BIOL 8000 special topics titled “How to be a Professional Scientist”, is focused on Ph.D. students and postdoctoral fellows, and is therefore an 8000 only level course. The new offering, **BIOL 6260/8260 Careers in Bioscience: Professional Development and Responsible Conduct**, will establish the special topics class as a formal course and include pertinent Master’s level content and training to allow a 6000/8000 level designation.

If the course is approved, we will petition the Graduate School for permission to use it as a substitute for GRAD 8002 *Responsible Conduct of Research* and PHIL 8240 *Research Ethics in the Biological and Behavioral Sciences*. All STEM doctoral students are required to take GRAD 8002 or PHIL 8240 to satisfy RCR requirements. Because the GRAD and PHIL courses must address the needs of a broad array of students from many disciplines, the courses must take a more “generic” approach to addressing RCR issues. The proposed BIOL 6260/8260 will be tailored specifically for Biology graduate students and will therefore provide customized BEST and RCR training. Biology PhD students can still take GRAD 8002 and PHIL 8240 to satisfy RCR training requirements; the proposed course will provide an additional avenue for our students to achieve this goal.

2. Discuss prerequisites/corequisites for course(s) including class-standing, admission to the major, GPA, or other factors that would affect a student’s ability to register.

The prerequisite for BIOL 6260 would be admission into the MS in Biology program; that for BIOL 8260 admission into the PhD in Biology program. Once admitted, students will be encouraged to take this course as early in their training as possible (e.g. first Fall semester following admission). One goal of this course is to provide a foundation of understanding and expectation for what must be accomplished as a graduate student in the Biosciences. Such knowledge will not only serve the students’ needs, but also provide faculty with more informed students, and therefore more productive, students. Therefore the only requirement will be admission to the graduate program in Biology or permission from the instructor for postdoctoral fellows or for graduate students from other programs.

3. Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended.

The numbering for BIOL 6260/8260 was chosen as follows:

- 1st digit: designates graduate level course work (6 open to MS students; 8 open to PhD students)

- 2nd digit: The Department of Biology uses 1 to indicate a required graduate course; 2 indicates a concentration or elective course. Although all Biology graduate students will be encouraged to take BIOL 6260/8260 at the earliest possible offering, it will not be required and thus we have selected 2 for the second digit.
- 3rd digit: consistent with established numbering systems
 - 2 - Plant Biology
 - 3 - Animal Biology
 - 4 - Ecology and Behavior
 - 5 - Microbiology/Immunology/Virology
 - 6 - Biotechnology
 - 7- Physiology
 - 8- Developmental Biology
 - 9- Anatomy & Morphology
- 4th digit: at the discretion of the individuals who developed the specific proposals

4. In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction?

Professional development training at all levels of graduate and post-graduate education in the Biosciences is sorely needed since employment in traditional academic positions presently accounts for less than half of our graduates, with the likelihood that such diverse employment opportunities will continue to increase in the future (see BEST documents). Students need to understand this changing landscape and become active participants in their career decisions. Without such knowledge, such employment opportunities might not be considered. Further, careers that involve interdisciplinary training or diverse skill sets should be identified early in one's career to tailor such educational efforts. With such foresight, it is likely that students will have a more directed and, therefore, more productive graduate education. This is one of the goals of this modified professional development course.

5. If course(s) has been offered previously under special topics numbers, give details of experience including number of times taught and enrollment figures.

The proposed course BIOL 6260/8260 **Careers in Bioscience: Professional Development and Responsible Conduct** has been previously taught each year for the past 7 years in a modified form as a BIOL 8000 special topics course entitled "How to be a Professional Scientist" that has been previously taught for 7 years as follows:

Spring 2006: 7 Ph.D. students
 Spring 2007: 7 Ph.D. students plus 1 postdoctoral fellow
 Spring 2008: 9 Ph.D. students plus 2 postdoctoral fellows
 Spring 2009: 9 Ph.D. students
 Spring 2010: 8 Ph.D. students plus 1 postdoctoral fellow
 Spring 2011: 5 Ph.D. students plus 1 postdoctoral fellow
 Fall 2012: 6 Ph.D. students

Additionally, during Fall 2013 the proposed Careers in Bioscience is offered as a BIOL 6000/8000 Special Topics with a total enrollment of 12 students (5 MS and 7 PhD)

The course is very popular with Biology graduate students and is widely regarded as providing timely and practical training for success in graduate school and careers in the biological sciences. Thus, the proposed course is already well established with a strong track record. Note that in most years, at least one UNCC Ph.D. students from outside Biology participated in this course. A news article showcasing Faculty-Student endeavors provides one ex-Ph.D. students' experience with this course. See EXCHANGE magazine

(CLAS) Spring edition, 2011. Dean's Letter page 3: "From a Ph.D. Student on the job market for a faculty position in biology at a research institution....."

- C. **IMPACT.** Changes to courses and curricula often have impacts both within the proposing department as well as campus-wide. What effect will this proposal have on existing courses and curricula, students, and other departments/units?

In summary, the impact of this new course will be to expand professional development training to Master's level students. At present, no such formalized training occurs in the Biosciences on the UNCC campus. This new course will replace an existing 8000 only level course entitled "How to be a Professional Scientist" that has been previously taught for 7 years. In essence, we are updating the old course to make it pertinent to all our graduate students while also updating the content toward the BEST initiatives being put forth by federal agencies. The impact of such training for all our graduate students should be positive, as well as necessary.

Other courses that satisfy the RCR requirements are taught on campus (e.g. GRAD 8002; PHIL 8240), however these classes are not tailored to the needs of graduate students in the Biosciences. Students who take this new ***Careers in Bioscience: Professional Development and Responsible Conduct*** course will be exposed to content consistent with that mandated for RCR, as well as material focused on specific issues in the Biosciences. Students who take this new course would have fulfilled the RCR requirements, and been exposed to content beyond what is taught in current RCR-based courses that is tailored for careers in the biological sciences.

1. What group(s) of students will be served by this proposal? Describe how you determined which students will be served.

The students served will primarily be MS, PhD and postdoctoral students in Biology. This new course will expand professional development training to Master's level students, which currently is lacking. We anticipate that, as with past offerings of this course, mostly Master's, Ph.D. students, and postdoctoral fellows in Biology would take this new course. However as noted above, a few students from other departmental programs have taken the 8000 only version of this course in the past.

2. What effect will this proposal have on existing courses and curricula?

- a. *When and how often will added course(s) be taught?*

We will offer the course at least once each year, typically in the Fall semester. However, we may need to offer the course twice each year, once in the Fall and once in the Spring semester each year, to provide flexibility in scheduling to accommodate incoming graduate students. Since this course deals with professional development, we anticipate that it will provide a foundation of understanding and expectation for what must be accomplished as a graduate student in the Biosciences. If successful, we will have more informed, and therefore more productive, students. Dr. Ken Bost has agreed to offer this course each semester, if necessary.

- b. *How will the content and/or frequency of offering of other courses be affected?*

The proposed course will not influence the content of other courses. It will be tailored specifically for Biology graduate students, whereas existing RCR courses are designed for a broader audience from all STEM disciplines. The proposed course could conceivably influence the enrollment in GRAD 8002 and PHIL 8240, but it is unlikely it would affect the frequency with which the GRAD and PHIL courses are offered. If we are approved to use BIOL 8260 course as a substitute for RCR training, some (but not all) of our Biology PhD students will opt to take BIOL 8260 instead of the GRAD or PHIL courses. However, given that the

GRAD and PHIL courses are required of all STEM doctoral students, it is unlikely the new course will decrease enrollment sufficiently to alter the frequency of offering GRAD 8002 or PHIL 8240.

c. *What is the anticipated enrollment in course(s) added (for credit and auditors)?*

We anticipate a minimum enrollment of 8 to 10 graduate students per year. Over the past three-year period, we have admitted an average of 6 doctoral students and 8 MS students each year. We anticipate that many of our 1st-year PhD students will opt to take BIOL 8260 to meet RCR requirements (some may opt to take GRAD 8002 or PHIL 8240 because of scheduling conflicts). Likewise all of our MS students will take BIOL 6260 if BEST or RCR training becomes required of Master's students. Presently there is no mechanism for postdoctoral fellows to take this course for credit on the UNCC campus. Therefore any postdoctoral fellows who take the course will be auditing it.

d. *How will enrollment in other courses be affected? How did you determine this?*

The proposed course will likely influence enrollment in GRAD 8002 and PHIL 8240. If we are approved to use BIOL 8260 course as a substitute for RCR training, some (but not all) of our Biology PhD students will opt to take BIOL 8260 instead of the GRAD or PHIL courses, thereby lowering enrollment in these courses. However, given that the GRAD and PHIL courses are required of all STEM doctoral students, it is unlikely the new course will decrease enrollment sufficiently to alter the frequency of offering GRAD 8002 or PHIL 8240.

e. *Identify other areas of catalog copy that would be affected, including within other departments and colleges (e.g., curriculum outlines, requirements for the degree, prerequisites, articulation agreements, etc.)*

No other areas of catalog copy will be affected.

D. RESOURCES REQUIRED TO SUPPORT PROPOSAL.

When added resources are not required, indicate "none". For items which require "none" explain how this determination was made.

1. **PERSONNEL.** Specify requirements for new faculty, part-time teaching, student assistants and/or increased load on present faculty. List by name qualified faculty members interested in teaching the course(s).

No new faculty positions are requested. Dr. Ken Bost has taught the BIOL 8000 special topics version of the proposed course for the past 7 years and he has developed and has agreed to teach the new **Careers in Bioscience: Professional Development and Responsible Conduct** course at least once each year.

2. **PHYSICAL FACILITY.** Is adequate space available for this course?

Yes

3. **EQUIPMENT AND SUPPLIES:** Has funding been allocated for any special equipment or supplies needed?

No new funding for equipment or supplies is needed, nor has it been requested for the proposed course.

4. **COMPUTER.** Specify any computer usage (beyond Moodle) required by students and/or faculty, and include an assessment of the adequacy of software/computing resources by available for the course(s).

No additional computing resources are required. Nothing beyond MOODLE access is required for the students

5. **AUDIO-VISUAL.** If there are requirements for audio-visual facilities beyond the standard classroom podiums, please list those here.

No additional equipment is needed.

6. **OTHER RESOURCES.** Specify and estimate cost of other new/added resources required, e.g., travel, communication, printing and binding.

None

7. **SOURCE OF FUNDING.** Indicate source(s) of funding for new/additional resources required to support this proposal.

Not applicable

E. CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS OR UNITS

LIBRARY CONSULTATION.

Please see attached (page 61)

CONSULTATION WITH OTHER DEPARTMENTS OR UNITS. List departments/units consulted in writing regarding all elements outlined in IIC: Impact Statement, including dates consulted. Summarize results of consultation and attach correspondence. Provide information on voting and dissenting opinions (if applicable).

The proposed courses may be of interest to students in other doctoral programs, especially given that non-biology graduate students have taken the BIOL 8000 special topics “How to be a Professional Scientist” in the pst. We therefore requested input from the departments of Geography and Earth Sciences and Bioinformatics and Genomics for the proposed changes on (date).

The Ph.D. in Biology program has an interdisciplinary approach that involves faculty from the departments of Chemistry, Kinesiology, Mechanical Engineering, Public Health Sciences, Anthropology, Physics and Optical Sciences, and the Carolinas Medical Center. We have a Doctoral Advisory Panel composed of faculty representatives from the participating units, which functions to provide input to the Biology Graduate Committee about doctoral program matters. The members of the Advisory Panel (Dr. Jerry Troutman, Chemistry; Dr. Farah Bahrani, CMC; Dr. Eric Wikstrom, Kinesiology; Dr. Gloria Elliott, Mechanical Engineering; Dr. Andrew Harver, Public Health Sciences; Dr. Diane Brockman, Anthropology; and Dr. Irina Nesmelova, Physics and Optical Sciences) were informed of the proposed revisions to the PhD curriculum on (date). Five outside units provided written input.

E. INITIATION, ATTACHMENTS AND CONSIDERATION OF THE PROPOSAL

1. **ORIGINATING UNIT.** Briefly summarize action on the proposal in the originating unit including information on voting and dissenting opinions.

A ballot distributed to the 21 members of the Biology Graduate Faculty on April 11, 2103 revealed unanimous support for the proposed course

2. **CREDIT HOUR. (Mandatory if new and/or revised course in proposal)**

Review statement and check box once completed:

The appropriate faculty committee has reviewed the course outline/syllabus and has determined that the assignments are sufficient to meet the University definition of a [credit hour](#).

The Graduate Committee in the Department of Biology has reviewed the course syllabus (see Attachment 1) and has approved the new course for 2 credit hours.

3. ATTACHMENTS.

- a. CONSULTATION: Attach relevant documentation of consultations with other units.

See **Attachment 1** for responses from the Departments of Geography and Earth Sciences and Bioinformatics and Genomics, as well as the participating units of the PhD in Biology Doctoral Advisory Panel.

- b. COURSE OUTLINE/SYLLABUS:

See attached Syllabus (pages 61-64). Also included is an explanation for how the proposed course will address BEST and RCR required topics (Attachment 3), as well as the document for the **Broadening Experiences in Scientific Training (BEST)** program (Attachment 4).

4. STUDENT LEARNING OUTCOMES: Please indicate what SLOs are supported by this course or courses or whether this curricular change requires a change in SLOs or assessment for the degree program.

SLOs for the Biology MS and PhD programs are listed below. Those highlighted in yellow will be supported by the proposed BIOL 6260/8260 course.

Biology MS Program SLOs	Biology PhD Program SLOs
<p>Candidates for the <i>Masters of Science in Biology</i> (thesis option) are expected to meet the following learning outcomes:</p> <ol style="list-style-type: none"> 1) Demonstrate breadth in knowledge about general biological principles. 2) Demonstrate depth in knowledge about the specific sub-discipline related to the MS thesis research topic. 3) Conduct independent research capable of generating at least one peer-reviewed publication. 4) Develop presentation and communication skills. 	<p>Candidates for the <i>Doctor of Philosophy in Biology</i> are expected to meet the following learning outcomes:</p> <ol style="list-style-type: none"> 1) Demonstrate breadth in knowledge about general biological principles related to the required advanced graduate core courses. 2) Demonstrate depth of knowledge about the specific sub-discipline related to the dissertation research topic. 3) Conduct independent research capable of generating multiple peer-reviewed publications and presentationnational and international meetings. 4) Develop advanced presentation, communication and networking skills.

3. STUDENT COMPETENCIES:

Graduate students completing BIOL 6260/8260 will gain the following competencies related to professional development:

- CV and résumé preparation
- Scientific writing, the publication process, the peer-review system, and responsible authorship
- Organizing and presenting a professional talk
- Grant proposal writing and review
- Leading and managing a laboratory research program
- An in-depth understanding of the performance expectations of faculty for research, teaching and service

- Professional networking
- An understanding of intellectual property, patent development and academic freedom.
- An understanding of the requirements for starting a biotechnology business
- An in-depth understanding of the professional ethics for conducting, publishing and collaborating on scientific research
- A detailed understanding of the ethical and societal responsibility associated with scientific research.

4. **TEXTBOOK COSTS:** It is the policy of the Board of Governors to reduce textbook costs for students whenever possible. Have electronic textbooks, textbook rentals, or the buyback program been considered and adopted?

Not applicable. All course materials will be distributed through MOODLE.



J. Murrey Atkins Library

Consultation on Library Holdings

To: Stan Schneider
From: John J Norris
Date: April 15, 2013
Subject: Evaluation for BIOL 6260/8260

Summary of Librarian's Evaluation of Holdings:

Evaluator: John J Norris **Date:** April 15, 2013

Check One:

5. Holdings are superior _____
 6. Holdings are adequate x
 7. Holdings are adequate only if Dept. purchases additional items. _____
 8. Holdings are inadequate _____

Comments:

Library holdings should be adequate to support student research for this course (see list of items held by subject heading below). Students will have access to relevant journals including: *Journal of Academic Ethics, Science & Engineering Ethics, Accountability in Research: Policies & Quality Assurance, Journal of the Scholarship of Teaching and Learning*, and many others.

LC Subject Heading	Total items held
HE 1, HA20, R852, Q175.35	20
R 116, HD 6060, TA 164	12
r	

John J Norris

Evaluator's Signature

April 15, 2013

Date

Attachment 2**Syllabus****Title: *Careers in Bioscience: Professional Development and Responsible Conduct***

Ken Bost, Instructor (Office Hours by appointment)

BIOL 6260/8260

Time: Thursday 11:00 – 12:15 Location: Woodward Room 254

Credit: 2 hours

(Hybrid Course: 1 Lecture per week + Online MOODLE 2 Tasks)

Course Goals: The intent of this course is to provide Master's students, Ph.D. students and Postdoctoral Fellows with: 1) an introduction and discussion of careers in the biosciences; 2) an understanding of the professional skills that will be required; 3) a structure for establishing goals that will allow for professional advancement and development (e.g. the Broadening Experiences in Scientific Training, BEST, initiative); and 4) training sufficient to fulfill the Responsible Conduct of Research (RCR) directive. Therefore, the overall goal of this course is to facilitate your development for a career in the biosciences. We will explore opportunities, duties, and liabilities that might arise at your first employment following completion of your Biosciences graduate or post-graduate training (i.e. Master's, Ph.D. or postdoc).

Prerequisites: Admission to the PhD or MS in Biology program or permission of Department.

Format: The course is a "hybrid"; with regularly scheduled classes as well as online tasks corresponding to particular lectures via a course-specific MOODLE 2 site.

What you will need for this course: You will need access to a computer. Some of the content for this course will be accessible online through UNCC's MOODLE 2, therefore you will need access to a computer to view the course content. It would be most convenient to have a personal computer, but you can also access the course from common computers (e.g. Biology Computer Lab, 4th Floor Woodward).

Grading for the course: Your course grade will be determined by 12 tasks that you will be asked to complete. Grades for each task will be assigned as follows:

Task #1: 5% of your grade

Task #2: 10% of your grade

Task #3: Pretest 10% of your grade

Task #4: 5% of your grade

Task #5: 5% of your grade

Task #6: 5% of your grade

Task #7: 5% of your grade

Task #8: 10% of your grade

Task #9: 15% of your grade

Task #10 10% of your grade

Task #11 10% of your grade

Task #12 Final Exam Posttest: 10% of your grade

Grading scheme: A = 90-100, B = 80-89, C = 70-79, U <70

Documentation: Participation in the course will be monitored and documented by the completion of the pretest, each task, the final exam posttest, and accessing articles and web links via MOODLE. Learning outcomes will be assessed by performing a pre-test and compared to the results of a similar post-test taken as a final exam to evaluate knowledge gained.

University Integrity Policy: Students will adhere to the University Integrity standards as described at:

<http://legal.uncc.edu/policies/up-407>

Attendance: As active learning will occur during class meetings, attendance is mandatory for all students

Textbooks: No textbooks will be required, as all materials used in the course can be found on MOODLE.

Detailed Course Topics and Tasks

Week	Topic	Online Exercises	Tasks
1	What are we trying to accomplish? What should your CV or resume look like 3 years from now?	Construct CV	1. Pretest
2	Teaching, research, & service: You need all three!	Read Reviews	2. List short term & long term goals
3	Research: How to fund your research or scholarship. Understanding granting agencies & money management	Read sample grant application	3. List funding agencies
4	Research: Experimental design, execution, and personnel management	Articles	
5	Research: Record keeping, documentation, data management, and compliance	Read Review	
6	Research: Publishing and Presentations: what, when, how Responsible authorship		4. List possible journals
7	Patents, technology transfer, intellectual property and ownership		5. Patent Search
8	How to start a Biotech Company: SBIRs, STTRs, angels, and VCs	Read sample SBIR	6. Find a VC group
9	Research: Responsibilities of a principal investigator, collaborator, or entrepreneur. What type of leader or manager will you be?	Read Review	7. Self evaluation of leadership style
10	Service: Does your opinion count? Critiquing your colleagues and understanding criticism of your own scholarship. Peer review.		8. Critique grant application
11	Teaching: Developing mentoring skills: It's more than just teaching!	Read Review	
12	Liabilities in Research, Teaching, and Service: What lands you in scientific jail?		9. Find example of misconduct
13	Societal impacts of research, and "academic freedom"		10. Find example
14	Time is the most important commodity you have. When to say "no"! Review of short term and long term goals.	Read Review	11. Update long term & short term goals
15	Where am I going? academics versus industry versus clinical Tenure versus staff, and how these concepts are changing	Read Review	
	Final Exam		12. Posttest

Attachment 3

How BIOL 6260/8260 will Address BEST and RCR Training

“*Careers in Bioscience: Professional Development and Responsible Conduct*” is designed to address RCR training required of granting agencies (NIH, NSF, etc.) and anticipated formalized requirements for Professional Development. Attached (Attachments 3 and 4) are two PDFs which outline the **Broadening Experiences in Scientific Training (BEST)** program (BEST_grant and BESTreport).

Below we indicate how the proposed course will fulfill the “Responsible Conduct in Research” (RCR) requirement. I have listed the nine points from the NIH website and addressed below: (See Syllabus for numbering of the “Detailed Course Topics and Tasks”)

<http://www.niaid.nih.gov/researchfunding/sop/pages/responsibleconductresearch.aspx>

a) Conflict of interest—personal, professional, and financial.

9	Research: Responsibilities of a principal investigator, collaborator, or entrepreneur. What type of leader or manager will you be?
10	Service: Does your opinion count? Critiquing your colleagues and understanding criticism of your own scholarship. Peer review.
12	Liabilities in Research, Teaching, and Service: What lands you in scientific jail?

b) Policies regarding human subjects, live vertebrate animal subjects in research, and safe laboratory practices.

4	Research: Experimental design, execution, and personnel management
5	Research: Record keeping, documentation, data management, and compliance
9	Research: Responsibilities of a principal investigator, collaborator, or entrepreneur. What type of leader or manager will you be?
12	Liabilities in Research, Teaching, and Service: What lands you in scientific jail?

c) Mentor and mentee responsibilities and relationships.

9	Research: Responsibilities of a principal investigator, collaborator, or entrepreneur. What type of leader or manager will you be?
11	Teaching: Developing mentoring skills: It’s more than just teaching!

d) Collaborative research including collaborations with industry.

8	How to start a Biotech Company: SBIRs, STTRs, angels, and VCs
9	Research: Responsibilities of a principal investigator, collaborator, or entrepreneur. What type of leader or manager will you be?

e) Peer review.

6	Research: Publishing and Presentations: what, when, how Responsible authorship
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10	Service: Does your opinion count? Critiquing your colleagues and understanding criticism of your own scholarship. Peer review.
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f) Data acquisition and laboratory tools; management, sharing and ownership.

4	Research: Experimental design, execution, and personnel management
5	Research: Record keeping, documentation, data management, and compliance
7	Patents, technology transfer, intellectual property and ownership
9	Research: Responsibilities of a principal investigator, collaborator, or entrepreneur. What type of leader or manager will you be?

g) Research misconduct and policies for handling misconduct.

9	Research: Responsibilities of a principal investigator, collaborator, or entrepreneur. What type of leader or manager will you be?
12	Liabilities in Research, Teaching, and Service: What lands you in scientific jail?

h) Responsible authorship and publication.

5	Research: Record keeping, documentation, data management, and compliance
6	Research: Publishing and Presentations: what, when, how Responsible authorship

i) The scientist as a responsible member of society, contemporary ethical issues in biomedical research, and the environmental and societal impacts of scientific research.

12	Liabilities in Research, Teaching, and Service: What lands you in scientific jail?
13	Societal impacts of research, and "academic freedom"

Attachment 4: Selected Sections from BEST program announcement

Department of Health and Human Services

Part 1. Overview Information

Participating

Organization(s)

National Institutes of Health ([NIH](#))

Office of Strategic Coordination ([Common Fund](#))

Components of

Participating

Organizations

This Funding Opportunity Announcement (FOA) is developed as a Common Fund

initiative (<http://commonfund.nih.gov/>) through the NIH Office of the NIH Director, Office of Strategic Coordination (<http://dpcpsi.nih.gov/osc/>). The FOA will

be administered by the National Institute of Dental and Craniofacial Research (<http://www.nidcr.nih.gov/>) on behalf of the NIH.

Funding

Opportunity Title

NIH Director's Biomedical Research Workforce Innovation Award: Broadening Experiences in Scientific Training (BEST) (DP7)

Activity Code

DP7 Director's Biomedical Research Workforce Innovation Award Program

AnnouncementType

New

Related Notices

[NOT-RM-13-005](#)

Funding

Opportunity Announcement (FOA) Number

RFA-RM-12-022

Number of

Applications

See [Section III. 3. Additional Information on Eligibility](#).

CFDA Number

93.310

Funding

Opportunity

Purpose

Key Dates

The purpose of this FOA is to seek, identify and support bold and innovative

approaches to broaden graduate and postdoctoral training, such that training programs reflect the range of career options that trainees (regardless of funding source) ultimately may pursue and that are required for a robust biomedical, behavioral, social and clinical research enterprise. Collaborations with non-academic partners are encouraged to ensure that experts from a broad spectrum of research and research-related careers contribute to coursework, rotations, internships or other forms of exposure. This program will establish a new paradigm for graduate and postdoctoral training; awardee institutions will work together to define needs and share best practices.

Posted Date

March 4, 2013

Open Date	April 10, 2013
Letter of Intent	April 10, 2013

Application Due	May 10, 2013, by 5:00 PM local time of applicant organization.
Merit Review	June /July 2013
Advisory Council Review	August 2013
Earliest Start Date	September 16, 2013
Expiration Date	May 11, 2013

Part 2. Full Text of Announcement

Section I. Funding Opportunity Description

This initiative is funded through the NIH Common Fund, which supports crosscutting programs that are expected to have exceptionally high impact. All Common Fund initiatives invite applicants to develop bold, innovative, and often-risky approaches to address problems that may seem intractable or to seize new opportunities that offer the potential for rapid progress.

Background

This initiative is developed in response to recommendations provided by the Advisory Committee to the Director (ACD), NIH. The committee studied the current state of the biomedical research workforce, and NIH's support of training for this workforce (http://acd.od.nih.gov/Biomedical_research_wgreport.pdf). The ACD report confirms that although the vast majority of people holding biomedical PhDs are productively employed, the proportion of PhDs that move into tenure-track or tenured faculty positions represents a minority of the trainee outcomes. An increasing proportion of trainees conduct research in non-academic venues such as government or private sector, or are in research-related areas (such as research management).

Despite the broad range of career options available to U.S.-trained PhD biomedical scientists, graduate programs and postdoctoral training focus almost exclusively on preparing individuals for careers as academic researchers. The ACD committee recommended that NIH-supported graduate programs and post-doctoral training be broadened to reflect the actual career outcomes of today's PhD graduates and postdoctoral scientists. For the purposes of this FOA, a "research career" is defined as an occupation in which

research is performed in any venue, including industry, academia, government or entrepreneurial pursuits. "Research-related" careers are defined as occupations that directly support the biomedical research enterprise.

Program Objectives

In consideration of these recommendations, this program invites applications that propose the establishment, implementation, and assessment of innovative approaches and activities to broaden and complement traditional research training in biomedical, behavioral, social and clinical (referred to as 'biomedical') sciences. These awards, also called the **Broadening Experiences in Scientific Training (BEST)** awards, will provide support for institutions to develop novel ideas in training and workforce development. The goal of this program is to better prepare pre-doctoral students and postdoctoral scientists for the breadth of careers in the biomedical research workforce, and to establish a network to develop, share, evaluate, and disseminate best practices within the training community.

The announcement seeks applications from institutions with established pre-doctoral programs. If the applicant institution also trains a significant number of postdoctoral scientists, their novel program designed in response to this FOA must also include a plan to address the needs of the postdoctoral trainees. We invite bold and innovative applications that leverage existing institutional resources to broaden and enrich training experiences so that trainees are exposed to multiple research and research-related career paths early in their training. Programs should identify various career paths and develop meaningful opportunities targeting those pathways. Trainees are expected to have the opportunity to select from among these preparatory experiences. The program is not meant to train them fully for new career options, but should prepare them for the next steps in their career development.

Training programs responsive to this FOA should provide opportunities to acquire a working knowledge of the skills necessary for a wide range of successful careers in the biomedical research workforce. The goal of this FOA is to broaden both pre- and postdoctoral traditional training experiences such that trainees are better prepared for careers in a variety of other venues, including industry, government, academia, or entrepreneurial enterprises. While it is expected that trainees intending to enter academic research careers will benefit from the broader training experience, programs designed exclusively to target academic research careers will be considered non-responsive. For individuals seeking careers in research-related areas, such as science policy, technology transfer, management or other areas requiring the research doctorate in biomedical science, NIH seeks applications to provide trainees meaningful training experiences so that they are better prepared to enter those occupations as well as for research careers in the private sector. Applicants are also encouraged to include the design of positive and attractive exit pathways for those individuals intending careers that do not require a research doctorate. More broadly, NIH seeks innovative new business and academic models of how graduate programs in biomedical research sciences define themselves and their purpose, how they recruit, admit, support, steer and mentor students to prepare them appropriately for chosen biomedical research or research-related careers. It is not expected that applicants must provide experiences in all research or research-related outcomes, but novel programs should target aspects of training that will enhance their existing programs and add to a more holistic approach across the enterprise.

Applicants are encouraged to form partnerships with organizations that employ scientists engaged in the careers for which the training experiences are directed (private sector, publishing, government, etc.). Partner organizations may provide opportunities for internships, their staff may participate in the development and implementation of novel curricula, or they may contribute in other ways to the success of the program.

Institutions that are currently exploring novel approaches are encouraged to apply but must carefully explain how support from this award would substantially complement and/or add new dimensions to their existing programs. Applications that request additional support only to maintain an existing program will be deemed non-responsive. Examples of innovative approaches include but are not limited to: exchange arrangements with other schools and programs within the applicant institution (Schools of Business, Economics, Law, Public Policy, Social Sciences, Public Health, Communications, etc.) with the potential for mutual benefit such as learning business skills, specific courses including hands-on training in technology transfer, program or policy development, management and administration at government agencies (Federal, state, and local governments, etc.), and internships with partner companies or other institutions.

It is expected that the **BEST** awards will transcend department, program, and possibly school boundaries, and be available to biomedical science students and postdocs across disciplines. They should aim to transform the culture of research training in the biomedical sciences for both trainees and mentors and disseminate findings widely across the training community.

Applications that leverage funds from this program with existing institutional offices and programs, local resources outside the institution, or partners are highly encouraged.

The training period for biomedical careers is already lengthy, and these activities should be integrated with traditional training so as to not increase the time to degree for predoctoral students, or the length of the postdoctoral period.

The **BEST** awards are meant to be experiments and therefore rigorous evaluation of each individual award will be required by both the individual awardees and independently by NIH. To accomplish this, applicants must provide information that clearly states what the program intends to do, what it hopes to accomplish, and the expected impact of the program. An example would be to include

a clear logic model and describe evaluative data that will be collected and other measures that will be used to demonstrate impact. For NIH's evaluation plan, awardees will be required to provide data including, but not limited to, information specified in the evaluation plan below. NIH expects that approaches that are tested and proven to be successful will be widely disseminated throughout the biomedical training community. A further expectation is that the newly developed training activities from these awards that are deemed successful will be institutionalized.

In order to prevent undue redundancies and to share information and best practices, the **BEST** awardees will interact on a regular basis. Each year, awardees will meet to discuss developments, progress and insights gained. Applicants should budget for participation at these meetings. The Program Director/Principal Investigator (PD/PI) and relevant personnel should be prepared to attend the "kick-off" meeting in Bethesda, MD, October 29-30, 2013. Periodic teleconference calls will augment interactions among the awardees, and site visits from NIH staff will evaluate progress of the program as it develops.

APPENDIX I: Comments from Outside Units

From: Mays, Larry
Sent: Wednesday, September 18, 2013 8:42 AM
To: Schneider, Stan
Subject: Re: long-form curriculum proposal from Biology

Dear Stan,
 I have read the proposed revision and distributed it to our faculty for review. It looks fine. I have no comments or suggestions to offer.
 Larry Mays

From: <Schneider>, Stan <sschnedr@uncc.edu>
Date: Monday, September 16, 2013 9:12 AM
To: Lawrence Mays <lemays@uncc.edu>, "Allan, Craig" <cjallan@uncc.edu>, "Brockman, Diane" <dkbrockm@uncc.edu>, "Elliott, Gloria" <gdelliott@uncc.edu>, "Gordon, Scott" <Scott.Gordon@uncc.edu>, "Harver, Andrew" <arharver@uncc.edu>, "Nesmelova, Irina" <Irina.Nesmelova@uncc.edu>, "Troutman, Jerry" <Jerry.Troutman@uncc.edu>, "Wikstrom, Erik" <EWikstrom@uncc.edu>
Cc: "Klotz, Martin" <mklotz@uncc.edu>, "Richardson, Christine" <caricha2@uncc.edu>
Subject: RE: long-form curriculum proposal from Biology

Dear Larry, Allan and members of the PhD in Biology Doctoral Advisory Panel,

Please find attached a long-form curriculum proposal to revise the core requirements for the PhD and MS programs and establish five new graduate-level courses. We would appreciate receiving any comments/input you may have by **Monday, Sept. 30, 2013**. Some of you have already provided input on one of the proposed courses, *BIOL 6260/8260 Careers in Bioscience: Professional Development and Responsible Conduct*. We have decided to include this course as part of the entire package to expedite the review process and, consequently, we are sending it to you again.

Thank you for your time and help. Please let me know if you have questions.

Stan

From: Elliott, Gloria
Sent: Monday, October 07, 2013 8:37 AM
To: Schneider, Stan; Nesmelova, Irina
Subject: RE: RE: input on biology curriculum proposal

Dear Stan,

I am supportive of the proposed changes. They appear to be very well thought out. You may wish to tinker with the name of the Evolutionary Biology course so that it more accurately reflects the broad content of the course, but this is a very minor issue which has no direct impact on the curriculum proposal, it's merely a suggestion.

Best Regards,
 Gloria Elliott
 Mechanical Engineering

From: Wikstrom, Erik
Sent: Monday, September 30, 2013 2:24 PM
To: Schneider, Stan
Subject: RE: RE: long-form curriculum proposal from Biology

Stan,

This email is to officially convey what we discussed in the Advisory Committee meeting on September 26th. In short, I support the addition of the proposed courses as well as the new requirements for each degree program. Additionally, I have circulated the proposed changes to the KNES faculty involved with the Biology PhD program and have not received any concerns. Please find attached my edits and comments on the proposal for your review.

If you have any questions about my edits or thoughts, please let me know.

Thanks

Erik

Erik Wikstrom, PhD, ATC, FACSM | Associate Professor
UNC Charlotte | Department of Kinesiology
9201 University City Blvd. | Charlotte, NC 28223
Phone: 704-687-0871 | Fax: 704-687-0930
ewikstrom@uncc.edu | <http://www.kinesiology.uncc.edu>

From: Nesmelova, Irina
Sent: Monday, October 07, 2013 9:28 AM
To: Schneider, Stan; Elliott, Gloria
Subject: RE: RE: input on biology curriculum proposal

Stan,

I fully support the revision of core requirements and the addition of new courses to the PhD and MS programs' curriculum. The proposed changes are well planned and timely.

Thank you,

Irina.

From: Rasmussen, Lisa
Sent: Saturday, February 01, 2014 9:32 AM
To: Schneider, Stan
Cc: Klotz, Martin; Gonzalez, Ann
Subject: RE: RE: Biology curriculum proposal

Dear Stan and Martin,

Thank you for sharing your proposal to change the Biology curriculum. We have looked at the proposal and the Philosophy Department supports the changes. Please let Ann or me know if we can be of further help.

Lisa Rasmussen

Lisa M. Rasmussen, PhD | Associate Professor of Philosophy
Philosophy Graduate Program Director
UNC Charlotte | Department of Philosophy
9201 University City Blvd. | Charlotte, NC 28223
Phone: 704-687-5238 | Fax: 704-687-1691
lrasmuss@uncc.edu | <http://clas-pages.uncc.edu/lisa-m-rasmussen/>



UNC CHARLOTTE

Department of Chemistry

9201 University City Blvd, Charlotte, NC 28223-0001
t/ 704.687.4765 f/ 704.687.3151 www.chem.uncc.edu

MEMORANDUM

TO: Martin Klotz
Professor and Chair of Biology

FROM: Bernadette T. Donovan-Merkert *Bernadette T. Donovan-Merkert*
Professor and Chair of Chemistry

DATE: November 1, 2013

RE: Chemistry Department position on BIOL 04-01-2013

The proposal BIOL 04-01-2013 was discussed during the October 31, 2013 Chemistry Faculty Meeting. Based on feedback received during that meeting and several other meetings I conducted with concerned individuals during the past several weeks, I neither endorse nor oppose the proposal, noting that numerous members of the Chemistry Department expressed disappointment with the proposal.

Faculty in the Chemistry Department remain committed to participating in the interdisciplinary Biology Ph.D. program in several ways, including but not limited to: (1) serving as the sole dissertation advisor for Biology Ph.D. students who choose to pursue their dissertation research with Chemistry Department faculty members; (2) continuing to serve on the Biology Doctoral Advisory Panel; (3) teaching courses relevant to Biology Ph.D. students; and (4) serving on the dissertation committees for students advised by other faculty in the program. The Biology Ph.D. program is particularly important to the junior faculty in the Chemistry Department who were hired with the promise that they could fully participate in the interdisciplinary Biology Ph.D. program, including serving as the dissertation advisor for Biology doctoral students working in their research laboratories.

The proposed changes to the Biology Ph.D. curriculum considerably restrict students' access to faculty in other disciplines as none of the core courses will be taught by faculty outside the discipline of Biology. Given that the ability to communicate across disciplines is becoming increasingly valued, a broadly trained student will be more marketable than one trained in a single discipline. The current instructor for CHEM 8101 has been proactive in seeking input from the Biology Department on how to make the course more relevant to Biology doctoral students, and how to better integrate the course material with other courses in the Biology Ph.D. curriculum. It is unfortunate that neither the current CHEM 8101 instructor, nor any of the other Biochemistry faculty in the Chemistry Department, were consulted when BIOL 6270/8270 (Biological Pathways and Metabolism), a course that contains a significant amount of biochemistry content, was being developed last year.

My colleagues and I agree that it is vital to assess curricula regularly and to make revisions that will improve student education and performance, and we therefore support your commitment to program improvement. As stakeholders of the Biology Ph.D. program, we want to be more fully involved in program matters. However, based on recent changes made to the program's governance structure, coupled with the imminent elimination of Chemistry faculty from the core curriculum, we grow increasingly concerned that the Biology Department may not be committed to maintaining the "interdisciplinary" part of the interdisciplinary Biology Ph.D. program, at least in terms of looking beyond the broad discipline of Biology. I look forward to working with you to find ways for our departments to collaborate in administering the Biology Ph.D. program and educating its students in the classroom and in research. Please do not hesitate to contact me if you have any questions.

