

# UNIVERSITY FACULTY SENATE FORMS

## Academic Program Approval

This form is a routing document for the approval of new and revised academic programs. Proposing department should complete this form. For more information, call the Faculty Senate Office at 831-2921.

**Submitted by:**  Melinda K. Duncan  phone number  0533

**Action:**  Request for New Concentration in Cell and Organ Systems for the M.S. and Ph.D. in Biology

(Example: add major/minor/concentration, delete major/minor/concentration, revise major/minor/concentration, academic unit name change, request for permanent status, policy change, etc.)

**Effective term**  08J   
(use format 04F, 05W)

**Current degree**  MS and Ph.D.   
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

**Proposed change leads to the degrees of:**  MS and Ph.D.   
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

**Proposed names:**  MS in Biological Sciences with a concentration in Biotechnology; MS in Biological Sciences with a concentration in Cell and Organ Systems; MS in Biological Sciences with a concentration in Molecular Biology and Genetics; MS in Biological Sciences with a concentration in Ecology and Evolution; Ph.D. in Biological Sciences with a concentration in Chemistry-Biology Interface; Ph.D. in Biological Sciences with a concentration in Cell and Organ Systems; Ph.D. in Biological Sciences with a concentration in Molecular Biology and Genetics; Ph.D. in Biological Sciences with a concentration in Ecology and Evolution

Proposed new name for revised or new major / minor / concentration / academic unit (if applicable)

### Revising or Deleting:

**Undergraduate major / Concentration:** \_\_\_\_\_  
(Example: Applied Music – Instrumental degree BMAS)

**Undergraduate minor:** \_\_\_\_\_  
(Example: African Studies, Business Administration, English, Leadership, etc.)

**Graduate Program Policy statement change:**  See attached   
(Attach your Graduate Program Policy Statement)

**Graduate Program of Study:** \_\_\_\_\_  
(Example: Animal Science: MS Animal Science: PHD Economics: MA Economics: PHD)

**Graduate minor / concentration:** \_\_\_\_\_

### List program changes for curriculum revisions:

None, this proposal seeks to codify our ongoing departmental policies at the level of the University.

**List new courses required for the new or revised curriculum:**

(Be aware that approval of the curriculum is dependent upon these courses successfully passing through the Course Challenge list. If there are no new courses enter "None")

None

**Other affected units:**

(List other departments affected by this new or revised curriculum. Attach permission from the affected units. If no other unit is affected, enter "None")

None

**Rationale:**

(Explain your reasons for creating, revising, or deleting the curriculum or program.)

Our department has required all of our graduate students to complete the curricular requirements of a "track" for many years although the track curricular requirements were never approved at the university level. At the request of the Office of Graduate Studies, we submitted our graduate program policy to through the appropriate channels for approval. In February of 2008, it was suggested by the University Graduate Studies Committee that we further revise our curriculum to change the term "Track" to "Concentration" so that the student's curriculum is noted on their transcript and diploma. This new proposal is in response to this request by the University graduate studies committee. At the same time, the University Graduate Studies Committee denied our request to initiate a MS in Biotechnology as an articulated program with our MS in Biological Sciences concentration in Biotechnology degree and suggested that this should be added as a new concentration leading to the MS in Biological Sciences.

**Program Requirements:**

(Show the new or revised curriculum as it should appear in the Course Catalog. If this is a revision, be sure to indicate the changes being made to the present curriculum.)

**See Attached.**

**ROUTING AND AUTHORIZATION:** (Please do not remove supporting documentation.)

Department Chairperson \_\_\_\_\_ Date \_\_\_\_\_

Dean of College \_\_\_\_\_ Date \_\_\_\_\_

Chairperson, College Curriculum Committee \_\_\_\_\_ Date \_\_\_\_\_

Chairperson, Senate Com. on UG or GR Studies \_\_\_\_\_ Date \_\_\_\_\_

Chairperson, Senate Coordinating Com. \_\_\_\_\_ Date \_\_\_\_\_

Secretary, Faculty Senate \_\_\_\_\_ Date \_\_\_\_\_

Date of Senate Resolution \_\_\_\_\_ Date to be Effective \_\_\_\_\_

Registrar \_\_\_\_\_ Program Code \_\_\_\_\_ Date \_\_\_\_\_

Vice Provost for Academic Programs & Planning \_\_\_\_\_ Date \_\_\_\_\_

Provost \_\_\_\_\_ Date \_\_\_\_\_

Board of Trustee Notification \_\_\_\_\_ Date \_\_\_\_\_

Revised 11/03/04 /khs

# Concentration in Cell and Organ Systems

## Policy and Curriculum

The Cell and Organ Systems Graduate Concentration encompasses a wide diversity of research areas, including cell biology, organ systems physiology, extracellular matrix biology, cell signaling, developmental biology and others. It is anticipated that, given the enormous increase in gene sequence data available, there will be an increasing need for individuals broadly trained in disciplines such as these. The goal of this concentration is to provide students a rigorous environment and careful guidance in their efforts towards earning a graduate degree. The curriculum provides for a breadth of background knowledge, skill development in oral and written communication and in critical thinking and opportunities for learning a variety of research techniques. Both M.S. and Ph.D. degree programs will emphasize the development and critical defense of an independent research project.

Students wishing to enter this concentration are expected to have some background (at the undergraduate or graduate level) in general physiology, cell biology, biochemistry and genetics/evolutionary biology. The requirements for the Ph.D. Degree include 16 credit hours of selected graduate level coursework, a series of 3 Laboratory Tutorials or rotations, at least 2 semesters of teaching experience (as a Teaching Assistant) and successful completion of a Graduate Preliminary Exam, a Ph.D. Candidacy Exam and a Dissertation Defense. Ph.D. students also take at least 9 credits of BISC 969 - Doctoral Dissertation, after passing the Candidacy Exam.

Students in the M.S. Degree program will take the same 16 credit hour core curriculum, a minimum of 8 credits of Research (BISC 868 to total at least 22 credits), plus 6 credits of BISC 869 - Master's Thesis. M.S. students are not required to specifically take Laboratory Tutorials, but may opt to as a way of identifying a primary thesis advisor. There is no candidacy exam for M.S. students; instead they become qualified to defend their Master's Thesis following successful completion of the Graduate Preliminary Exam.

The curriculum outlined below conforms to both department of Biological Sciences and University of Delaware policy. (see "Departmental Graduate Program Policy").

### Graduate Curriculum

#### Year One: Fall Semester

| Course Name(s) and Number(s)   | Credits |
|--|---------|
| BISC 605 - Advanced Mammalian Physiology                                     | 3       |
| BISC 827 - Graduate Seminar <sup>1</sup>                                     | 1       |
| Teaching Assistantship <sup>2</sup>  | 0       |
| BISC 864 - Research (Laboratory Tutorials: 2 at 2 credits each) <sup>3</sup> | 4       |

#### Winter Session

| Course Name(s) and Number(s)              | Credits |
|---|---------|
| BISC 864 - Research (Laboratory Tutorial) | 2       |

#### Spring Semester

| Course Name(s) and Number(s)     | Credits |
|----------------------------------|---------|
| BISC 612 - Advanced Cell Biology | 3       |

|                             |          |
|-----------------------------|----------|
| BISC 827 - Graduate Seminar | 1        |
| Teaching Assistantship      | 0        |
| BISC 868 - Research         | Variable |

### Summer Session

| Course Name(s) and Number(s)                       | Credits  |
|--|----------|
| Graduate Preliminary Exam -<br>BISC 868 - Research | Variable |

### Year 2: Fall Semester

| Course Name(s) and Number(s)                                  | Credits  |
|---|----------|
| BISC 6XX – Elective   | 3        |
| BISC 827 - Graduate Seminar                                   | 1        |
| Teaching Assistantship  | 0        |
| BISC 868, BISC 869 - Master's Thesis or BISC 964 <sup>4</sup> | Variable |

### Spring Semester

| Course Name(s) and Number(s)  | Credits |
|---|---------|
| BISC 806 - Current Topics in Cell and Organ Systems, or<br>BISC 833 - Special Topics in Biology | 3       |
| BISC 827 - Graduate Seminar   | 1       |
| Teaching Assistantship  | 0       |
| BISC 869 - Master's Thesis or BISC 964 - Research   | 6       |

### Notes

1. BISC 827 - Graduate Seminar is required every fall and spring semester. Students will present oral summaries of their laboratory tutorials or ongoing research.
2. For Ph.D. students, Teaching Assistantship will be awarded to (usually) new graduate students as part of their requirement to gain teaching experience. At least two semesters, but no more than 4 semesters (two years) will be supported on TA stipends. For M.S. students, there is neither a minimum requirement, nor a 2 year limit of TA support. Generally, the TA carries with it an expectation of 20 hours/week, including in-class/laboratory time, preparation, grading, etc.
3. For the Ph.D. program, BISC 864 credit will include, during the first year, three two-credit Laboratory Tutorials or rotations in 3 different research labs (one of which will ultimately be chosen as the primary research lab). Generally, two of these tutorials will be taken during the first semester (6 weeks each) and the third during the following Winter Session. Additional BISC 868 credits during the following spring semester will be considered research credit, assigned by the student's primary research advisor. M.S. students are not required to take Laboratory Tutorials. Instead, BISC 868 (variable credit hours) may be used as research credit in the primary research advisor's lab.
4. BISC 869 - Master's Thesis, should be taken by M.S. students who have passed the Graduate Preliminary Exam. BISC 964 is intended for Ph.D. students who have passed the Graduate Preliminary Exam and have Pre-Candidacy status.

### Graduate Electives

The following list of graduate courses are those that can be used as Electives in the Cell and Organ Systems Concentration. However, other courses, including selected courses from other departments may also be included, with approval of the student's thesis/dissertation committee or of the Graduate Programs Committee. If a graduate level course similar in content to any of these has been accepted as graduate level transfer credit by the University, the transferred course may be used to satisfy the Concentration requirements with the approval of the Concentration coordinator.

BISC 602 - Molecular Biology of Animal Cells

BISC 615 - Vertebrate Developmental Biology

BISC 618 - Computer Imaging in Biology

BISC 625 - Cancer Biology

BISC 630 - Ichthyology

BISC 631 - The Practice of Science

BISC 639 - Developmental Neurobiology

BISC 645 - Bacterial Evolution

BISC 656 - Evolutionary Genetics

BISC 660 - Environmental Physiology

BISC 665 - Advanced Molecular Biology & Genetics

BISC 667 - Biological Statistics

BISC 671 - Cell and Molecular Immunology

BISC 675 - Cardiovascular Physiology

BISC 679 - Virology

CHEM 641 - Biochemistry

PLSC 635 - Plant Developmental Biology

PLSC/BISC 646 - Plant Cell Biology

PLSC 666 - Plant Physiology

### **Thesis/Dissertation Committees**

Based on tutorials and discussions with different faculty members, students should choose a primary research advisor as soon as possible and prior to the end of their first academic year in the program. This advisor must have a primary or secondary appointment in the Department of Biological Sciences. With the help of the advisor, the student should then select 4-6 additional advisory committee members (minimum of 2 for MS thesis committees), one of whom must have a primary appointment outside the Department of Biological Sciences. It is expected that students will meet at least twice-yearly with their committees (see Graduate Program Policy).

### **Graduate Preliminary Exam in the Cell and Organ Systems Concentration**

All graduate students in the Cell and Organ Systems Concentration must take an oral "Graduate Preliminary Exam," the purpose of which is to evaluate both breadth of knowledge (see the core competency list for more details) and the ability to assimilate and critically evaluate published scientific work in the field. In order to be eligible to take the preliminary exam, students must have completed first year core courses (BISC605 and BISC612) with a grade of B or better. In all cases, the student is expected to correct all deficiencies in their performance in the first year curriculum by the end of the semester after the deficiency occurred but no later than the end of their third semester in the program. If the applicable course is not offered, a suitable substitute will be determined by the Concentration coordinator. Failure to obtain a B or better in a required course in the second attempt will make the student subject to dismissal from the graduate program. Students are expected to take the preliminary exam within six weeks after the first year curriculum has been successfully completed. If the student fails to complete the preliminary exam by this time, the student will be subject to dismissal.

The examining committee (4 faculty members appointed by the Concentration coordinator each year) will assemble a selection of scientific articles and screen these for consistency in terms of depth and breadth of information covered. Each article will have associated with it, 2-3 secondary or "backup" papers that provide additional background on the topic. The committee will eventually select a candidate pool of 3-4 of these collected papers to present to the students taking the exam. Each student will read through the articles and eventually select one (along with its designated backup papers) to be the basis of their prelim exam. This selection must be communicated to the examining committee.

The student will then be responsible for demonstrating a thorough understanding of all aspects of this work, including tangential areas of methodology, interpretation of results, significance in the context of other work in the field, and any related background (die physiology, anatomy, biochemistry, cell biology, etc). Some questions may derive from published articles or textbook materials that are not specifically included in the paper set; it is up to the student to determine what areas they may need to further study by, for example, carefully reviewing the bibliography of the selected article. The student should have prepared a collection of overheads or slides of all figures and tables from the papers, which may be used during the questioning. Students may consult with members of the examining committee prior to the exam to clarify information or breadth of coverage.

An approximate timetable is as follows:

May 1: Examining Committee makes available to students the selected paper sets

June 1: Each student informs the Examining Committee of their selection

June 15-30: Administration of prelim exam (individually)

There are four possible outcomes: unconditional pass, conditional pass, re-examination, or failure. The student will be informed of the outcome after brief deliberations of the committee and this outcome will also be transmitted to the Graduate Program Director. A conditional pass may be appropriate if the committee felt that the student did not have an adequate background or understanding in one or more specific areas. The conditional pass will be communicated to the student along with specific requirements for strengthening these areas and completing the unconditional pass. These requirements may include one or more specific courses, which must be completed with grades of B or better, specific Teaching Assistantship assignments, special problems or others. The student must inform the Graduate Program Director and the Concentration coordinator when these conditions have been completed. In cases where the committee feels there are more significant problems in background or communication skills the committee may decide on a re-examination. This will be done using the same format and prior to the beginning of the next academic semester. If the student still does not perform satisfactorily on this re-examination, he/she will then be terminated from the Concentration and recommended to the Graduate affairs committee for dismissal from the graduate program. Finally, the examining committee may find that a candidate lacks the skills or motivation to successfully complete a graduate program and may then decide on failure without the possibility of re-examination.

M.S. students who successfully complete the Graduate Preliminary Exam are eligible to finish and defend a Master's Thesis. Ph.D. students must additionally complete a Ph.D. Candidacy (Qualifying) Exam.

## **Ph.D. Candidacy Exam**

The Ph.D. Candidacy Exam consists of two parts:

- 1.a comprehensive, formal written Research Proposal
- 2.an oral exam (qualifying exam)

The purpose of this requirement is to determine whether a candidate for the Ph.D. degree has reached the level of critical understanding of their own selected research area to make an independent and significant contribution to that field. Specifically, the exam should determine the student's ability to identify a specific problem or question, design appropriate experiments to address this problem, critically evaluate shortcomings or potential pitfalls and to effectively communicate the importance and significance of their work in the context of ongoing research in that area (i.e., knowledge of the primary research literature). The Candidacy Exam should be taken before the end of the student's sixth academic semester.

The Candidacy Exam is administered by an examining committee consisting of 4-5 members of the Dissertation Committee, but excluding the primary research advisor. The student should choose one member of this group to serve as chairperson, who will then be responsible for coordinating the exam and for writing a detailed report on the outcome. This report may include perceived strengths and weaknesses, as well as specific recommendations for changes or modifications in the student's research plan. The student and chairperson should agree on a specific date for the oral portion of the exam.

Research Proposal. The student will be responsible for independently writing a detailed research proposal, following a format that would be used for an NIH grant proposal. This should include the following sections:

- 1.specific aims
- 2.background and literature review, including critical assessment of the field and how the proposed research will contribute to it
- 3.a statement of how the specific aims might relate to long term goals
- 4.a detailed summary of proposed experiments and methods to be used.

This latter section should also include a description of how the results will be analyzed, as well as potential pitfalls and contingency plans for dealing with unforeseen obstacles. All cited work should be fully referenced with complete authors and titles. If appropriate, a Prelim Results section may also be included; however, the major portion of the oral exam will focus on the proposed work. The proposal should be an actual, realistic outline of the work the student expects to complete during the remaining time here. The proposal should be presented to members of the Dissertation (Examining) Committee at least two weeks before the exam date.

Qualifying Exam. The oral exam will consist of an initial, 30-45 minute presentation by the student, summarizing the research proposal and preliminary results. Generally, this portion should be uninterrupted, except for occasional questions for clarification (i.e., a seminar format). The major part of this presentation should focus on the experiments yet to be done, the methods to be used and the strategies behind the experimental approach. Following this presentation the committee members will ask questions related to all aspects of the proposal, including literature and background, methods and significance. The goals of this exam are to assess both the preparedness and critical thinking ability of the student and the feasibility and validity of the

proposed work. The student may meet with members of the committee before the exam to determine topics and areas that that member might feel are appropriate to cover in the exam. As with the Graduate Preliminary Exam, the four possible outcomes of the Candidacy Exam are: unconditional pass, conditional pass, re-examination, or failure. Again, the examining committee may make specific recommendations for changes in the proposal or in the student's preparation, in order to revert a conditional pass into an unconditional pass. Likewise, a re-examination will require significant re-writing of the research proposal and a second Qualifying Exam. If the Examining Committee determines that a student has failed, either on the first or second round, a recommendation may be made for either terminating the student from the graduate program or offering a terminal M.S. degree.

### **Thesis/Dissertation Defense**

Both the M.S. Thesis and Ph.D. Dissertation must be defended in a public presentation. The format is a formal seminar summarizing the work done and its significance, followed by general questions from the audience and, finally, a questioning period by the Thesis/Dissertation Committee

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