

Current

## Graduate Concentration in Molecular Biology and Genetics: M.S. Policy and Curriculum

The prospective student must meet all general requirements for the M.S. degree in the Department of Biological Sciences. The curriculum described below was developed to ensure that students achieve the breadth of knowledge, written and oral communication skills, and proficiency in the practice of research expected of individuals holding an advanced degree with a specialization in Molecular Biology and Genetics. All students are expected to have basic competency in biochemistry, molecular biology and genetics upon admittance to the program since these fields underpin the training provided in this concentration. The biochemistry competency must be demonstrated by superior performance in a biochemistry course from another institution or by completing CHEM 641 - Biochemistry (core) with a B or better in the first semester of graduate enrollment. Acceptance of courses from other institutions is subject to approval by the Concentration Coordinator. Competency in Molecular Biology and Genetics is primarily assessed by the student's performance on the oral preliminary exam. However, all students are required to take a written diagnostic exam or equivalent after one semester of enrollment to help them assess their level of preparation for the preliminary exam. The results of this exam will be discussed with the student by the concentration coordinator to help the student plan a strategy to prepare for the preliminary exam.

Revised

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### **Required Courses:**

**BISC 602 - Molecular Biology of Animal Cells 3**

**CHEM 641 - Biochemistry<sup>1</sup> 3**

**BISC 654 - Biochemical Genetics 3**

**BISC 827 - Graduate Research Seminar<sup>2</sup>  
1 credit every semester**

**Notes:**

1. The requirement to take Biochemistry may be waived for students with superior performance in a biochemistry course from a previous institution, subject to approval by the Concentration Coordinator.
2. BISC 827 - Graduate Seminar is required every fall and spring semester while enrolled as a student. Students will present oral summaries of their laboratory tutorials or ongoing research.

## Graduate Curriculum

### Year One:

Fall Semester

Course Name and Number	Credits
BISC 602 - Molecular Biology of Animal Cells (core)	3
BISC 827 - Graduate Research Seminar, course in oral presentation skills (core) <sup>1</sup>	1
BISC 864 or 868 - Research <sup>2</sup>	3
Teaching assistantship, development of oral presentation and teaching skills <sup>3</sup>	0

Total: 7 credits

### Winter Session<sup>4</sup>

- Molecular Biology and Genetics diagnostic exam

Spring Semester

Course Name and Number	Credits
BISC 654 - Biochemical Genetics (core)	3
BISC 827 - Graduate Research Seminar, course in oral presentation skills (core)	1
BISC 868 - Research in the laboratory of chosen dissertation advisor	3
Teaching Assistantship	0

Total: 7 credits

### Summer Session

- June
  - Preliminary examination

Suggested Schedule – listed at the end (do not include this – just for informational purposes). Will put the graduate curriculum that is to the left at the bottom so it is easier for comparison.

- July and August<sup>4</sup>
  - BISC 868 - Research in the thesis laboratory (2 credits)

## Year Two:

Fall Semester

Course Name and Number	Credits
BISC 665 - Advanced Molecular Biology and Genetics (core)	3
BISC 827 - Graduate Research Seminar, course in oral presentation skills (core)	1
BISC 869 - M.S. thesis <sup>5</sup>	3

Total: 7 credits

Spring Semester

Course Name and Number	Credits
BISC 827 - Graduate Research Seminar, course in oral presentation skills (core)	1
BISC 869 - Master's thesis (research, in thesis laboratory) <sup>5</sup>	3
From elective list (core)	3

Total: 7 credits

## Electives

All students also are required to complete one elective from the approved list. Choice of elective should be made with approval of the student's research advisor.

- ANSC 644 - Bioinformatics
- BISC 605 - Advanced Mammalian Physiology
- BISC 612 - Advanced Cell Biology
- BISC 615 - Vertebrate Developmental Biology
- BISC 625 - Cancer Biology
- BISC 639 - Developmental Neurobiology
- BISC 645 - Bacterial Evolution
- BISC 646 - Plant Cell Biology
- BISC 656 - Evolutionary Genetics
- BISC 671 - Cellular and Molecular Immunology (4 credits)
- BISC 679 - Virology
- BISC 693 - Human Genetics
- BISC 806 - Advances in Cell and Organ Systems
- CHEM 645 - Proteins, Structure and Function
- CHEM 646 - DNA-Protein Interactions
- ELEG 673 - Signal Processing in Neural

## Electives:

Students must take either two courses from the following list of three- and four-credit courses, or one course from this list plus three one-credit sections of BISC850.

- BISC 605 - Advanced Mammalian Physiology
- BISC 606 - Advanced Mammalian Physiology II
- BISC 612 - Advanced Cell Biology
- BISC 615 - Vertebrate Developmental Biology
- BISC 625 - Cancer Biology
- BISC 639 - Developmental Neurobiology
- BISC 643 - Biological Data Analysis
- BISC 656 - Evolutionary Genetics
- BISC 671 - Cellular and Molecular Immunology
- BISC 675 - Cardiovascular Physiology
- BISC 679 - Virology
- BISC 682 - Bacterial Pathogens: Molecular Mechanisms
- BISC 690 - Fundamentals of Pharmacology
- BISC 693 - Human Genetics
- BINF 644 - Bioinformatics

Systems

- PLSC 635 - Plant Developmental Biology

## Notes

1. M.S. students are encouraged to identify an advisor without tutorials. In this case, they would register for the appropriate number of BISC 868 credits instead of tutorial research. Such students should also form their thesis committee and have their first meeting by March of the first year.
2. BISC 827 - Graduate Seminar is required every fall and spring semester. Students will present oral summaries of their laboratory tutorials or ongoing research.
3. M.S. students are not explicitly required to serve as departmental teaching assistants but will do so in most cases.
4. Students are expected to spend winter and summer sessions in full time research towards the thesis
5. BISC 869 - Master's Thesis, should be taken by M.S. students who have passed the Graduate Preliminary Exam.

Masters students must complete 24 credits of course work/research credit in addition to 6 credits of BISC 869 - Master's Thesis, prior to public defense of the research based Master's thesis.

If any graduate courses equivalent to those listed above have been taken in previous graduate degree programs and have been accepted as graduate level transfer credit by the University, the transferred courses may be used to satisfy the Concentration requirements with the approval of the Concentration coordinator.

Other courses in addition to those listed above may be taken upon the advice of the student's advisor and thesis committee, but these will not substitute for approved electives.

## The Preliminary Examination

Graduate students in the Molecular Biology and Genetics Concentration are expected to possess a fundamental body of knowledge in biochemistry equivalent to CHEM 641, molecular/cellular biology equivalent to BISC 401, and genetics equivalent to BISC 403 as well as the ability to critically analyze scientific literature. See the core competency list for more details. To ensure that this is the case, an oral preliminary examination will be administered to all graduate students in the Concentration at the end of their first year of study.

In order to be eligible to take the preliminary exam,

**BINF 694 - Systems Biology I**

**MAST 625 - Microbial Physiology and Diversity**

If any graduate courses equivalent to those listed above have been taken in previous graduate degree programs and have been accepted as graduate level transfer credit by the University, the transferred courses may be used to satisfy the Concentration requirements with the approval of the Concentration coordinator.

**Other three- or four-credit courses at the University may be used to fulfill the elective requirement if approval from the Concentration coordinator is received prior to taking the course.**

## The Comprehensive Examination

Graduate students in the Molecular Biology and Genetics Concentration are expected to possess a fundamental body of knowledge in biochemistry equivalent to CHEM 641, molecular/cellular biology equivalent to BISC 401, and genetics equivalent to BISC 403 as well as the ability to critically analyze scientific literature. See the core competency list for more details. To ensure that this is the case, an oral **comprehensive** examination will be administered to all graduate students in the Concentration.

students must have completed first year core courses (CHEM 641 if needed, BISC 602, and BISC 654) 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.

### Procedure

Students will be provided with at least four sets of papers from the primary literature selected by faculty from which they must choose one set as the basis for their oral examination. These papers will be available at least six weeks before the exam, usually no later than May 1 [for students admitted in the summer or fall], so that the exam can be administered the second or third week of June. Students admitted in the Spring will usually have paper sets available by December 10 so that the exam can be administered in late January. Four weeks prior to the exam, the student should inform the Concentration coordinator of the chosen paper set and arrange the time of the exam. Prior to the exam, the student should prepare transparencies of all of the figures and tables presented in the papers so that they will be available for discussion during the exam.

During the exam, the student will be tested by a committee of four to six faculty on his/her comprehension of all aspects of the paper including background and related information. Students present a 10 minute synopsis of the primary paper, then the examination committee will ask questions pertaining to the paper's background material, methodology, experimental results and their significance, the article's overall significance to the field as well as the topics found in the list of core competencies. It therefore is imperative that the student searches and reads the literature for background and related information. While a good starting point is the bibliography at the end of the chosen paper set, it is likely that other primary literature sources will need to be consulted. Prior to the exam, students are encouraged to contact faculty to discuss the topics they are responsible for and to clarify difficult concepts.

In order to be eligible to take the comprehensive exam, students must have completed first year core courses (CHEM 641 if needed, BISC 602, and BISC 654) with a grade of B or better. Students are required to take the comprehensive exam at a time set by the Concentration Coordinator for as soon as feasible after the first year curriculum has been successfully completed. If the student fails to complete the comprehensive exam by this time, the student will be subject to dismissal.

### Procedure

Students will be provided with at least four sets of papers from the primary literature selected by faculty, from which they must choose one set as the basis for their oral examination. These papers will be available at least three weeks before the exam, so that the exam can be administered the first or second week of June for students admitted the previous summer or fall. Students admitted in the spring will usually have paper sets available by December 10 so that the exam can be administered in early January. Two weeks prior to the exam, the student should inform the Concentration coordinator of the chosen paper set. Prior to the exam, the student should prepare slides of all of the figures and tables presented in the papers so that they will be available for discussion during the exam.

During the exam, the student will be tested by a committee of four to six faculty on the student's comprehension of all aspects of the paper and the core competencies. Students will present a synopsis of the primary paper, then the examination committee will ask questions pertaining to the paper. The committee will also ask questions pertaining to the core competencies as listed at <http://www.bio.udel.edu/graduate-concentration-molecular-biology-and-genetics-preliminary-exam-guidelines>. Prior to the exam, students are encouraged to contact faculty to discuss the topics they are responsible for and to clarify difficult concepts.

### Grading

The comprehensive exam committee will grade the student based on:

- the quality of the student's oral presentation of

- the primary paper and background information;
- the student's understanding of the background, methods, results, interpretation, and overall significance to the field of the primary paper;
- the student's understanding of the topics in the list of core competencies.

After the oral examination, the examination committee will determine an appropriate grade. Four grades are possible at the initial exam:

1. Unconditional pass. The student may proceed to the next stage of the degree training.
2. Conditional pass. The student performed marginally in one or more areas and may be asked to complete (with a grade of B or better) one or more courses as a condition for changing the grade to pass. The examination committee may prescribe conditions in addition to, or in lieu of, course enrollment. Once the condition is fulfilled, the student is responsible for informing the Biology Graduate Program Director so that the grade can be changed officially.
3. Re-examination. This result is appropriate for a student whose performance was unsatisfactory, but displayed evidence of the potential to complete graduate degree training. Re-examination must be completed within eight weeks of the initial exam, at a time to be set by the examining committee. The possible outcomes of the re-examination are unconditional pass, conditional pass or failure. The student may not take the exam a third time.
4. Failure. This outcome would indicate that examination committee considers the student incapable of completing degree training. The student's academic progress will be reviewed by the Graduate Affairs Committee, who will make recommendations to the Department Chair regarding the student's enrollment status. The Chair may recommend to the Office of Graduate & Professional Education that the student be dismissed from the Program immediately.

Once the student passes the comprehensive examination, the student becomes eligible to register for Master's thesis credit (BISC869).

## Graduate Curriculum

### Year One:

## Suggested Schedule:

### Year One:

Fall Semester		Fall Semester	
Course Name and Number	Credits	Course Name and Number	Credits
BISC 602 - Molecular Biology of Animal Cells (core)	3	BISC 602 - Molecular Biology of Animal Cells	3
BISC 827 - Graduate Research Seminar, course in oral presentation skills (core) <sup>1</sup>	1	BISC 827 - Graduate Research Seminar	1
BISC 864 or 868 - Research <sup>2</sup>	3	<b>CHEM 641 - Biochemistry</b>	<b>3</b>
Teaching assistantship, development of oral presentation and teaching skills <sup>3</sup>	0	BISC868 - Laboratory Research	2
Total: 7 credits		Teaching assistantship, development of oral presentation and teaching skills	0
<b>Winter Session<sup>4</sup></b>		Total: <b>9 credits</b>	
<ul style="list-style-type: none"> <li>Molecular Biology and Genetics diagnostic exam</li> </ul>		<b>Winter Session</b>	
		<ul style="list-style-type: none"> <li>Molecular Biology and Genetics diagnostic exam</li> </ul>	
Spring Semester		Spring Semester	
Course Name and Number	Credits	Course Name and Number	Credits
BISC 654 - Biochemical Genetics (core)	3	BISC 654 - Biochemical Genetics	3
BISC 827 - Graduate Research Seminar, course in oral presentation skills (core)	1	BISC 827 - Graduate Research Seminar	1
BISC 868 - Research in the laboratory of chosen dissertation advisor	3	BISC 868 - Research in the laboratory of chosen thesis advisor	<b>4</b>
Teaching Assistantship	0	Teaching assistantship, development of oral presentation and teaching skills	0
Total: 7 credits		Total: <b>8 credits</b>	
<b>Summer Session</b>		<b>Summer Session</b>	
<ul style="list-style-type: none"> <li>June <ul style="list-style-type: none"> <li>Preliminary examination</li> </ul> </li> <li>July and August<sup>4</sup> <ul style="list-style-type: none"> <li>BISC 868 - Research in the thesis laboratory (2 credits)</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li><b>early June</b> <ul style="list-style-type: none"> <li><b>Comprehensive examination</b></li> </ul> </li> <li><b>late June, July and August</b> <ul style="list-style-type: none"> <li>BISC 868 - Research in the thesis laboratory (<b>3</b> credits)</li> </ul> </li> </ul>	
<b>Year Two:</b>		<b>Year Two:</b>	
Fall Semester		Fall Semester	

Course Name and Number	Credits	Course Name and Number	Credits
BISC 665 - Advanced Molecular Biology and Genetics (core)	3	Elective	3
BISC 827 - Graduate Research Seminar, course in oral presentation skills (core)	1	BISC 827 - Graduate Research Seminar	1
BISC 869 - M.S. thesis <sup>5</sup>	3	BISC 868 - Research in thesis laboratory	4-6
Total: 7 credits		Total: 8-10 credits	
Spring Semester		<b>Spring Semester</b>	
Course Name and Number	Credits	Course Name and Number	Credits
BISC 827 - Graduate Research Seminar, course in oral presentation skills (core)	1	Elective	3
BISC 869 - Master's thesis (research, in thesis laboratory) <sup>5</sup>	3	BISC 827 - Graduate Research Seminar	1
From elective list (core)	3	BISC 868 - Research in thesis laboratory	6
Total: 7 credits		Total: 10 credits	
<p>After the oral examination, the examination committee will determine an appropriate grade. Four grades are possible at the initial exam: unconditional pass, conditional pass, re-examination or failure. If the student receives an unconditional pass, the exam was completed satisfactorily and no conditions are applied. In a conditional pass, the student performed marginally in one or more areas and may be asked to complete (with a grade of B or better) one or more courses as a condition for changing the grade to pass. The examination committee may prescribe conditions in addition to, or in lieu of, course enrollment. Once the condition is fulfilled, the student is responsible for informing both the Biology Graduate Program Director and the Concentration Coordinator so that the grade can be changed officially. If the student receives a re-examination, the student's performance was unsatisfactory and the exam should be repeated within three months, but no later than six months after the initial examination. Only one retake will be permitted. This would normally be prior to the start of the fall semester for June examinations, and during Spring break for January examinations. If the student receives a failure, the student's performance strongly indicated an inability to complete an independent research project and the student will be terminated from the Molecular</p>			



<p>Biology and Genetics concentration without the possibility of a retest. If the student does not perform satisfactorily in a re-examination, the student will be terminated from the Concentration in Molecular Biology and Genetics and recommended to the Graduate Affairs Committee for dismissal from the graduate program. Once the student passes the preliminary examination, he/she becomes eligible to register for Master's thesis credit.</p>	
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