Current

Graduate Concentration in Molecular Biology and Genetics: Ph.D. Policy and Curriculum

The prospective student must meet all general requirements for the Ph.D. 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

Graduate Concentration in Molecular Biology and Genetics: Ph.D. Policy and Curriculum

The prospective student must meet all general requirements for the Ph.D. 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. Competency in Molecular Biology and Genetics is primarily assessed by the student's performance on the oral comprehensive 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 comprehensive 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 comprehensive exam.

Required Courses:

BISC 602 - Molecular Biology of Animal Cells 3

CHEM 641 - Biochemistry[1] 3

BISC 654 - Biochemical Genetics 3

BISC 827 - Graduate Research Seminar[2]
1 credit every semester

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 (core)[1]	1
BISC 864 - Laboratory tutorial[3]	2
Teaching assistantship, development of oral presentation and teaching skills[2]	0

Total: 6 credits

Winter Session

- Molecular Biology and Genetics diagnostic exam
- Second laboratory tutorial[4]

Spring Semester

Course Name and Number	Credits
BISC 654 - Biochemical Genetics (core)	3
BISC 827 - Graduate Research Seminar (core)	1
BISC 864 - Laboratory Tutorial[3]	4

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.
3. For the Ph.D. program, BISC 864 credit will include, during the first year, two, two-credit Laboratory Tutorials or rotations in 2 different research labs (one of which will ultimately be chosen as the primary research lab). During winter term of the first year, Ph.D. students are expected to devote full time effort to a laboratory tutorial. Registration for this is during the spring semester.

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.

BISC 864 - Laboratory tutorial (registration for winter session tutorial)[4]	2
BISC 868 - Research in the laboratory of chosen dissertation advisor[5]	2
Teaching assistantship, development of oral presentation and teaching skills	0

Total: 8 credits

Summer Session

- June
  - Preliminary examination
- July and August[4]
  - BISC 868 - Research in the dissertation laboratory (3 credits)[5,6]
  - Identification of Advisory Committee and first committee meeting

Year Two:

Fall Semester

Course Name and Number	Credits
BISC 665 - Advanced Molecular Biology and Genetics (core)	3
BISC 827 - Graduate Research Seminar (core)	1
Research, in dissertation laboratory	4-6
BISC 964 for students who have unconditionally passed preliminary exam, or BISC 868 for students who have not unconditionally passed preliminary exam[5]	0

Total: 8-10 credits

Spring Semester

Course Name and Number	Credits
BISC 827 - Graduate Research Seminar (core)	1
BISC 964 - Research, in dissertation laboratory	6
From elective list (core)	3

Total: 10 credits

Year Three:

Until successful completion of qualifying exam

Course Name and Number	Credits

BISC 964 - Pre-candidacy Study 6

BISC 827 - Graduate Research Seminar 1

Total: 7 credits

After completion of qualifying exam

Course Name and Number Credits

BISC 969 - Doctoral Dissertation 9

BISC 827 - Graduate Research Seminar 1

Total: 10 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 Systems
- PLSC 635 - Plant Developmental Biology

Notes

1. 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.
2. For Ph.D. students, Teaching Assistantship will be awarded to (usually) new graduate students as part of their requirement to gain teaching experience. All Ph.D. student must serve as teaching assistants at least two semesters but under usual circumstances, no more than 4 semesters (two years) will be supported on TA stipends. Generally, the TA carries with it an expectation of 20 hours/week, including in-

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
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.

class/laboratory time, preparation, grading, etc.

3. For the Ph.D. program, BISC 864 credit will include, during the first year, two, two-credit Laboratory Tutorials or rotations in 2 different research labs (one of which will ultimately be chosen as the primary research lab).
4. During winter term of the first year, Ph.D. students are expected to devote full time effort to a laboratory tutorial. Registration for this is during the spring semester.
5. BISC 868 credits during the following spring semester will be considered research credit, assigned by the student's primary research advisor.
6. Students are expected to devote summer and winter session after the first year to full time research work towards the dissertation after completion of the preliminary examination.

Doctoral students must pass a qualifying examination in order to advance to candidacy for the Ph.D. degree.
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 dissertation 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, 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

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.

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

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 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.

Grading

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 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 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.

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 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 take the qualifying examination for advancement to Ph.D. candidacy.

The Ph.D. Candidacy Examination

The purpose of the oral candidacy examination is to give the student the opportunity to demonstrate:

- the ability to write and defend a research proposal;
- an understanding of the research area in which he or she is interested
- the ability to formulate a research problem and to comprehend its significance; and,
- the ability to design appropriate experimental

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 take the qualifying examination for advancement to Ph.D. candidacy.

The Ph.D. Candidacy Examination

The purpose of the oral candidacy examination is to give the student the opportunity to demonstrate:

- the ability to formulate a research problem and to comprehend its significance;
- the ability to design appropriate experimental approaches to solve the problem;
- the ability to write and defend a research

approaches to solve the problem.

A student's performance will be regarded as satisfactory only if the student:

- demonstrates an adequate knowledge of the field in general as well as the research specialty in which he or she is interested;
- formulates a research problem, the solution of which will make a substantial contribution to our existing knowledge;
- demonstrates that the experimental design and methods proposed are appropriate to solving the problem.

Ph.D. Research Proposal

At the end of the student's third year, the student is expected to have spent at least two years working on a research project in the laboratory of the dissertation advisor. At this time, the student, in consultation with the dissertation advisor, will prepare a proposal in a format similar to an NIH grant proposal that outlines the background of the project, the hypothesis to be tested, the research accomplishments to date and the research to be completed to fulfill the requirements of a Ph.D. in Biological Sciences. It is the student's responsibility to submit the Research Proposal to each member of the dissertation committee at least two weeks prior to the oral exam date.

The Research Proposal must be double-spaced and should include:

- Specific Aims: State concisely and realistically what the research is intended to accomplish and what hypothesis is to be tested. Do not exceed two pages.
- Background and Significance: Briefly sketch the background to the present proposal, critically evaluate existing knowledge, and identify gaps that the proposed research is intended to fill. State concisely the importance of the research by relating the specific aims to longer term objectives. Four to eight pages.
- Research Design and Methods: Briefly summarize the experimental design and the procedures to be used to accomplish the specific aims of this research. Include a description of the types of data to be obtained and how they will be analyzed to accomplish the specific aims. Students must be prepared to discuss potential pitfalls in the experimental design and contingency plans in the event that the data run counter to expectations. Fifteen to twenty pages.
- Literature Cited: All citations must include all author names as well as article titles. A suggested format (the standard for Journal of Cell Science for EndNote users) is:

proposal;

- an understanding of the research area in which the student is interested.

Ph.D. Research Proposal

At the end of the student's third year, the student is expected to have spent at least two years working on a research project in the laboratory of the dissertation advisor. At this time, the student, in consultation with the dissertation advisor, will prepare a proposal in the format described below that outlines the background of the project, the hypothesis to be tested, the research accomplishments to date and the research to be completed to fulfill the requirements of a Ph.D. in Biological Sciences. It is the student's responsibility to submit the Research Proposal to each member of the dissertation committee at least two weeks prior to the oral exam date.

The Research Proposal must be double-spaced, in 12-point Arial or Palatino, and include:

- Specific Aims: State concisely and realistically what the research is intended to accomplish, what hypothesis is to be tested, and specific aims to address the hypothesis. Do not exceed two pages.
- Background and Significance: Briefly sketch the background to the present proposal, critically evaluate existing knowledge, and identify gaps that the proposed research is intended to fill. State concisely the importance of the research by describing the overall significance to the field of each specific aim. Do not exceed 10 pages.
- Preliminary Research. Summarize preliminary data relevant to the proposed research, and briefly describe other research accomplishments. Do not exceed 10 pages.
- Research Design and Methods: Briefly summarize the experimental design and the procedures to be used to accomplish the specific aims of this research. Include a description of the types of data to be obtained and how they will be analyzed to accomplish the specific

Mazaki, Y., Uchida, H., Hino, O., Hashimoto, S. and Sabe, H. (1998). Paxillin isoforms in mouse. J. Biol. Chem. 273, 22435-22441.

The Proposal should also contain a concise Preliminary Results section. However, the candidacy examination is not meant to be a defense of the student's previous laboratory work, but rather it should be an evaluation of the student's ability to construct a hypothesis and to design the means by which to test it.

Exam for admission into candidacy for the Ph.D. (Qualifying exam)

The exam will be administered by the student's dissertation committee excluding the student's primary research advisor. Since the primary advisor for the dissertation will not be present during the examination, the student must choose an examination committee chair from among the four remaining members. The chair will be responsible for the conduct of the exam and the completion of a detailed report outlining the student's strengths and weaknesses, as well as any suggestions for alterations to the research proposal after the defense. Prior to the exam, the student should meet with each committee member to clarify which topics that member feels are relevant for the background knowledge portion of the exam. At the oral defense, the student will present the background and significance of the work, the hypothesis to be tested and the preliminary data collected. The majority of the presentation should be devoted to explaining the research to be performed in the two years remaining in the student's degree program. Students should plan on a 30-45 minute presentation during which the committee will not ask questions except to clarify very specific issues (graph axes, incubation times, etc.). At the conclusion of the formal presentation the committee will evaluate the student's scientific background as well as the scientific validity of the proposed research project. It also is essential that the student demonstrates the ability to make a significant intellectual contribution to their project.

If the student receives a grade of unconditional pass, the student will be admitted into candidacy and should arrange for the appropriate paperwork to be filed with

aims. Students must be prepared to discuss potential pitfalls in the experimental design and contingency plans in the event that the data run counter to expectations. The description of each experiment must explain its significance to the overall goals of the project. Do not exceed 15 pages.

- Literature Cited: All citations must include all author names as well as article titles. A suggested format (the standard for Journal of Cell Science for EndNote users) is:

  Mazaki, Y., Uchida, H., Hino, O., Hashimoto, S. and Sabe, H. (1998). Paxillin isoforms in mouse. J. Biol. Chem. 273, 22435-22441.

Exam for admission into candidacy for the Ph.D. (Qualifying exam)

The exam will be administered by the student's dissertation committee, excluding the student's primary research advisor. If a student has co-advisors with major roles in supervising the student's research, the co-advisors may not serve on the examination committee. If a student whose research is supervised by someone outside the Department has an advisor of record who does not play a primary role in supervising the student's research, the advisor of record may serve on the exam committee. The exam committee must have at least four members, and at least two of the members must have primary appointments in Biological Sciences. Temporary members may be added to the dissertation committee to meet these requirements. It is not necessary to have a member of the exam committee from outside the Department.

Since the primary advisor for the dissertation will not be present during the examination, the student must choose an examination committee chair from among the remaining members. The chair will be responsible for the conduct of the exam and the completion of a detailed report outlining the student's strengths and weaknesses, as well as any suggestions for alterations to the research proposal after the defense.

At the oral defense, the student will present the background and significance of the work, the hypothesis to be tested and the preliminary data collected. The majority of the presentation should be devoted to explaining the research to be performed in the two years remaining in the student's degree program. Students should plan on a 30-45 minute presentation, throughout

the graduate school. If the student receives a grade of conditional pass, deficiencies were found in the student's preparation that need to be rectified by completion of the "condition(s)" before the student is admitted into candidacy. The student is responsible for informing the Graduate Program Director when any such conditions are fulfilled so that the student can be admitted into candidacy. If the student receives a re-examination, deficiencies in the written proposal and/or the student's scientific background will need to be corrected and the defense repeated. Only one reexamination will be permitted. If the student fails the qualifying exam on the first or second attempt, the student may be either recommended for a terminal Master's degree or for termination from the Ph.D. program by the examining committee.	which the committee will ask questions. At the conclusion of the formal presentation the committee will evaluate the student's scientific background as well as the scientific validity of the proposed research project. It also is essential that the student demonstrates the ability to make a significant intellectual contribution to the project. **Grading** A student's performance will be regarded as satisfactory only if the student: • demonstrates an adequate knowledge of the field in general as well as the research specialty in which the student is interested; • formulates a research problem, the solution of which will make a substantial contribution to our existing knowledge; • demonstrates that the experimental design and methods proposed are appropriate to solving the problem; • writes and defends a proposal that meets the scholarly expectations of the field. After the oral examination, the examination committee will determine an appropriate grade. Four grades are possible: • Unconditional pass. The student will be admitted into candidacy and should arrange for the appropriate paperwork to be filed with the graduate office. • Conditional pass. The student was deficient in one or more areas. The examination committee will prescribe conditions that the student must complete. Once the condition is fulfilled, the student is responsible for informing the Biology Graduate Program Director so that the student can be admitted into candidacy. • Re-examination. Deficiencies are severe. The student must re-take the exam at a time to be determined by the committee, but no later than 6 months after the initial exam. The possible outcomes of the re-examination are unconditional pass, conditional pass or failure.

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 (core)[1]	1
BISC 864 - Laboratory tutorial[3]	2
Teaching assistantship, development of oral presentation and teaching skills[2]	0

Total: 6 credits

Winter Session

- Molecular Biology and Genetics diagnostic exam
- Second laboratory tutorial[4]

Spring Semester

Course Name and Number	Credits
BISC 654 - Biochemical Genetics (core)	3
BISC 827 - Graduate Research Seminar (core)	1

The student may not take the qualifying exam a third time.

- Failure. This outcome would indicate that examination committee considers the student incapable of completing Ph.D. 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, or may recommend that the student be transferred to the Master's program and be ineligible for the Ph.D. in Biological Sciences.

Suggested Schedule:

Year One:

Fall Semester

Course Name and Number	Credits
BISC 602 - Molecular Biology of Animal Cells	3
BISC 827 - Graduate Research Seminar	1
CHEM 641 - Biochemistry	3
BISC 864 - Laboratory tutorial	2
Teaching assistantship, development of oral presentation and teaching skills	0

Total: 9 credits

Winter Session

- Molecular Biology and Genetics diagnostic exam
- Second laboratory tutorial

Spring Semester

Course Name and Number	Credits
BISC 654 - Biochemical Genetics	3
BISC 827 - Graduate Research Seminar	1

BISC 864 - Laboratory tutorial (registration for winter session tutorial)[4]	2
BISC 868 - Research in the laboratory of chosen dissertation advisor[5]	2
Teaching assistantship, development of oral presentation and teaching skills	0

Total: 8 credits

Summer Session

- June
  - Preliminary examination
- July and August[4]
  - BISC 868 - Research in the dissertation laboratory (3 credits)[5,6]
  - Identification of Advisory Committee and first committee meeting

Year Two:

Fall Semester

Course Name and Number	Credits
BISC 665 - Advanced Molecular Biology and Genetics (core)	3
BISC 827 - Graduate Research Seminar (core)	1
Research, in dissertation laboratory	4-6
BISC 964 for students who have unconditionally passed preliminary exam, or BISC 868 for students who have not unconditionally passed preliminary exam[5]	0

Total: 8-10 credits

Spring Semester

Course Name and Number	Credits
BISC 827 - Graduate Research Seminar (core)	1
BISC 964 - Research, in dissertation laboratory	6
From elective list (core)	3

Total: 10 credits

BISC 864 - Laboratory tutorial (registration for winter session tutorial)	2
BISC 868 - Research in the laboratory of chosen dissertation advisor	2
Teaching assistantship, development of oral presentation and teaching skills	0

Total: 8 credits

Summer Session

- early June
  - Comprehensive examination
- late June, July and August
  - BISC 868 - Research in the dissertation laboratory (3 credits)
  - Identification of Advisory Committee and first committee meeting

Year Two:

Fall Semester

Course Name and Number	Credits
Elective	3
BISC 827 - Graduate Research Seminar	1
Research in dissertation laboratory	4-6
(BISC 868 for students who have unconditionally passed comprehensive exam, or BISC 964 for students who have not unconditionally passed comprehensive exam)	

Total: 8-10 credits

Spring Semester

Course Name and Number	Credits
Elective	3
BISC 827 - Graduate Research Seminar	1
BISC 964 - Research in dissertation laboratory	6

Year Three:

Until successful completion of qualifying exam

Course Name and Number	Credits
BISC 964 - Pre-candidacy Study	6
BISC 827 - Graduate Research Seminar	1

Total: 7 credits

After completion of qualifying exam

Course Name and Number	Credits
BISC 969 - Doctoral Dissertation	9
BISC 827 - Graduate Research Seminar	1

Total: 10 credits

Total: 10 credits

Years Three-Five:

Until successful completion of qualifying exam:

Course Name and Number	Credits
BISC 964 - Pre-candidacy Study	6
BISC 827 - Graduate Research Seminar	1

Total: 7 credits

After completion of qualifying exam:

Course Name and Number	Credits
BISC 969 - Doctoral Dissertation	9
BISC 827 - Graduate Research Seminar	1

Total: 10 credits