

MOLECULAR, CELLULAR AND INTEGRATIVE BIOSCIENCES

Degree Requirements

Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<http://gradschool.psu.edu/graduate-education-policies/>)

Master's students must take a minimum of 30 credits, described below. At least 18 credits in 500- and 600-level courses combined must be included in the program. A minimum of 24 credits in course work (400, 500, and 800 series), as contrasted with research, must be completed in the major program.

Code	Title	Credits
Required Courses		
MCIBS 590	Colloquium	2
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	1
BIOL 893	Experiential Teaching in Biology	2
MCIBS 596	Individual Studies (for Research Rotations)	1
MCIBS/BIOL/BMMB/VBSC 503	Critical Elements of Genetics and Molecular and Cellular Biology	4
MCIBS 592	Current Research Seminar	2
Emphasis Areas		
MCIBS	offers curricular/research specializations in the following Emphasis Areas: Cell and Developmental Biology; Immunology and Infectious Disease; Molecular and Evolutionary Genetics; Molecular Medicine; Molecular Toxicology; Neurobiology. To complete an emphasis in any of these areas, students take a minimum of 9 credits of specialized course work and conduct original research associated with the respective Emphasis Area. The list of specialized courses that will count towards each Emphasis Area is maintained by the program office.	9
Additional Course Requirements		
Quantitative Foundation Course:	A minimum of 3 credits in 400- or 500-level courses in a quantitative area such as statistics, genetics, bioinformatics, etc. (e.g., STAT 501 Regression Methods; STAT 502 Analysis of Variance and Design of Experiments; STAT 503 Design of Experiments; Population Genetics; etc.). The list of courses that will count towards the Quantitative Foundation requirement is maintained by the program office.	3
Culminating Experience		
MCIBS 600	Thesis Research	6
Total Credits		30

In addition, all graduate students in MCIBS are required to have one semester of teaching experience by serving as a teaching assistant (TA) in an undergraduate course (400-level or lower) in a bioscience-related field. Teaching assistant opportunities are arranged in consultation with the adviser and program chair.

Master's students must complete at least 6 credits of MCIBS 600, and up to 6 of the MCIBS 600 credits may be assigned a quality grade (A-F). In consultation with the adviser, the student must select a thesis committee of at least three members (including the adviser), write a thesis, and

defend the thesis. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass the thesis defense. If all course credits and requirements are met, a student does not have to be registered for classes while writing and/or defending the thesis. Students must present their thesis in accordance with Graduate Council and Graduate School guidelines as described in the Thesis and Dissertation Guide: Requirements and Guidelines for the Preparation of Master's Theses and Doctoral Dissertations (<http://www.gradsch.psu.edu/index.cfm/current-students/thesis-and-dissertation-information/thesisdissertationguidepdf/>).

Additional Requirements

All MCIBS graduate students must maintain a cumulative grade-point average of > 3.0 to remain in good academic standing. One or more failing grades (F) or a cumulative grade-point average below 3.0 will be considered evidence of unsatisfactory scholarship and may be grounds for dismissal from the program.

Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<http://gradschool.psu.edu/graduate-education-policies/>)

Ph.D. students must take a minimum of 24 credits, as described below. At least 18 credits in 500- and 600-level courses combined must be included in the program. A minimum of 24 credits in course work (400, 500, and 800 series), as contrasted with MCIBS 600, must be completed in the major program. A student's dissertation committee can require additional course work depending on the student's background and research plans.

Code	Title	Credits
Required Courses		
MCIBS 590	Colloquium	2
MCIBS 591	Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences	1
BIOL 893	Experiential Teaching in Biology	2
MCIBS 596	Individual Studies (for Research Rotations)	1
MCIBS/BIOL/BMMB/VBSC 503	Critical Elements of Genetics and Molecular and Cellular Biology	4
MCIBS 592	Current Research Seminar	2
Emphasis Areas		
MCIBS	offers curricular/research specializations in the following Emphasis Areas: Cell and Developmental Biology; Immunology and Infectious Disease; Molecular and Evolutionary Genetics; Molecular Medicine; Molecular Toxicology; Neurobiology. To complete an emphasis in any of these areas, students take a minimum of 9 credits of specialized course work and conduct original research associated with the respective Emphasis Area. The list of specialized courses that will count towards each Emphasis Area is maintained by the program office.	9
Additional Course Requirements		

Quantitative Foundation Course: A minimum of 3 credits in 400- or 500-level courses in a quantitative area such as statistics, genetics, bioinformatics, etc. (e.g., STAT 501 Regression Methods; STAT 502 Analysis of Variance and Design of Experiments; STAT 503 Design of Experiments; Population Genetics; etc.). The list of courses that will count towards the Quantitative Foundation requirement is maintained by the program office.

Total Credits
24
Teaching Experience

In addition, all graduate students in MCIBS are required to have one semester of teaching experience by serving as a teaching assistant (TA) in an undergraduate course (400-level or lower) in a bioscience-related field. Teaching assistant opportunities are arranged in consultation with the adviser and program chair.

English Competence

Doctoral degree students are required to demonstrate high-level competence in the use of the English language, including reading, writing, and speaking, as part of the language and communication requirements for the doctorate. This will be assessed for both domestic and international students as part of the qualifying exam, which includes a reading and original writing component. Should deficiencies be identified at the qualifying examination, students will be directed into appropriate remedial activities, including additional English and communication courses. Competence must be formally attested by the program before the doctoral student's comprehensive examination is scheduled. (Note: Passage of the minimal TOEFL or IELTS requirement does not demonstrate the level of competence expected of a doctoral degree candidate and for conferral of a doctorate from Penn State.)

Qualifying Exam

All Ph.D. students in the IGDP in MCIBS must take a qualifying exam no later than the fall semester of the second year. The purpose of the exam is to ensure that students have mastered the core concepts necessary to proceed further towards the Ph.D. The exam consists of both written and oral components, and is based primarily on the students' ability to critically read, understand, and communicate the key findings of a current research paper selected from the literature.

Dissertation Committee

Upon successful completion of the qualifying examination, the student in consultation with his/her adviser will, as soon as possible, select a dissertation committee. The committee must meet Graduate Council guidelines for the composition of dissertation committees (<http://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/phd-dissertation-committee-formation/>). This committee is responsible for supervising the academic program and monitoring the progress of the student towards his/her degree. It is the charge of this committee to assure that the student carries out a substantial piece of independent research and presents it as a dissertation.

Comprehensive Examination

The Comprehensive Examination is administered and evaluated by the entire dissertation committee when the student has completed substantially all required course work, and is intended to determine the feasibility of the student's proposed research and the preparedness of the student to embark on his/her dissertation research. Students must be registered for classes (typically MCIBS 600) the semester they take this exam. The examination will consist of a written research proposal using an NRSA or NSF format, based upon the student's proposed dissertation research, and an oral presentation of the proposed research.

- 3 The proposal must include a timeline for the completion of the work that will be considered in the feasibility of the work.

Dissertation

All Ph.D. candidates must conduct original research and prepare a dissertation that makes a significant contribution of new knowledge, is presented in a scholarly manner, and demonstrates an ability on the part of the candidate to do independent research of high quality. The contents and conclusions of the dissertation must be defended at the time of the final oral examination. The dissertation must be accepted by the dissertation committee, the head of the graduate program, and the Graduate School, and the student must pass a final oral examination (the dissertation defense).

Students must present their dissertation in accordance with Graduate Council and Graduate School guidelines as described in the Thesis and Dissertation Guide: Requirements and Guidelines for the Preparation of Master's Theses and Doctoral Dissertations (<http://www.gradsch.psu.edu/index.cfm/current-students/thesis-and-dissertation-information/thesisdissertationguidepdf/>).

Final Oral Examination

The final examination of the doctoral candidate is an oral examination administered and evaluated by the entire dissertation committee. It consists of an oral presentation of the dissertation by the candidate and a period of questions and responses. These will relate in large part to the dissertation, but may cover the candidate's entire program of study, because a major purpose of the examination is also to assess the general scholarly attainments of the candidate. The portion of the examination in which the dissertation is presented is open to the University community and the public; therefore, it is expected that the examination will take place at University Park or the Hershey campus.

Additional Requirements

All MCIBS graduate students must maintain a cumulative grade-point average of > 3.0 to remain in good academic standing. Furthermore, a Ph.D. student must have a 3.0 GPA to take the doctoral qualifying, comprehensive, and final oral examinations. One or more failing grades (F) or a cumulative grade-point average below 3.0 will be considered evidence of unsatisfactory scholarship and may be grounds for dismissal from the program.