

CMMB Common Requirements

An incoming CMMB student is advised by a Graduate Education Committee (GEC) member in the programmatic requirements and in the selection of courses for the first semester (and for the second if an Advisory Committee has not yet been formed and coursework approved). All CMMB PhD students have a common set of requirements: students must take a total of 60 semester credits, including 20 semester credits of courses (includes any course other than Dissertation and Research), which must include at least three 3-credit (or more) graduate courses at the 500 or 600 level. All CMMB MS students also have a common set of requirements: students must take a total of 30 semester credits, including 20 semester credits of courses (includes any course other than Thesis and Research); at least half of the credits toward the degree must be at the 500 or 600 level. In addition to these common requirements, each option has its own prerequisites and suggested curricula (see below). PhD students who already have MS degrees in a related field may apply some of the MS coursework toward the PhD degree (as determined by the Advisory Committee). Students should be aware that additional coursework might be required at the discretion of the Advisory Committee. Furthermore, students must take:

- MS/PhD: Four credits of Professional Seminar (BCH/BIOM 594) or a seminar series course in another program as approved by the student's Advisory Committee. (An additional four credits in a seminar course can be counted toward PhD degree requirements.)
- MS: Two credits of Experimental Microbial Ecology (BIOM 546) or Exp Molec Cell & Chemical Bio (BIOB 547).
PhD: Four credits of Experimental Microbial Ecology (BIOM 546) or Exp Molec Cell & Chemical Bio (BIOB 547).
(Students are required to attend one of these "Data Club" courses, or a suitable alternative, throughout their tenure on campus.)
- MS: One credit of Introduction to Research (BCH/BIOM 570).
PhD: Two credits of Introduction to Research (BCH/BIOM 570).

In addition to coursework, all PhD students must teach at least one semester (typically as a Graduate Teaching Assistant) and must rotate in at least two research laboratories. The requirement for a second research rotation can be waived by request of the GEC or Advisory Committee and by majority vote of approval from the CMMB faculty if the student enters the doctoral program with a Masters degree or extensive prior research experience.

MS Student Timeline

End of semester 1	<p>Select Research Advisor and assemble Advisory Committee. In addition to the Research Advisor, the Advisory Committee must include at least one CMMB faculty member and one outside faculty member. (Only tenure-track faculty, research-track faculty, current faculty affiliates, or faculty on adjunct appointment can serve as voting members.) If the Research Advisor is not primarily affiliated with CMMB, then the Advisory Committee must include a CMMB committee member to serve as the Academic Advisor and the “Research Advisor” is referred to as the “Research Director.” Advisory committee meets and approves curriculum. Any course waivers are documented and forwarded to the GEC.</p>
End of semester 2	<p>Complete any missing prerequisite coursework. Submit research proposal to Advisory Committee for approval.</p>
End of semester 4	<p>The research proposal is a description of the work completed, in progress, and to be completed for the fulfillment of the research component of the MS degree. Complete coursework.</p>
1 semester prior to graduation	<p>Apply for graduation.</p>
2 weeks before defense	<p>Send thesis to Advisory Committee.</p>
1 week before defense	<p>Public notice of defense. Advisory Committee-approved draft sent to Dean of the Graduate School.</p>
After passing defense	<p>Signed Graduation Application to Graduate School.</p>

PhD Student Timeline

End of Semester 2	<p>Select Research Advisor and assemble Advisory Committee. In addition to the Research Advisor, the Advisory Committee must include at least three CMMB faculty members and one outside faculty member. (Only tenure-track faculty, research-track faculty, current faculty affiliates, or faculty on adjunct appointment can serve as voting members.) If the “Research Advisor” is not primarily affiliated with CMMB, then the Advisory Committee must include a CMMB committee member to serve as the academic advisor and the “Research Advisor” is referred to as the “Research Director.” Complete any missing prerequisite coursework.</p>
End of semester 3	<p>Advisory Committee meets and approves curriculum. Any course waivers are documented and forwarded to the GEC.</p>
End of semester 4	<p>Submit a preliminary dissertation research proposal to Advisory Committee. The dissertation research proposal is a description of the work completed, in progress, and to be completed for fulfilling the research component of the PhD degree. This preliminary research proposal should emphasize key questions and the experimental approach, and briefly state the specific aims (two pages).</p>
End of semester 5	<p>Pass the comprehensive examination (which consists of two parts: the written portion and the oral portion). Complete coursework.</p>
End of semester 6	<p>Submit final dissertation research proposal and schedule to Advisory Committee for approval and defend it in a public forum, such as Data Club. The dissertation research proposal is a description of the work completed, in progress, and to be completed for fulfilling the research component of the PhD degree. This research proposal serves as an informal contract that defines what must be completed before the student can apply for graduation (10 to 25 pages).</p>
1 semester prior to graduation	<p>Apply for graduation.</p>
2 weeks before defense	<p>Send thesis to Advisory Committee.</p>
1 week before defense	<p>Public notice of defense. Advisory Committee-approved draft sent to Dean of the Graduate School.</p>
After passing defense	<p>Signed Graduation Application to Graduate School.</p>

Comprehensive Exam

The comprehensive exam includes a written portion and an oral portion. The written exam is either an out-of-field research proposal or two days of written questions; the Advisory Committee, with input from the student, will choose the format. The Examination Chair will be a CMMB faculty member not serving on the Advisory Committee and will be appointed by the GEC, with advice from the Advisory Committee. The Examination Committee will consist of the Examination Chair and the members of the Advisory Committee other than the Research Advisor or Academic Advisor. The student's Research Advisor or Academic Advisor can participate in the oral exam, but cannot vote and must not be present during the Examination Committee deliberation. The student will pass the written and oral portions with no more than one negative vote from Examination Committee. The oral exam is scheduled after the written exam is passed. If the oral exam is not satisfactory, the student should meet individually with each Examination Committee member to discuss possible improvements. A second oral exam may be scheduled no sooner than one month and no later than three months after the first oral exam. An extension of the three-month limit may be made only by request of the Advisory Committee and by majority vote of approval from the CMMB faculty. Upon successful completion of the comprehensive exam, and with the recommendation of the Examination Committee, the Examination Chair signs that the student has passed the Comprehensive Examination on the Graduation Application on file in the DBS office. The student becomes a PhD candidate upon successful completion of the comprehensive exam. Failure to pass either the written or oral portions of the comprehensive examination after a second attempt will necessitate removal of the student from the doctoral degree program.

Comprehensive exam: out-of-field research proposal

For this format, the student must write an outside, original research proposal, with the intent of focusing on a research problem and the approach required to address the problem. The topic will be outside of the student's dissertation research. The following criteria will be applied by the Examination Committee to determine if the proposal topic is acceptable:

1. The system must be different than what the student is employing in the dissertation research.
2. The approach must be different from that which the student uses to pursue the dissertation problem.
3. The student will have to read literature not normally read for the dissertation research.
4. The out-of-field proposal must not be significantly similar to any proposal that the student has written for another purpose, such as an assignment for a course. Any appearance of overlap with a preexisting proposal must be declared and will be subject to approval by the Examination Committee.

After consulting with the academic advisor, the student must present a brief (up to 500 words) description of two possible topics to the Examination Committee for approval prior to initiating the written exam. The student will have five weeks from the time the topic is approved by the Committee to submit the out-of-field research proposal. The student will follow the guidelines for preparing the research portion of either an NSF or NIH (R01) grant application and include a biosketch. The scope of the proposal should be limited to experiments that can be performed within three years and should be no more than 12 single-spaced pages plus references.

Preliminary data can be utilized from published sources with proper citation. (Students following the NSF guidelines should neglect the Broader Impacts section.) The ideas and approach must belong to the student, but the student can consult with other people, but not Examination Committee members, about techniques.

The written examination will be submitted to the Examination Committee for their approval. The Examination Committee will have ten days to decide if the student has passed the written exam and if the proposal is defensible. Each Examination Committee member will provide the student with a concise written critique. The student will pass with no more than one negative vote and will then schedule the oral examination within ten days. If the written exam is not satisfactory, the student should meet individually with each Examination Committee member to discuss possible improvements and resubmit the written exam a final time within three months.

The oral exam will consist of two parts, for a total of no more than three hours:

1. Presentation of an overview of the out-of-field proposal for the written comprehensive exam and a brief response to the Examination Committee members' written critiques (no longer than 20 minutes).

2. Defense of the student's out-of-field proposal as well as examination of the depth and breadth of knowledge in the student's field of study and cognate areas, especially as it applies to the out-of-field proposal and the student's coursework. The student can be questioned on any topic that relates to the out-of-field proposal or completed coursework.

Comprehensive exam: written questions

For this format, the student must answer written questions over a two-day period. Each member of the Examination Committee will submit questions designed to probe both the depth and breadth of knowledge in the student's field of study and cognate areas depending on the student's goals; the Examination Chair will coordinate the written exam. The written exam will take place over two consecutive days. Each day, the student will be given seven questions and must choose five to answer. Before giving the student the written exam, the Examination Chair will consult with the other members of the Examination Committee to ensure the exam is relevant and fair to the student. A total score of 80% is required to pass the written exam. If the student fails, they can take the exam one more time within three months.

After passing the written exam, an oral exam will be scheduled within ten days. The oral exam, which will last no more than three hours, will be conducted by the Examination Committee to test the student's depth and breadth of knowledge in his or her field of study and cognate areas.

Other requirements

The student must meet with his or her Advisory Committee once every year.

The student must complete and submit each January an annual evaluation that monitors progress in the graduate program and quality of teaching performance. Evidence of unsatisfactory

progress for two years in succession or failure to address concerns of the Advisory Committee is grounds for academic probation or termination of the graduate assistantship.

The student must submit a preliminary dissertation research proposal (about two pages) to the Advisory Committee that briefly states the specific aims and focuses on the key questions and experimental approach before the end of the second year. The student must submit the final dissertation research proposal (10 to 25 pages including references) to the Advisory Committee before the end of the third year. The student must defend the research proposal in Data Club or a suitable public forum and the Advisory Committee will vote if it is acceptable.

The student must maintain a GPA of 3.0 or higher for the curriculum approved by the Advisory Committee, or the student will be placed on academic probation. The student has one semester to raise the GPA to 3.0 or higher; failure to raise the GPA to a satisfactory level will result in removal from the graduate program.

The PhD student must write and defend a doctoral dissertation, which describes original scientific research performed by the student and developed by the student with input from the Research Advisor or Research Director. The Research Advisor or Academic Advisor along with the Advisory Committee determine the length and content of the dissertation. The PhD requires demonstrating proficiency in the scientific method, mastery of the current state of knowledge in the field of study, and a substantive new contribution to the body of either knowledge or methodology in the field of study. The student must demonstrate a rigorous comprehension of the principles and current techniques in the field of study, a thorough understanding of scientific data and error analyses, an appreciation of academic and scientific ethics, and a competence in scientific writing and presentation.

Non-thesis Masters degree option

An optional non-thesis Masters degree is available to doctoral candidates. This degree does not replace the thesis Masters degree and is not available as an option to students matriculated in one of the Masters degree options or already holding a Masters degree in a related discipline.

Doctoral students may receive a non-thesis Masters degree upon fulfillment of all the following:

1. Completion of coursework.
2. Passing of the doctoral comprehensive examination.
3. Approval of doctoral dissertation research proposal by the Advisory Committee.
4. Approval of the CMMB faculty by a majority vote.

CMMB Cellular and Developmental Biology Requirements

Cellular and Developmental Biology Option Prerequisites

- MS/PhD: Cell and Molecular Biology (equivalent of BIOB 260)
- MS/PhD: Genetics and Evolution (equivalent of BIOB 272)

Cellular and Developmental Biology Option Suggested Curriculum

- BIOB 425 Advanced Cellular Biology, 3 cr.
- BCH 480 Advanced Biochemistry I, 3 cr.
- BCH 482 Advanced Biochemistry II, 3 cr.
- BIOM 410 Microbial Genetics, 3 cr.
- BCH 582 Proteins and Enzymes, 3 cr.
- BCH 584 Nucleic Acids, 3 cr.
- BIOM 502 Advanced Immunology, 3 cr.
- BIOM 509 Advanced Virology, 3 cr.
- BCH 600 Cell Organization and Mechanisms, 3 cr.

CMMB Microbial Evolution and Ecology Requirements

Microbial Evolution and Ecology Option Prerequisites

- MS/PhD: Microbiology (equivalent of BIOM 360)
- MS/PhD: General Ecology (equivalent of BIOE 370)
- MS/PhD: Statistics (equivalent of STAT 341)

Microbial Evolution and Ecology Option Suggested Curriculum

All students are encouraged to take a minimum of one course in each of the following three areas.

1. Microbial Processes/Biogeochemistry
 - CHMY 541 Environmental Chemistry, 3 cr.
 - FOR 511 Soil Chemistry, 3 cr.
 - GEO 407 Global Biogeochemical Cycles, 3 cr.
 - GEO 531 Environmental Geochemistry of Metal Contamination, 4 cr.
 - GEO 570 Advanced Geochemistry, 4 cr.
2. Environmental/Quantitative Microbial Ecology
 - BIOB 513 Community Ecology, 3 cr.
 - BIOB 517 Advanced Plant Ecology, 3 cr.
 - EVST 560 Environmental Impact Analysis, 3 cr.
 - FOR 532 Forest Ecosystem Analysis, 3 cr.
 - WBIO 580 Readings in Population Dynamics, 1 cr.
 - WBIO 540 Research Design, 3 cr.
3. Microbial Diversity and Interactions
 - BIOL/MICB 483 Molecular Phylogenetics and Evolution, 3 cr.
 - BIOM 520 Medical Parasitology, 2 cr.
 - BIOM 540 Molecular Pathogenesis, 3 cr.
 - BIOM 509 Advanced Virology, 3 cr.
 - BCH 584 Nucleic Acids, 3 cr.
 - BCH 582 Proteins and Enzymes, 3 cr.

CMMB Microbiology and Immunology Requirements

Microbiology and Immunology Option Prerequisites

- MS/PhD: Upper level Biochemistry (equivalent of BCH 480 and 482)
- MS/PhD: General Microbiology (equivalent of BIOM 360)
- MS/PhD: Immunology (equivalent of BIOB 410)
- MS/PhD: Medical Bacteriology & Mycology (equivalent of BIOM 402)
- MS/PhD: Microbial Genetics (equivalent of BIOM 410)
- MS/PhD: Virology (equivalent of BIOM 435)
- MS/PhD: Microbial Physiology (equivalent of BIOM 450)

Microbiology and Immunology Option Suggested Curriculum

- BIOM 502 Advanced Immunology, 3 cr.
- BIOM 509 Advanced Virology, 3 cr.
- BIOM 520 Medical Parasitology, 2 cr.
- BIOM 540 Molecular Pathogenesis, 3 cr.
- BCH 584 Nucleic Acids, 3 cr.
- BCH 582 Proteins and Enzymes, 3 cr.
- BCH 600 Cell Organization and Mechanisms, 3 cr.
- BIOB 541 Electron Microscopy Laboratory, variable cr.

CMMB Molecular Biology and Biochemistry Requirements

Molecular Biology and Biochemistry Option Prerequisites

- MS/PhD: Cell and Molecular Biology (equivalent of BIOB 260)
- MS/PhD: Upper level Biochemistry (equivalent of BCH 480 and BCH 482)
- MS/PhD: Biochemistry Laboratory Course (equivalent of BCH 486 or research experience)
- MS/PhD: Physical chemistry (equivalent of CHMY 360 or CHMY 373 and 371)

Molecular Biology and Biochemistry Option Suggested Curriculum

- BCH 584 Nucleic Acids, 3 cr.
- BCH 582 Proteins and Enzymes, 3 cr.
- BCH 600 Cell Organization and Mechanisms, 3 cr.
- BCH 581 Physical Biochemistry, 3 cr.