

Boston University

**MOLECULAR BIOLOGY, CELL BIOLOGY &
BIOCHEMISTRY PROGRAM**

(MCBB)

2014-2015

GRADUATE PROGRAM GUIDE

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MOLECULAR BIOLOGY, CELL BIOLOGY & BIOCHEMISTRY PROGRAM
(MCBB)
 BOSTON UNIVERSITY
 2014-2015

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GRADUATE PROGRAM ADMINISTRATION

The MCBB Program is administered by the MCBB Program Committee. The MCBB Program Committee oversees all academic programs and policies. The Committee consists of the Director of the MCBB Program and representative faculty from other Departments. The Program Committee is responsible for evaluating the programs of continuing students and petitions, curriculum development, determining MCBB faculty membership in the program, and maintaining the overall standards of the graduate program. The Admissions Committee is responsible for evaluating applications submitted for admission, accepting students for Dean's Fellowships, and nominating first-year students to the appropriate departments for MCBB Teaching Fellowships, department scholarships, traineeships, and/or research assistantships.

Students should consult the Program Coordinator for the MCBB Program, located in the Biology Department (Room BRB 101), with any questions or concerns about administration, policies, resources, and/or procedures. In all cases, if there are problems or concerns the student should first ask his/her advisor, which after the first year is the student's major professor.

MCBB PROGRAM/ADMISSIONS COMMITTEE (2014-2015):

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GRADUATE PROGRAM

The interdepartmental graduate Program in Molecular Biology, Cell Biology & Biochemistry (MCBB) offers both the Ph.D. and M.A. degrees. The MCBB curriculum is designed to provide a solid foundation in these three and related interdisciplinary fields through coursework, seminars, and research, in order to prepare students for research and/or teaching positions in academia, industry, or government.

MCBB PROGRAM REQUIREMENTS:

1. SEMINARS

All students participate in the MCBB seminar program that consists of two required weekly seminars, and a number of optional lectures and colloquia.

- 1) **CM/MCBB Graduate Student Seminar (BI 583/584).** This seminar is the keystone of the Program. It offers a chance each week for students in the biological sciences and faculty to meet, and creates a forum for the exchange of ideas. Ph.D. students generally present their laboratory research. M.A. students must also attend. Meets Friday at 12:00 Noon in LSE B01. **(Required)**
- 2) **Biomolecular/Biology Seminar Series.** A colloquium of outside speakers from various fields related to MCBB. Meets periodic Mondays at 12 noon in LSE B01. Students are also encouraged to collectively invite 1-2 speakers in this seminar series each year. **(Required)**
- 3) Seminars offered through the Chemistry Department, during both the fall and spring semesters include: the **Chemistry Colloquium** on Monday at 4 PM in SCI 107, the **Physical Chemistry Seminar Series** on Wednesday at 2 PM in LSE 103. There is also an informal Chemical Biology Student Seminar for graduate students only on Thursday at 6 PM every other week in LSE 103.
- 4) **Biomedical Engineering Seminars**
The Hearing Research Center Seminar Series – Fridays at 10:30 AM, details can be found at <http://www.bu.edu/dbin/hrc/calendar/>
Neuromuscular Research Center Seminar Series – Thursdays at 3:30 PM –details found at <http://www.bu.edu/bme/research/centers/nmrc/>
The Center for Nanoscience and Nanobiotechnology Seminar Series has various seminars found at <http://nanoscience.bu.edu/seminars.asp>
The Brain and Vision Seminar Series can be found at <http://www.bu.edu/bravi/news/seminars/>
- 5) **Other graduate program seminars**
Graduate Program in Neuroscience (GPN) seminars can be found at <http://www.bu.edu/neuro/>
The Bioinformatics Graduate Program seminars can be found at <http://www.bu.edu/bioinformatics/news/events/>
Further details can be found on the MCBB website: www.bu.edu/mcbb.
- 6) **Systems Biology Seminars** Thursdays at 12:30 PM, LSE 103. Details can be found at: <http://bu.edu/bioinformatics/seminars/sysbioseminars/>

7) **Thesis Defense Seminars** These seminars are widely announced via student email lists and through postings throughout the various science buildings. They vary in frequency; all students are encouraged to attend.

2. COURSES

PHD COURSEWORK

All students enrolled in the MCBB Ph.D. Program are required to complete the following core coursework, totaling 20 credits, as a portion of the total credits required for their degree.

Ph.D. Core Courses:

- 1) BI 753 Advanced Molecular Biology (4 cr)
 - 2) MB 721 Graduate Biochemistry (4 cr) OR MB 722 Advanced Biochemistry[^] (4 cr)
 - 3) BI 735 Advanced Cell Biology (4 cr)
 - 4) BS 704 Introduction to Biostatistics, at SPH (School of Public Health) (3 cr)
 - 5) MB 697 A Bridge to Knowledge: A Practical Seminar for First-Year Graduate Students (1 cr)
 - 6) BI 583 Progress in Cell & Molecular Biology (2 cr)
 - 7) BI 584 Progress in Cell & Molecular Biology (2 cr)
- (Students are required to attend BI 583/584 throughout their graduate career but only 4 credits may count toward the degree - see above.)

For the post-Bachelor's Ph.D., students in consultation with their advisor choose an additional twelve credits in Elective Courses (see list below). The final 32 credits required for the Post-Bachelor's Ph.D. degree, for a total of 64, consist normally of research credits.

For the post-Master's Ph.D. degree, students in consultation with their advisor choose an additional eight credits in Elective Courses (see list below), with the remaining credits obtained from research credits.

MA COURSEWORK

All students enrolled in the MCBB Master's Program are required to complete the following core coursework, totaling 24 credits, as a portion of the total credits required for their degree.

MA Core Courses:

- 1) BI 552 Molecular Biology I[^] (4 cr)
 - 2) BI 553 Molecular Biology II[^] (for Master's students) (4 cr)
 - 3) BI 621 Biochemistry I[^] (4 cr)
 - 4) BI 622 Biochemistry II[^] (4 cr)
 - 5) BI 735 Advanced Cell Biology[^] (4 cr)
 - 6) BI 583 Progress in Cell & Molecular Biology[^] (2 cr)
 - 7) BI 584 Progress in Cell & Molecular Biology[^] (2 cr)
- (Students are required to attend BI 583/584 throughout their graduate career but only 4 credits may count toward the degree - see above.)

A total of 32 credits is required to graduate with a Master's degree. The remaining 8 credits derive from research and/or elective courses (see list below).

Research Courses:

MB 907/908 Research in MCBB (variable credit)

ELECTIVE COURSEWORK:

The following lists courses approved for MCBB elective course credit. Some Elective Courses are not offered on a regular basis; students should consult course bulletins offered by participating departments and/or class schedules, available each semester, for details. Other courses, subject to the approval of the MCBB Program Committee, may also be appropriate, depending on the student's area of research. Not all courses are offered every academic year, it is advised that students reference the online student link for current class listings.

No more than eight credits from 2-credit seminar courses may be used towards the degree. Most courses are four credits, although seminar courses are generally two credits.

MOLECULAR BIOLOGY, CELL BIOLOGY, AND BIOCHEMISTRY

MB 701/702 Graduate Readings in Molecular Biology, Cell Biology, and Biochemistry

BIOCHEMISTRY & MOLECULAR BIOLOGY

BB 522 Molecular Biology Laboratory (4 cr)

BIOINFORMATICS

BF 527 Bioinformatics Applications (4 cr)

BIOLOGY

BI 502 Topics in the Mathematical Structure of Biological Systems (4 cr)

BI 505 Evolution and Development (4 cr)

BI 545 Neurobiology of Motivated Behavior (4 cr)

BI 551 Biology of Stem Cells (4 cr)

BI 554 Neuroendocrinology (4 cr)

BI 556 Membrane Biochemistry (4 cr)

BI 560 Systems Biology (4 cr)

BI 572 Advanced Genetics (4 cr)

BI 576 Carcinogenesis (4 cr)

BI 581/582 Seminar in Biology (2 x 2 cr)

BI 610 Cellular Aspects of Development and Differentiation (4 cr)

BI 642 Physiology and Biochemistry of Reproduction (4 cr)

BI 645 Neurophysiology (4 cr)

BI 646 Biology of the Cell Cycle (4 cr)

BI 655 Developmental Neurobiology (4 cr)

BI 681 Molecular Biology of the Neuron (4 cr)

BI 708 Biochemical and Molecular Aspects of Development (4 cr)

CHEMISTRY

CH 625 Enzymology: Mechanisms of Enzymatic Reactions (4 cr)

CH 626 Epigenetics (4 cr)

CH 627 RNA Structure and Function (4 cr)

CH 629 DNA Nanotechnology (4 cr)

CH 632 Advanced Coordination Chemistry II: Inorganic Reaction Mechanisms (4 cr)

CH 633 Physical Methods of Inorganic and Bioinorganic Chemistry (4 cr)
CH 634 Metallobiochemistry (4 cr)
CH 721 Protein Structure Determination (4 cr)
CH 722 Protein Chemistry (4 cr)
CH 723 Physical Chemistry of Biological Macromolecules (4 cr)
CH 724 Special Topics in Biochemistry: DNA Nanotechnology (4 cr)
CH 744 Chemical Biology (4 cr)

PHYSICS

PY 771 Concepts in Biophysics (4 cr)

ENGINEERING

ENG ME 500 Introduction to Biological Physics (4 cr)
ENG BE 508 Quantitative Studies of the Respiratory and Cardiovascular Systems (4 cr)
ENG BE 517 Optical Microscopy of Biological Materials (4 cr)
ENG BE 560 Biomolecular Architecture (4 cr)
ENG BE 561 DNA Protein Sequence Analysis (4 cr)
ENG BE 565 Molecular Biotechnology (4 cr)
ENG BE 705 Single Molecule Approaches to Biophysics and Bioengineering – Fundamentals and Applications (4 cr)
ENG BE 726 Fundamentals of Biomaterials (4 cr)
ENG BE 768 Biological Database Analysis (4 cr)

HEALTH SCIENCES

SAR HS 560 Muscle Biology in Health and Disease (4 cr)

ADDITIONAL APPROVED COURSES IN OTHER DEPARTMENTS

SPH (School of Public Health) BS 704 Introduction to Biostatistics (4 cr)
SPH (School of Public Health) BS 723 Introduction to Statistical Computing (4 cr)
GMS (BU Medical Campus) BT 520 Biology of Cancer (4 cr)
GMS (BU Medical Campus) MI 713 Comprehensive Immunology (4 cr)
GMS (BU Medical Campus) MI 823 Special Topics in Microbiology (4 cr)

MCBB COURSE DESCRIPTIONS:

GRS MB 697 (1 cr.): A seminar for first-year biology and MCBB graduate students. Basic pedagogical theory and professional development topics are covered. The course is intended to help students become effective teachers and members of the graduate community.

GRS MB 701/702 (2 cr. each semester): Graduate Readings in MCBB (MA Students only). Library research on well-defined subjects determined in consultation with a faculty member. Two such half courses may be used to partially satisfy the eight full-course requirements for the one-year non-research M.A. degree in MCBB.

GRS MB 721 (4 cr.): Graduate Biochemistry – Introductory biochemistry course that in one semester covers the major principles of biochemistry; proteins, nucleic acids, carbohydrates, lipids, and metabolism. Emphasis on how knowledge was derived and the theoretical principles governing biochemistry.

GRS MB 722 (4 cr.): Advanced Biochemistry – An advanced treatment of the underlying theories, principles, mechanisms, and chemistry of current biochemical investigation. Selected topics may include enzyme mechanics, protein structure and folding, bioinformatics, signal transduction, nucleic-acid protein interactions, techniques in proteomics, and genetic disease mechanisms.

GRS MB 907/908 (Var. cr.): MCBB Graduate Research - The variable-credit research course involves reading, laboratory work, and conferences. Instructor's consent required. Hours arranged.

All Biology, Chemistry, and Physics course descriptions may be found in the graduate bulletin available on the Graduate School of Arts & Sciences website at <http://www.bu.edu/academics/grs/courses>. Engineering can be found at <http://www.bu.edu/bme/graduate/courses/>

3. ACADEMIC REQUIREMENTS

Students must maintain a 3.0 GPA to graduate. Grades below B- and permanent "I" grades are considered failing and do not count towards graduation. The accumulation of more than two grades lower than B- results in dismissal from the Graduate School. Any student receiving a grade lower than B- in a graduate course will be counseled by his or her faculty advisor and the MCBB Director will be informed. Any student who receives a second grade lower than B-, or whose cumulative GPA falls below 3.0 in the core and elective courses used toward the degree for more than one semester will be counseled by the MCBB Director, will lose good academic standing, and will be placed on academic probation. All Program guarantees are dependent on being in good academic standing.

The MCBB Program Director will advise the student on academic probation of the specific time frame [generally within 2 semesters] during which the student must re-establish a cumulative GPA of 3.0 in the core and elective courses used toward the degree and, thus, regain good academic standing. Failure to meet these requirements within the specified time, or receipt of a third grade lower than B- will result in a recommendation to the graduate school for termination of the student's enrollment at the University. Appeals of the decision to recommend termination may be made to the Program Committee.

4. ANNUAL REPORT

All MCBB students are required to submit an annual report by October 1 for the previous year. This report is completed on forms provided (see MCBB website) and includes a summary of courses completed, research progress, courses taught, examinations passed, committee members and meetings held, publications and presentations, a current transcript, and an assessment by the faculty advisor. During each year after advancement to candidacy, Ph.D. students should present either a written or oral report on research progress to the thesis advisory committee (see pp. 14-15). Normally, this occurs at the annual meeting of the committee. The committee meeting date and synopsis must be included on the annual report. The assessment by the faculty advisor should include progress of the student, plus any deficiencies in course work or examinations. Any recommendations, if needed, should be made to the student. Students failing to comply with these recommendations may be subject to probation and loss of financial support. Some sections may not be applicable to all students depending on their degree and their time in the program. **Students failing to submit the report by the deadline are not eligible to register, or their registration is withdrawn, which can result in problems with continued financial support.**

5. RESPONSIBLE CONDUCT IN RESEARCH

All MCBB PhD. students and MA students conducting research are required to complete the Responsible Conduct in Research (RCR) training during their first two years in the program. Students are encouraged to continue to attend training sessions subsequently as topics change. RCR is offered through the Provost's Office and involves online programs and modules, plus four workshops involving lectures and round table discussions covering topics such as proper data acquisition and management, research collaboration ethics, publication do's and don'ts, social responsibility in research, research that involves human subjects, and research that involves animals. Information about this program can be found at www.bu.edu/orc/training/responsible-conduct-of-research/.

6. TEACHING REQUIREMENT FOR THE PHD DEGREE

The MCBB Program requires participation in teaching as a part of the Doctor of Philosophy degree. This consists of teaching in laboratory and/or discussion sections for a total of two semesters sometime during the student's graduate career. This requirement can be satisfied by teaching in any of the participating departments in the MCBB program.

REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY DEGREE (PH.D.) IN MCBB

I. REQUIREMENTS FOR ALL PH.D. STUDENTS:

A. Laboratory Rotations. First-year Ph.D. students who enter the MCBB Program with University or Departmental support [i.e., Teaching Fellowship, Dean's Fellowship (see Financial Assistance, page 26)] are required to perform three laboratory rotations during their first academic year. These laboratory rotations are with MCBB faculty, and each rotation is 6-8 weeks. After these rotations, students provide the faculty with a rank-ordered list of faculty with whom they would like to work. The faculty then finalize matches with major thesis advisors.

B. Faculty Advisor. Students admitted to the Ph.D. program are assigned a temporary faculty advisor from the MCBB Program Committee, who is generally the Director of the program. By the end of the second semester of the first year a permanent research advisor should be selected (see above).

C. Preliminary and Qualifying Examinations. For the Ph.D. degree, Preliminary and Qualifying Examinations must be passed. Once the student has passed these exams, she/he is formally a candidate for the Ph.D. in MCBB.

1. Preliminary Exam. Every six months (in January and June) a Preliminary Exam is offered. This exam must be passed prior to taking the Qualifying Examination. The exam covers topics related to cell biology, molecular biology, and biochemistry and other fields represented by faculty in the program, based on primary and review papers provided to the students in advance. The exam tests critical evaluation, interpretation, problem solving ability, and a synthesis of what students learned in the courses, as befits a potential candidate for the Ph.D. degree. Students normally take the Preliminary Exam in January of their second year. A committee of faculty members writes the exam questions for all students. A student has two chances to pass this exam. If a student fails to pass on the second attempt, they are dismissed from the Ph.D. program. In such a case, the preliminary exam committee, the major professor, and the Director determine if the performance on the preliminary exam(s) and any additional work is sufficient to confer the M.A. degree. In addition, the student must have completed at least 32 credits of graduate level course work.

2. Qualifying Exam. The Qualifying Examination consists of two parts; first, a written research proposal and second, the oral defense of this research proposal. The qualifying exam should be completed within 6 months of passing the preliminary exam, and within the first 3 years of matriculation into the MCBB Ph.D. program.

a. Qualifying Exam Committee. Within 6 weeks after passing the Preliminary Examination, in consultation with the research advisor, the student selects a Qualifying Examination Committee consisting of five faculty members. This committee shall include the major professor and at least two other MCBB faculty members. If one or two members are chosen outside of MCBB and are not on the faculty of Boston University, approval is required by the MCBB Program Committee and the Dean of the Graduate School. (A

"Special Service Appointment Form" must be submitted to the Program Director. These forms are available from the Graduate Program Coordinator). A form listing the qualifying examination committee and the proposed date of the examination, signed by both the student and the research advisor, is submitted to the MCBB Director within 6 weeks after passing the Preliminary Examination.

b. Written Proposal. The student, in consultation with the major professor submits a WRITTEN proposal of an intended research project. The academic code of conduct applies, and the written document should be from the student's own hand, certainly not just cutting and pasting old grant proposals, papers, etc. The major professor may have some input in the form of suggestions on content and organization, but should not directly edit the document. This proposal should include an extensive introduction, complete with appropriately cited literature, a list of specific aims, and an outline of the intended experiments. Preliminary data may be included, but it is not required. The proposal should be concise, approximately 15-20 pages long, double-spaced. The written proposal must be submitted to the Chair of the Qualifying Examination Committee at least two weeks prior to the scheduled examination. The Chair will confirm that the proposal is done properly and is ready for submission to the remaining committee members. There are several examples of appropriate Qualifying Examination proposals on file in the MCBB Office. If the proposal is not organized or written properly, the Chair will ask the student to make appropriate changes and resubmit it for approval. The date of the exam will then be re-scheduled. After approval by the Chair, the student will confirm the time and date of the examination for all committee members.

c. Oral Exam. At the examination, the student gives an oral defense of the proposal. This usually begins with the student giving a short (15-20 minute) audiovisual presentation. The media and content for the presentation should be approved by the Chair prior to the examination with the concept in mind that this is an examination and not a seminar. The committee then poses questions related to the intended research, background information, and the field of the work. The committee may also question areas perceived as the student's weaknesses during the Preliminary Exam, but only as they pertain to the research proposal. The committee Chair ensures that the questions are appropriate (e.g. not too far afield) and that each committee member has sufficient opportunity to question the student.

d. Advancing to Candidacy. The student's Qualifying Examination Committee is responsible for grading the exam. By passing, the student advances to Ph.D. candidacy. Two or more negative votes or a negative vote by the major professor on the Qualifying Examination constitutes a failure. Any student failing this examination has the opportunity to take it again; at least three months must elapse before a student can retake the exam. Failure of the second examination is grounds for automatic dismissal from the Ph.D. program and the loss of any further financial aid.

If a student fails for the second time, but at least four members of the Qualifying Examination Committee, including at least two of the MCBB

faculty, vote that the student's performance on the examination was at a level appropriate for an M.A. degree, the M.A. degree can be conferred. In addition, the student must have completed at least 32 credits of graduate level course work.

D. Thesis/Dissertation

1. Thesis/Dissertation Committee. Within six months after advancing to candidacy for the Ph.D. in MCBB, the student and his or her major professor must jointly convene a Thesis/Dissertation Committee, which will then continue to meet at least once a year. At these meetings the committee evaluates the progress and advises on future research directions of the student. This committee consists of no fewer than five faculty members, of whom at least three must be members of the MCBB Program. It shall include the major professor and four other scientists who are either faculty at academic institutions or a comparable level of standing appointment and experience at a scientific institution such as industry. At least one member outside of the MCBB program is encouraged.

The Thesis Committee shall consist of a Chairperson, a First Reader, a Second Reader, and at least two other members (a third reader is optional). The thesis readers are those faculty members who eventually read and approve the written Ph.D. thesis. They are the final arbiters of this document. The Chairperson and First Reader (major professor) must be members of the MCBB Program and must be present at the final thesis committee meeting and at the thesis defense. It is strongly suggested that the Second Reader be a Boston University faculty member, unless the student has been directly advised by a scientist outside of Boston University; this member may not be the Chairperson. The fourth and fifth members of the committee may be chosen from other faculty of Boston University or from other institutions upon approval of the MCBB Program Committee and the Dean of the Graduate School. (A "Special Service Appointment Form" must be filled out and, with the C.V. of the proposed committee member, submitted to the Program Director. These forms are available from the Graduate Program Coordinator). It is suggested that the composition of the Thesis Committee remain the same for the duration of the student's graduate program unless changes in the direction of the research dictate new areas of expertise on the committee. A student cannot change the members of the thesis committee after submission of the Dissertation Prospectus to the Graduate School (see Table 1, below) without approval of the MCBB Program Committee.

Responsibility for the successful completion of the dissertation lies with the candidate, who, through insight, initiative, and resourcefulness, shall make a significant contribution to the knowledge of his or her specialized field. For the Ph.D. degree, a dissertation describing original research of publication quality is required. The dissertation is "defended" at the Final Oral Examination at a time agreed on by the student and the Thesis Committee. At least two weeks prior to this defense, ALL work that comprises the dissertation and the written thesis, which has been approved by all readers, must be distributed to the committee. At the Final Oral Examination, also referred to as the Thesis Defense, the committee agrees on the adequacy of the body of work and written thesis for the Ph.D. degree in MCBB.

A formal public seminar by the candidate (Thesis Seminar) is required as well (see details below).

2. Preparation and Submission of a Ph.D. Dissertation/Thesis in MCBB.

Conferral of the Ph.D. degree in MCBB is dependent upon the successful preparation and defense of a Ph.D. thesis on original research conducted by the student. There are three Ph.D. thesis deadlines per year: in April, August, and December. A precise timetable for completion of essential steps in submission of a Ph.D. thesis can be obtained from the Graduate School office. A timetable for the preparation and defense of the dissertation can be found at the end of this section. These steps, and MCBB Program requirements and guidelines, are summarized briefly here.

a. Approximately 9 months prior to the proposed graduation date, a formal Dissertation Prospectus (thesis outline) must be submitted to the Graduate School Office. The thesis outline should be prepared in consultation with, and approval of, the first and second readers. The Director of the MCBB Program must also approve it. This document generally provides an outline of the major chapters and subheadings to be included in the Ph.D. thesis. The Thesis Outline is approximately 3 to 7 typed, double-spaced pages. It is recommended that the outline be approved by the Thesis Committee before final submission.

b. At least 3 months prior to the proposed graduation date, a Diploma Application must be completed and submitted to the Graduate School. Diploma applications are available from the Graduate School, and simply indicate the student's desire to be considered for the next graduation date. During this time, drafts of the thesis should be submitted to the first and second readers for approval/editing (see 2.d. below). The student should prepare the thesis in close consultation with the first and second readers. The student-prepared thesis will go through multiple revisions by the first reader, followed by one or more revisions by the second reader.

c. At least 3 weeks prior to Final Oral Examination, a Dissertation Abstract of the thesis must be submitted to the Graduate School office for approval. This abstract must be approved by the first and second readers, and by the Director of the MCBB Program, before being submitted to the Graduate School for final approval.

d. At least 2 weeks prior to the Final Oral Examination, all work that comprises the dissertation, i.e., the written thesis, should have been completed as described below (section 3). After approval of both readers, the dissertation must be distributed to all members of the Thesis Committee. Students should keep in mind the Graduate School deadlines and leave ample time for any required revisions imposed after the Final Oral Examination.

e. At least 2 weeks prior to the Final Oral Examination, the time, place, and list of Thesis Committee members (the Final Oral Examination Schedule) must be submitted to the Graduate School Office, along with 14

copies of the final Dissertation Abstract. The Graduate School Office then mails a formal announcement to all committee members

f. There are two options for scheduling of the Thesis Seminar.

Option 1: the student presents the Thesis Seminar (see 2.j-k below) just prior to the meeting with the Thesis Committee at the Final Oral Examination.

Option 2: the student presents the Thesis Seminar at a date following the Final Oral Examination, as scheduled at that Final Oral Examination.

g. Final Oral Examination. The committee discusses with the candidate the thesis research and the written dissertation. If the Thesis Seminar is to occur at a later date, the student presents the thesis work in a 45-50 minute presentation to the thesis committee. The student should be prepared to defend all aspects of the work. Committee members ensure that the research is complete and is understood by the candidate, and voice any concerns over data or the preparation of the dissertation. Depending on how well the thesis experiments are designed, performed, and defended, and how well the dissertation is prepared, the committee votes on whether the thesis is complete and satisfactory. Ordinarily the candidate receives written comments from all committee members, which should be incorporated (in consultation with the Readers) into a final version of the dissertation. Two or more faculty members voting that the thesis is not complete or satisfactory requires another Final Oral Examination or a decision about whether the Ph.D. degree is offered. Because the signatures of the Readers are required on the thesis, a Reader who votes negatively automatically necessitates another Final Oral Examination. If the vote results in a positive outcome, but revisions are required, the committee and candidate must agree on the amount of time necessary for the candidate to meet any of the committee's objections. At this time, the Thesis Committee must sign the Graduate School Exam Report and agree on the thesis title and wording of the abstract.

h. Upon satisfactory completion of revisions, the First and Second Readers must approve and sign several copies of a final version of the thesis.

i. Final submission of the thesis. The Ph.D. thesis must meet the format specifications of the Graduate School (handout available at the GRS office) as well as those of the MCBB Program (see information in section 3 below). Two copies of the final thesis on appropriate bond paper must be submitted to the Graduate School office by the required date prior to graduation. The student must give final copies to the First Reader and Second Reader. A copy should also be made available if requested by other members of the thesis committee.

j. Thesis Seminar by the Ph.D. candidate. This formal presentation on the dissertation research ordinarily lasts approximately 45-50 minutes and is open to the public. If subsequent to the Final Oral Examination, it is preferable that the entire Thesis Committee attends. However, at least the Chairperson of the Thesis Committee and the First Reader *must* be present.

k. Public announcement of Thesis Seminar. A formal announcement of the Thesis Seminar should be made. It is the responsibility of the student to see that both of the following are taken care of:

(1) A four-page flyer containing an announcement of the Thesis Seminar, the Thesis Abstract, and a brief CV of the candidate must be distributed to all MCBB Faculty. The student should prepare this flyer, which can be given to the Graduate Program Coordinator for distribution. A template is on the MCBB website.

(2) The Thesis Seminar should be publicized by informal posters and e-mail. This is normally done with the help of the research advisor and/or the Graduate Program Coordinator.

3. Organization of the MCBB Ph.D. Thesis. A set of rules concerning page sizes, page numbering, etc., of the thesis can be obtained from the Graduate School office in a pamphlet entitled Guide for the Writers of Theses and Dissertations. The Graduate School rules must be strictly followed. It is advisable for the student to schedule a meeting with the Graduate School Records Officer (705 Commonwealth Avenue, 3-2964) when the thesis is beginning to "take shape" to ensure that specific stylistic guidelines are being followed.

Below is an additional set of guidelines, which are applicable to all MCBB Ph.D. theses. The format of the complete thesis document submitted at the time of the defense should meet the specifications of the Graduate School for final submission of the thesis as well as the guidelines that follow:

a. Comprehensive Thesis. In general, the thesis is organized in the following comprehensive format. The exact format to be followed is usually decided by the student in consultation with the first and second readers.

The thesis normally includes, in order, the following sections: Title Page, Approval Signature Page, Acknowledgments, Abstract, Table of Contents, List of Figures, List of Tables, List of Abbreviations, several Chapters, and a comprehensive Reference List. The thesis should have a consistent style format from chapter to chapter. In the most common format, Materials and Methods used in different types of experiments from different chapters are combined into a single consistent Materials and Methods chapter, although in some instances, separate sections for each chapter are more appropriate. References should be cited consistently throughout the thesis, and there should be an initial Introduction chapter, a final Discussion chapter, and a single Reference List.

Chapter One usually provides a contextual Introduction to the thesis. This includes an overview of the importance of the work, a specific introduction to the field, and a statement of the thesis goal(s).

Chapter Two usually details the Materials & Methods used in the thesis work.

Chapter 3 (and more) describes the Results obtained from the thesis work. These chapters include figures, tables and descriptions of original work. Often these chapters have short introductions to provide a framework for the results that follow, and sometimes specific discussion sections of those results at the end. Figures and tables must have appropriate legends.

The final Chapter should include both a specific and general Discussion of the thesis work in light of other work in the field.

b. Specific guidelines for presentation of research and data. In all cases, details for the presentation of original data should be worked out between the student and the first and second readers. However, the following can be used as guidelines:

(i) The thesis must be written by the student and plagiarism will not be tolerated.

(ii) Large parts of the written thesis may be taken or adapted from material already published by the student. However, published papers cannot be simply stapled together. When the work is part of a multi-authored paper the student should clearly designate what experiments and analyses were performed by co-authors, giving credit in the text as well as in the figure legends or table footnotes. In order that the student does not encroach on any copyrights, the student should be sure that they have prior permission from the publisher to use any copyrighted material in their thesis.

(iii) In general, all data relevant to the thesis should be included in the thesis. It is usually not acceptable to list primary, relevant data as "data not shown" or to refer to primary data published in another source.

(iv) It is recognized that figures within the thesis may not be consistent. For example, figures may have been taken from published articles in journals with different style formats. In general, it is not necessary to revise figures specifically for the thesis.

(v) Original figures (even in the final Graduate School versions of the thesis) are required only where it is necessary to see and evaluate primary data. For example, students are encouraged to use electronic scans of autoradiographs if relevant data are clear.

c. References must be listed and cited according to a standard and consistent journal format.

(i) The Reference List must include all authors, year published, title of article, journal (full name), volume and inclusive pages. Journal name abbreviations may only be used if the references are preceded by a list of these abbreviations along with the full name of each journal. The following provides examples of a suggested concise format for references:

(Journal Sample) Monod, J., Changeux, J.-P. & Jacob, F. (1962) Allosteric proteins and cellular control systems. *Journal of Molecular Biology*. 6, 306-309.

(Book Sample) Pauling, L. (1960) The Nature of the Chemical Bond, 3rd ed., Cornell University Press, Ithaca NY.

(Edited Book Chapter Sample) Smith, W.L. & Borgeat, P. (1985) The eicosanoids: prostaglandins, thromboxanes, leukotrienes, and hydroxyeicosaenoic acids) *In, Biochemistry of Lipids and*

Membranes, 2nd ed. (Vance, D.E. & Vance, J.E., eds.) Benjamin/Cummings, New York, pp. 325-360.

(Abstract Sample) Pirani, A., Allen, K.N., Tolan, D.R., Craig, X., & Lehman, W.(2004) Electron Microscopy and 3D Reconstruction of Dimeric Aldolase on F-Actin. *The Biophysical Society*, Baltimore, MD 14-18 February.

References should be ordered alphabetically in the final Reference List. If a given first author has multiple citations, these should be ordered chronologically in the list (starting with the earliest publication). If a given first author has multiple papers in a single year, they should be designated by "a" and "b" (e.g., Doe et al., 1988a; Doe et al., 1988b, etc.), and should be ordered alphabetically by last name of second author. All references included in the final Reference List must be cited at least once within the text of the thesis, and all references cited within the text must be included in the final Reference List.

(ii) Citations within text should provide author(s) and date, and be provided in parenthesis. If two authors, use Doe & Smith; if more than two authors, use Doe et al. If multiple citations are given, they are to be separated by semicolons, and ordered by year. That is, the above references would be cited in the text as (Pauling, 1960; Monod et al., 1962; Smith & Borgeat, 1985; Pirani et. al., 2004). If one discusses a specific study within the text, include only the year in parentheses; for example, "Monod et al. (1962) showed that..."

4. Costs. All costs related to printing, photocopying, and binding of the thesis are the responsibility of the candidate. The MCBB Program occasionally has a thesis fund to help students for this purpose.

5. Deadlines. Students are held to the deadlines set by the Graduate School. A general timetable is provided below, but it is important that students refer to the current graduate academic calendar available at the Graduate School or from the Graduate Program Coordinator for specific deadline dates.

TABLE 1
TIMETABLE FOR THE PREPARATION AND DEFENSE OF THE Ph.D. DISSERTATION*

	Jan. Award	May Award	Sept. Award
Dissertation Outline (Prospectus) due in the GRS office	1st wk April	1st wk Oct.	1 st wk Feb.
First draft of dissertation (submitted to major professor)†	1st wk Oct.	1st wk Feb.	1 st wk June
Diploma application due in Graduate School office	1st wk Nov.	1st wk Feb.	1 st wk July
Last draft to all Readers †	last wk Oct.	last wk Feb.	last wk June
Abstract due to Graduate School Office	3rd wk Nov.	3rd wk March	3rd wk July

Fourteen copies of dissertation abstract due in Graduate School Office (should accompany Final Oral Examination Schedule)	last wk Nov.	last wk March	last wk July
Final copies to Thesis Committee †	last wk Nov.	last wk March	last wk July
Last date to hold Final Oral Examination ‡	1st wk Dec.	1st wk April	2 nd wk August
Approved and signed dissertation (2 copies due in the Graduate School Office on or before this date)**	2nd wk Dec.	2nd wk April submitted electronically	2 nd wk August, submitted electronically
Thesis Seminar	Dec. – Jan.	April - May	August-Sept

*Specific deadline dates for each year are posted on the Graduate School Graduation Calendar.

†Prompt submission of drafts and final copies to Readers and Committee members is essential. A Thesis Committee member may refuse to evaluate the dissertation if insufficient time is allowed and thus progress to the degree will be delayed.

‡Sufficient time should be allotted between this meeting and the final deadline such that the concerns of the committee can be met.

**Prior to the dissertation defense, the candidate must schedule an appointment with the Records Officer for the review of the dissertation format. All Ph.D. degree requirements are complete only when both copies of the dissertation have been certified as meeting the standards of the Graduate School and of the library.

II. TYPES OF PH.D. DEGREES:

A. Post-Bachelor's Ph.D.

1. Course Work. A total of 64 credits earned from courses and/or research is required. A minimum of 32 credits of course work is fulfilled by the 20 credits for the Required Core Courses, as described above, and twelve credits selected from the menu of Elective Courses approved by the MCBB Program. No more than eight credits may be derived from two-credit seminars. Only under special circumstances can other graduate-level courses be transferred from other institutions, and under no conditions can more than eight credits be transferred, and only if such courses were not previously counted toward another degree.

2. Time Limits. Officially, the post-bachelor's Ph.D. must be completed within seven years after the first registration for doctoral study. Ph.D. degrees are conferred in either May, September, or January, as specified in the Graduate School Bulletin. In addition, the Ph.D. candidacy expires after the fifth anniversary of passing the Qualifying Examination. Petitions to extend this deadline are possible at the discretion of the MCBB Director and the Dean of the Graduate School and can be obtained from the Office of the Graduate School of Arts & Sciences.

3. Master's Certificate of Completion. Post-bachelor's Ph.D. candidates may apply for a M.A. degree in MCBB after they have successfully passed their Qualifying Examination and completed 32 credits of graduate level course work. Applications are available from, and must be returned to, the Graduate School, Room 112, 705 Commonwealth Avenue. The MCBB Program Committee must approve this application for the M.A. degree. The student's major professor receives notification of this application process.

B. Post-Master's Ph.D.

1. Course Work. A total of 32 credits earned from courses and/or research is required. A minimum of 28 credits of course work is fulfilled by completion of the

Required Core Courses (20 credits), as described above, plus 8 additional credits of coursework. The remaining four credits are generally fulfilled by research credit. No more than eight credits may be derived from two-credit seminars. Only in special circumstances can any courses be transferred from other institutions.

2. Time Limits. Officially, the post-Master's Ph.D. must be completed within five years after the first registration for doctoral study. Ph.D. degrees are conferred in either May, September, or January, as specified in the Graduate School Bulletin. In addition, the Ph.D. candidacy expires after the fifth anniversary of passing the qualifying examination. Petitions to extend this deadline are possible at the discretion of the MCBB Director and the Dean of the Graduate School and can be obtained from the Office of the Graduate School of Arts & Sciences.

REQUIREMENTS FOR THE MASTER OF ARTS DEGREE (M.A.) IN MCBB

I. REQUIREMENTS FOR ALL MASTER’S STUDENTS:

A. Credits. In addition to the 24 credits obtained through the Required Core Courses described under the Course Curriculum, all students must complete at least eight credits of graduate course work, for a total of 32 credits to graduate. These eight (8) credits are obtained through elective course work or research as determined in consultation with their advisor and regulated by the Master’s program for which they are enrolled (please refer to either the Master’s with Scholarly Review Paper or Master’s with a Research Thesis section below).

B. Faculty Advisor. Each student who is admitted to the M.A. degree program is assigned a faculty advisor from the MCBB Program, either the Director of the Program or a faculty member based on the student’s interests. This advisor recommends a course of study for the student. It is the responsibility of the student to find an appropriate faculty member to serve as the first reader on the scholarly paper or thesis.

C. Time Limits. Officially, all Master’s degree requirements must be completed within three years from the date of first registration. However, students may apply to the Graduate School for extensions past the three-year deadline. The degree is conferred at the end of the academic year or at the times specified in the Graduate School Bulletin.

D. Deadlines. Students are held to the deadlines published each year by the Graduate School. A general timetable is provided below, but it is important that students refer to the current graduate academic calendar available at the Graduate School or the Graduate Program Coordinator for specific deadline dates.

TABLE 2
Timetable for M.A. in MCBB

	January Award	May Award	September Award
Research Thesis Title Approval Card to be submitted to GRS Office - Research M.A. only.	1st wk May	1st wk Nov.	1st wk April
Diploma application due in GRS Office	1st wk Nov.	1st wk Feb.	1st wk July

*First draft of thesis/scholarly review paper (to be submitted to Readers)	1st wk Oct.	1st wk March	1st wk July
†Approved and signed thesis (2 copies) to the Program Administrator - Research M.A. only	2nd wk Dec.	2nd wk April	2nd wk Aug.

*Prompt submission of drafts and final copies to Readers is essential. A Reader may refuse to evaluate the paper/thesis if insufficient time is allowed and thus progress to the degree may be delayed.

†Prior to the signing of the thesis, the candidate must schedule an appointment with the Records Officer for the review of the thesis format. All M.A. degree requirements are complete only when both copies of the thesis have been certified as meeting the standards of the Graduate School and of the library.

II. Type of M.A. Degrees

A. Master's with Scholarly Review Paper

1. Course Work. As stated above, students must complete 32 credits, 24 of which are fulfilled by the Required Core Courses. Students normally take MB 701 and MB 702, Graduate Readings (2 x 2 credits) under the direction of their Graduate Advisor, which serves as credit for preparation of the required Scholarly Paper. However, if this option is taken, students may not count any other two-credit courses, other than BI 583/584, towards graduation. For the remaining 4 credits, students must select from the menu of Elective Courses approved by the MCBB Program. A typical schedule would be as follows:

<u>Fall</u>		<u>Spring</u>	
CAS BI 552 Molecular Biology I	(4 cr)	CAS BI 553 Molecular Biology II	(4 cr)
GRS BI 621 Biochemistry I	(4 cr)	GRS BI 622 Biochemistry II	(4 cr)
CAS BI 583 Progress in CM Biology	(2 cr)	CAS BI 584 Progress in CM Biology	(2 cr)
GRS MB 701 Graduate Readings	(2 cr)	GRS MB 702 Graduate Readings	(2 cr)
<u>Elective Course</u>	<u>(4 cr)</u>	<u>GRS BI 735 Advanced Cell Biology</u>	<u>(4 cr)</u>
Total Credits	16 cr	+	16 cr = 32

2. Scholarly Review Paper. Students must write a Scholarly Review Paper on a selected topic in the field of Molecular Biology, Cell Biology, or Biochemistry in consultation with a faculty advisor from the MCBB Program who serves as the first reader. The paper should review a selected current research topic and usually includes several chapters and extensive literature references. The final version of the paper must be read and approved by the first reader and at least one other MCBB faculty member. The paper must comply with the format described below. A final copy must be given to both readers, the Graduate Program Coordinator, and the student should keep one copy.

Format of a Scholarly Review Paper for the M.A. in MCBB

a. The first page must be a Title Page and must include the following information: the title of the paper (in capital letters); your name and BU identification number; and

A Scholarly Review Paper
submitted in partial

fulfillment of the degree
of Masters of Arts in
Molecular Biology, Cell Biology
& Biochemistry

Month, Year

b. The second page must be a signature approval page and should be organized, for example, as follows:

First Reader: _____

John Caradonna, Professor of Chemistry

Second Reader: _____

Robert E. Hausman, Professor of Biology

c. The third page must be a Table of Contents that lists the chapter titles and subheadings of chapters.

d. Description of Chapters. There should be a series of chapters describing the topic. Usually the first chapter provides a broad Introduction to the topic. One or more chapters should follow this that describe in some detail the specific topic, including experiments that led to the models and hypotheses that now dominate the field, or conflicting hypotheses. Usually the final chapter provides a Summary and Perspective for the field.

e. Figures and Tables. If figures or tables are included in the thesis, the source from which the information has been taken must be cited, such as "(taken from Doe et al., 1995)" or "(adapted from Doe et al., 1995)". Each figure or table should follow its first citation in the text; they should not be grouped at the end.

f. Bibliography. A comprehensive reference list must be included at the end of the text, and information taken from references must be cited properly within the text.

(1) Listings in the bibliography. List must include authors, year published, title of article, journal, or book, volume / edition, and inclusive pages. The following provides examples of the required format for references:

- (Journal Sample) Monod, J., Changeux, J.-P. & Jacob, F. (1962) Allosteric proteins and cellular control systems. *J. Mol. Biol.* **6**, 306-309.
- (Book Sample) Pauling, L. (1960) The Nature of the Chemical Bond, 3rd ed., Cornell University Press, Ithaca, NY.
- (Edited Book Chapter Sample) Smith, W.L. & Borgeat, P. (1985) The eicosanoids: prostaglandins, thromboxanes, leukotrienes, and hydroxyeicosaenoic acids. *In*, Biochemistry of Lipids and

Membranes, 2nd ed. (Vance, D.E. & Vance, J.E., eds.)
Benjamin/Cummings, New York, pp. 325-360.

(Abstract Sample) Pirani, A., Allen, K.N., Tolan, D.R., Craig, X., & Lehman, W. (2004) Electron Microscopy and 3D Reconstruction of Dimeric Aldolase on F-Actin. *The Biophysical Society*, Baltimore, MD 14-18 February.

References must be ordered alphabetically in the final reference list. If a given first author has multiple citations, these should be ordered chronologically in the final reference list (starting with the earliest publication). If a given first author has multiple papers in a single year, they should be designated by "a" and "b" (e.g., Doe et al., 1988a; Doe et al., 1988b, etc.), and should be ordered alphabetically by first letter of second author's last name.

All references included in the final Reference List must be cited at least once within the text of the paper, and all references cited within the text must be included in the final Reference List.

(2) Citations within text should provide author(s) and date, and be provided in parenthesis. If two authors, use Doe & Smith; if more than two authors, use Doe et al. If multiple citations are given, they should be separated by semicolons, and ordered by year. That is, the above references would be cited in the text as (Watson & Crick, 1953; Pauling, 1960; Monod et al., 1962; Smith & Borgeat, 1985). If one discusses a specific study within the text, include only the year in parentheses; for example, "Monod et al. (1962) showed that..."

g. Costs. All costs related to photocopying and binding of the paper are the responsibility of the student.

B. Master's with a Research Thesis.

This option is only available on an individual basis upon approval by an MCBB faculty member, who agrees to serve as the research advisor.

1. Course Work. As stated above, students must complete 32 credits, 24 of which are fulfilled by the Required Core Courses. Prior course work that might be equivalent to the Required Core Courses may be petitioned to the MCBB Program Committee which may either waive the required course or accept the course for credit. Students who are seeking this type of Master's degree *may not* take BI 701/702 for credit toward graduation. For the remaining eight credits, students select from the menu of Elective Courses listed above on pages 8-9 or enroll for research credits under their advisor (MB 907/908). Typically, students complete the Required Core Courses in their first year.

2. Research Thesis. The student must write a thesis detailing the original research that was conducted under the sponsoring faculty member. This thesis generally includes the following sections: Title Page, Approval Signature Page, Table of Contents, Abstract, Introduction, Materials & Methods, Results, Discussion, References and figures and/or tables from that research. The M.A. thesis must meet

the format specifications of the Graduate School (handout available at the GRS office) as well as those of the MCBB Program (see pp. 18-20 on Preparation of a Ph.D. Thesis for guidelines). This thesis must be read and approved by a committee of three faculty members that includes at least two faculty members from the MCBB Program; one committee member must be the faculty member who acted as the research advisor. The final reader-approved thesis must be submitted electronically to ETD Administrator for final approval by the Graduate School. In addition a final paper copy of the thesis must be given to all committee members, the Graduate Program Coordinator, and the student should keep a copy.

FINANCIAL ASSISTANCE

All MCBB Ph.D. students who are in good standing in the MCBB Program are eligible for financial aid. Students admitted to the program with financial aid can expect continuing support for at least five years, provided that satisfactory progress toward the Ph.D. degree is made (progress is evaluated by the student's Thesis Advisory Committee and is based on an Annual Report - see page 11). This aid includes Teaching Fellowships provided by the participating departments, Fellowships provided by the Graduate School, Research Assistantships provided by the participating MCBB faculty, Traineeships provided through Training grants, and Fellowships from outside agencies awarded to students on an individual basis. The MCBB Committee (see section on Administration, page 1), in consultation with the participating departments, faculty, and training programs, coordinates allocation of financial aid until a Ph.D. student is associated with a Ph.D. research advisor. Thereafter, the Ph.D. thesis advisor and his/her associated department has primary responsibility for providing financial aid. If all other options within the participating department and laboratory have been exhausted, the MCBB program director can be consulted regarding other possible financial options, although these are highly limited.

MCBB Master's students normally are not considered for financial aid (except for the Federal work-study program).

Ph.D. graduate students who are admitted to the MCBB Program at Boston University are typically supported the first year by Teaching or University Fellowships during the academic year and research grant support during the summer. The MCBB faculty consider teaching to be an important part of a student's training for the Ph.D. degree, and all Ph.D. students are required to have teaching experience before the degree is conferred (also see page 11). Generally, Ph.D. students who satisfactorily complete their course work, pass the qualifying examination, and become associated with a major advisor in MCBB, receive Research Assistantships from their second or third year onward. The details of each award are given below:

Dean's Fellowships (DFs): There are a limited number of these fellowships available, which are honorary and do not require teaching during the period of the award. These awards provide a stipend plus full tuition and fees for either 4 or 8 months. Additional summer stipend support is guaranteed to all such students following the first year, provided that the student is in good standing.

Teaching Fellowships (TF): These provide a stipend plus full tuition and fees for up to two courses per semester. Teaching responsibilities usually require approximately 20-25 hours per week. Full or partial awards may be given. Additional summer stipend support is

guaranteed to all students receiving a TF in the first year, provided that the student is in good standing.

Research Assistantships (RA): These awards are given to students who assist individual faculty with specific areas of research and are funded by faculty research grants. There are a substantial number of graduate student research positions in the MCBB Program, which are funded through faculty research grants. These Research Assistantships generally provide the stipend, with full tuition being supplemented by the university. The supervising faculty member determines the specific duties of the Research Assistant. Consult your faculty advisor.

Training Grants: Opportunities for support through this avenue exist. Consult your faculty advisor.

Work Study Aid: All eligible graduate students may apply for summer and academic year awards. Applications may be obtained from the Graduate School. Students receiving work-study aid are expected to provide service to the Department (teaching) or in the laboratory of their Major professor (research). Masters candidates are eligible for these awards as well as Ph.D. students.

National Science Foundation (NSF) Graduate Fellowships: First-year (and second-year) graduate students apply for these prestigious three-year fellowships. NSF Fellowship applications are due in November of each year. For applications and instructions go to: http://www.nsf.gov/funding/education.jsp?fund_type=2

George R. Bernard, Jr. Graduate Travel Grants: Travel Grants from the Biology Department are available to assist students in their travel to professional scientific meetings. Only students presenting papers or posters are eligible to receive consideration. Students must have passed their Ph.D. Qualifying exam to be eligible for travel funds. Further questions may be directed to the Biology Department Graduate Committee.

Other sources: Students see their faculty advisors for information on other potential sources of financial support. Please consult with the Director of MCBB prior to applying for other sources of financial aid so you can avoid pitfalls common with various sources.

Web Resources: All web links can be found at: <http://people.bu.edu/BGSA/funding.html>

Fellowships (partial list):

Sigma Xi

<http://www.sigmaxi.org/>

The Leopold Schepp Foundation

<http://www.scheppfoundation.org/>

Dr. Nancy Foster Scholarship

<http://fosterscholars.noaa.gov/>

American Association of University Women

http://www.aauw.org/fga/fellowships_grants/index.cfm

Explorer's Club

http://www.explorers.org/index.php/expeditions/funding/expedition_grants

Switzer Foundation Fellowship

<http://www.switzernetwork.org/>

NSF Graduate Research Fellowship

<https://www.fastlane.nsf.gov/grfp/>

NIH Pre-doctoral Research Fellowship
<http://grants.nih.gov/training/nrsa.htm>

Graduate Women in Science
<http://gwis.org/programs.html#travel>

NSF Doctoral Dissertation Improvement Grant
<http://nsf.gov/>

EPA GRO / EPA STAR
<http://epa.gov/ncer/fellow/>

Josephine de Karma Fellowship Trust
<http://www.dekarman.org/>

Lewis and Clark Fund for Exploration and Field Research
<http://www.amphilsoc.org/grants>

National Defense Science and Engineering Graduate Fellowship
<http://www.asee.org/ndseg/>

ESAF Graduate Study Fellowship
<http://www.esaintl.com/esaf/graduatestudy.html>

BU Graduate Research Abroad Fellowship
<http://www.bu.edu/cas/admissions/graduate/aid/fellowships/graf/>

NOAA Graduate Fellowship
http://www.csc.noaa.gov/cms/fellows/grad_opportunities.html

SICB Fellowship
<http://www.sicb.org/awards.php3>

StraightForward Media Dale E. Fridell Scholarship
<http://www.straightforwardmedia.com/fridell/index.php>

AIBS Diversity Scholars Program
http://www.aibs.org/diversity/diversity_scholars_program.html

National Geographic Young Explorers Grant
<http://www.nationalgeographic.com/yeg/>

NSF East Asian and Pacific Summer Institute for US Graduates Fellowship
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5284

The Boehringer Ingelheim Fonds PhD fellowships (max. age: 27 years)
<http://www.bifonds.de/fellowships-grants/phd-fellowships.html>

California Policy Fellowships
fellows.ccst.us

The American Society for Biochemistry and Molecular Biology
<http://www.asbmb.org/advocacy/Advocacy.aspx?id=14744>

Fellowship Search Data Base:

Michigan State University
<http://www.lib.msu.edu/harris23/grants/index.htm>

Cornell
<http://www.gradschool.cornell.edu/?p=132>

Community of Science
<http://fundingopps2.cos.com/>

Fastweb Grant Search
<http://www.fastweb.com/>

Science

<http://sciencecareers.sciencemag.org>

Stanford

http://www.stanford.edu/group/HMSGSO/funding_database_2005.htm

The National Academies

http://www7.nationalacademies.org/fellowships/Other_Sources_of_Funding.html

FACILITIES

All Charles River Campus Buildings are Non-Smoking!

Biology Research Building (BRB), 5 Cummington Mall

This building houses the Biology Department and MCBB Administrative offices, Biology Department research laboratories, and offices of Biology faculty. It also houses common facilities, including Stable Isotope Laboratory, Biology Department Workshop, a MCBB and Biology graduate student/faculty lounge, seminar rooms, and several classrooms.

Biology Science Center (BSC), 2 Cummington Mall

This building houses research laboratories and offices for Biology faculty and graduate students.

Engineering Research Building (ERB), 44 Cummington Mall

This building houses the offices and laboratories of several Biomedical Engineering faculty. The building also houses common facilities including seminar rooms, instrument rooms and environmental rooms. The Biomedical Data-Acquisition Lab supports the data acquisition and measurement activities of several courses. The Cell and Biomolecular Mechanics Instructional Laboratory's focus is on methods for study and manipulation of biomolecules and structural components of cells.

Life Science and Engineering Building (LSE), 24 Cummington Mall

This 10-story building has 200,000 sq. ft. of space and houses 23 of the MCBB faculty and their labs in the Departments of Biology, Chemistry, and Biomedical Engineering. The building was designed to encourage interdisciplinary interactions. Laboratories in this building include darkrooms, autoclaves, dishwashing facilities, cold rooms, and a variety of shared equipment: ultracentrifuges, shakers, scintillation counters, and imaging equipment. There are additionally major Core Facilities: **Genomic and Proteomic Facilities** in Biology with DNA array facility, automated 2-D gel system, molecular imagers, a spot picker, and mass spectrometers (MS) with nanospray capabilities. The Chemistry Department has multiple MS for proteomic applications, the matrix-assisted laser desorption ionization (MALDI)-Mass spectrometer, and two ion-trap electrospray ionization mass spectrometers (ESI-MS). **The Center for Chemical Methodology and Library Development** (CMLD) is devoted to the exploration and expansion of the diversity of small-molecule libraries by creating general, useful protocols for stereo-controlled synthesis. The Center is equipped with instrumentation for parallel organic synthesis and microarrays. A **Microscope Facility** has an imaging facility with four confocal microscopes, an electron microscope, a flow cytometer and a DNA microarray scanner. **Molecular Imaging Facility** has phosphorimagers, a fluorimager, and a Media Center for printmaking and poster printing.

Metcalf Center for Science and Engineering (SCI), 590 Commonwealth Avenue

The Metcalf Center houses the Chemistry Department, as well as portions of the Physics and Biology Departments. The Chemistry Department (main office: Room 299) occupies the east wing of the complex, and is equipped with instrumentation for studying the structure of proteins and other macromolecules, including 400- and 500-MHz NMR, circular dichroism and mass spectrometers, and facilities for protein sequencing and peptide synthesis. Within the west wing are the administrative offices (room 255), teaching laboratories, and biophysics research laboratories of the Physics Department; the teaching laboratories for Introductory Biology (third floor) and for upper division Biology courses (fourth floor); and the lower division Chemistry course laboratories.

Physics Research Building (PRB), 3 Cummington Mall

This building houses the research laboratories and offices of Physics Department faculty. It also houses common facilities, including the Physics Department Electronics Facility, Super-computer Facility, and several classrooms.

Sargent College of Allied Health & Rehabilitative Sciences (SAR), 635 Commonwealth Avenue

This building houses the laboratories of the MCBB faculty in the Health Sciences Department. The labs are located on the fourth floor and the departmental office is in Room 433. There is a graduate student lounge in Room 305 and an instructional resource center in room 235.

Science and Engineering Library, 38 Cummington Mall

This library contains most of the University's holdings in Science and Engineering. More general holdings are located in the Mugar Library (771 Commonwealth Avenue). On-line catalogue access is available at both libraries, as well as via any departmental computer terminal. The Charles River Campus is within a 20-minute walk of the MIT library and Countway Library at the Harvard Medical School. The Boston University Medical School Library located on Albany Street is also available.

Common Facilities

All persons using MCBB Program facilities must arrange for their use through the staff or faculty member responsible for the facility and should use the resources in the department in which the student's advisor is housed. Persons wanting access to these facilities must contact the responsible staff member and must familiarize themselves with the regulations governing instrument use and maintenance.

	Contact(E-Mail/phone)
Biology Computer Terminals (BRB Main Office)	CAS IT (cashelp@bu.edu)
Biology Stockroom (LSE 107)	Tom Symancyk (symancyk@bu.edu /2467)
Biology Van (LSE 107)	Tom Symancyk (symancyk@bu.edu /2467)
Biology Workshop (BRB B19)	Jonathan Perry (perry@bu.edu /2142)
Chemistry Instrumentation Center (SCI B)	Norman Lee (ncylee@chem.bu.edu /4818)
Chemistry Stockroom (SCI 262)	Mike Gooley (gooley@chem.bu.edu /2082)
Confocal Imaging Facility (LSE 448)	Todd Blute (blute@bu.edu /2638)

DNA Chip Reader Facility (LSE 444)
Electron Microscope Facility (LSE 449)
Proteomics Facility (LSE 448)
Laboratory Animal Care Facility
Mass Spectrometer Facility (SCI B87A)
Molecular Modeling Facility (SCI 501)
NMR Facility (SCI B87)
Photomicroscope Facility (SAR433)
Real time Quantitative PCR (LSE 632)
Scientific Instrument Facility (PRB, B09)
Stable Isotope Laboratory (BRB 440)
Super-computing Facility Coordinator (111 Cummington)

Todd Blute (blute@bu.edu / 2638)
Todd Blute (blute@bu.edu / 2638)
Todd Blute (blute@bu.edu / 2638)
lasc@bu.edu / 5415
Michael Creech (creech@bu.edu / 5678)
John Straub (straub@chem.bu.edu / 6816)
Norman Lee (ncylee@chem.bu.edu / 4818)
Helen Barbas (barbas@bu.edu / 5036)
Todd Blute (blute@bu.edu / 2638)
Leo Dumais (dumais@buphyc.bu.edu / 5056)
Robert Michener (michener@bio / 6980)
Glenn Bresnehan (glenn@bu.edu / 1319)

POLICIES AND PROCEDURES

Patents & Research Materials

All Ph.D. and M.A. students should be aware that Boston University serves as the guardian of research conducted at Boston University, including research supported by all government agencies and most private foundations. This has several implications.

1. Patents that arise from research conducted at Boston University are the property of Boston University, as outlined in the Faculty Handbook.
2. Students are required to leave all original data and notebooks at Boston University upon completion of their studies. Students may take photocopies of their original research data and notes.

Both Ph.D. and M.A. students performing research must fill out a patent policy form available from the Graduate Program Coordinator.

MCBB Program Sexual Harassment Guidelines

The MCBB Program expects that the learning and work environment to be free of sexual harassment, including unprofessional conduct in faculty-student relationships and sexism in the classroom. Sexual harassment is an abuse of authority. Such behavior is unacceptable, and serves as a barrier to the educational, scholarly, and research goals of the University. The MCBB faculty has adopted the following guidelines:

1. Professors, teaching fellows, or undergraduate assistants may not date a student in their class, laboratory section, or discussion section until the final grade has been given. A teaching fellow already dating a student in his/her sections cannot be responsible for the grade of the student.
2. Professors should avoid dating members of their laboratory (i.e., graduate students, technicians, or postdoctoral fellows). If such a relationship exists, the member of the lab should consider and/or be advised to change labs. If the person remains in the lab, the professor must excuse him or herself as an official member of all evaluating committees (e.g., qualifying and defense committees) for the student, and can only serve as an *ad hoc* non-voting member of the committees. Remember that although both parties may initially consent to this relationship, it is only the professor, by virtue of his/her special responsibility, who is held accountable for unprofessional behavior.
3. A professor dating a graduate student from another laboratory must excuse him or herself from all evaluating committees (e.g., qualifying and defense committees) for the student.
4. Faculty and students should be discouraged from touching a student, technician, or postdoctoral fellow except with the universally accepted handshake. Hugs, kisses, high-fives, or slaps on different regions of the body may be acceptable in American culture, but may be interpreted in unintended ways by students of other cultures.
5. When a faculty member is meeting alone with a student, the door should be kept open if possible.
6. Faculty should not invite a student to his or her home when the faculty member and the student would be alone. More than one member of the class should be included in all social occasions.

7. Inappropriate sexual comments in classrooms, laboratory sessions, or discussion sessions are not acceptable. Inappropriate messages may be subtle and even unintentional, but nevertheless these comments compromise the learning experience of the students.
8. When hanging material on doors or walls, everyone must be sensitive to other people's feelings. Remember, sexual harassment is a form of sex discrimination that is illegal under the Civil Rights Act.

Students, fellows, or faculty who think that they are being sexually harassed are encouraged to speak with Dr. Edward Loechler, Chairperson of the *Ad hoc* Sexual Harassment Committee (LSE 703; 3-9259).

Emergencies & First Aid

In case of emergencies in building services for BRB, BSC, or SCI (heat, electricity, water, refrigeration, air-conditioning, etc.), call Tom Symancyk, Materials/Facilities Administrator, at 3-2467. For LSE, please contact the building supervisor, Dennis Batista, at 8-4282. For Biomedical Engineering labs please contact Phil Allen at 8-3814. For Chemistry labs, please contact Paul Ferrari at 8-2851. For Health Sciences labs, please contact Lisa Tornatore at 3-2705. The Building & Grounds off-hour emergency number is 3-2105.

In case of emergencies posing threat to health or safety (chemical spills, etc.), contact the Director of Life Safety, at 3-9734.

For immediate assistance or to report an accident, fire, or medical emergency dial 3-2121 (Campus Police). A police officer will be sent to evaluate the situation and to determine what action should be taken. Later you should contact the Graduate Program Coordinator to file the required Accident Report Form.

Building Hours and Security

Main doors to 2 & 5 Cummington and the Metcalf Science Center (590 Commonwealth Ave.) are unlocked from 7:00 a.m. to 6:00 p.m. (or 9 p.m. when classes are in session) Monday through Friday. The main doors of the Life Science and Engineering Building at 24 Cummington are open from 6:00 a.m. until 7:00 p.m. Off hours require BU ID access/clearance. The 2nd through 6th floors are locked 24 hours a day, seven days a week, BU ID access/clearance is needed for these floors.

For access to Biomedical Engineering at 64 Cummington Mall off-hours, please see the Biomedical Engineering Graduate Program Administrator at 3-7609.

Admittance to these buildings, when appropriate for their research and teaching, is possible 24 hours a day (including weekends) for MCBB graduate students. See the MCBB Graduate Program Coordinator for information.

It is important to remember that Boston University is located in a large urban area. Thefts do occur. Please make certain that doors are kept locked and valuables are secured. In case of an emergency call the BU Police at 3-2121.

Computers

The University has a multi-user UNIX computer called ACS (Academic Computing System) that you can access to read email, word processing, etc., by way of public terminals

or personal computers. Public terminals can be found throughout the campus. The largest terminal room is located on the first floor of the Mugar Library, 771 Commonwealth Avenue.

The College of Arts and Sciences offers a file server (casfsb.bu.edu) to all faculty, staff, and students to back up and share their data. To establish a folder on this server, go to <http://cashelp.bu.edu>, click on "File Servers" and follow the instructions.

Wireless on campus is available in most academic buildings, but signal strength can vary floor to floor, building to building. To join the BU wireless network, you will need to accept the certificate for the secured and encrypted 802.1x security protocol with your user login and kerberos password. For more information on how to join the wireless network, go to <http://www.bu.edu/tech/accounts/wireless/> or stop by one of the IT Help centers at Mugar Library, 771 Commonwealth Ave. or the main Help Center in Kenmore Square at 533 Commonwealth Ave. (next to the Barnes and Noble Bookstore).

Getting a Computer Account

ACS (Academic Computing System) is a shared cluster of UNIX systems, which can be used as your sole computing resource or in conjunction with personal or departmental computers. ACS provides access to e-mail, the Web, statistical and scientific software packages, programming languages, text processing software, and much more. All graduate students, faculty and staff at the University are eligible for an account on ACS.

Incoming first-year students should have already received an "early-bird" login with instructions for activating your account. If you did not, then visit one of the two the IT Help Centers (see above) with your BU ID card to set up your account.

The buildings that have wireless (officially) are:

- Life Science and Engineering Building (LSE), 24 Cummington Mall
- Biological Research Building (BRB) 5 Cummington, 2nd and 4th floors
- Metcalf Science Center (SCI) 590 Commonwealth Ave
- Biological Sciences Center (BSC), 2 Cummington Mall
- Science Library Building (SLB) 30-38 Cummington Mall
- Engineering Research Building (ERB), 44 Cummington Mall
- Sargent College of Health and Rehabilitation Services (SAR) 635 Commonwealth Ave

For a map of wireless locations campus-wide, please see:
http://www.bu.edu/maps/?lat=42.34312489659957&lng=-71.10034525394441&zoom=15&wireless_box=on

Getting on the MCBB Email Aliases

Once you have an ACS account, you will automatically be added to the graduate student alias ("mccb-grad-list@bu.edu") for the MCBB Program. Please read all emails sent to this alias, as it has information pertaining specifically to your program and often action must be taken on the part of the student.

Common Facilities (for First-Year Students only):

Networked Laser Printers

<u>Name</u>	<u>Location</u>	<u>IP Address</u>	<u>Model</u>	<u>Administrator</u>
BIO1	LSE 301	128.197.37.59	HP4000	Building Facilities
BIO3	BRB 101	128.197.80.190	HP4050	Melissa Hamel

Memos and announcements are sent to you via electronic mail; you are responsible for any and all information sent via e-mail.

Keys

First-year MCBB graduate students are given desks in a common office. Keys to this room are distributed in BRB 101 by the Front Desk. A key request form must be filled out, signed by the appropriate faculty member (the MCBB Program Director for first-year students) and turned in. Check the number on the door lock/core. Such keys also open common space (copy room, terminal rooms, conference rooms, and faculty/graduate student lounge) and the outside door of 5 Cummington Mall. The Metcalf Science Center is accessed, after hours, via the door on Blandford Mall. Your BU I.D. can serve as a computerized card-swipe to open the front door to 2 Cummington Mall, the side door to the Metcalf Science Center, and LSE after hours. Please see the Graduate Program Coordinator in Biomedical Engineering for swipe card access to 64 Cummington after hours. See your major professor for gaining access.

The keys for all departments participating in MCBB can be obtained from the respective departmental administrators.

When you leave the University, you must turn in your keys.

Mail

MCBB graduate student mailboxes are located in the department in which their Major professor resides. First-year students will receive mail in the Biology Department.

Biology Department mailboxes are in the corridor outside BRB 101. They are set up alphabetically. The combinations and box number assignments can be obtained from Jenal Austin at the front desk, Biology Main Office.

Chemistry Department graduate students have individual mailboxes at the Chemistry Office (SCI 299).

Physics Department mailboxes are in the Departmental Office (SCI 201).

Biomedical Engineering Department mailboxes are in room 407, 44 Cummington Mall.

Health Sciences Department graduate student mailboxes are in the Departmental Office, Room 433.

The federal and interdepartmental mail is picked up from the respective mailrooms once a day by the Boston University Mail Services in most departments. The BU Mail Service sorts this mail into interdepartmental and U.S. Mail, so please use manila envelopes for interdepartmental mail and clearly mark as such. There are usually interdepartmental ink stamps in the mailroom for this purpose. If you must use a white envelope for interdepartmental mail it should be clearly marked or it will be sorted into the U.S. Mail and charged back to the Departments. It will also take a long time for this mail to arrive at its destination as it will be sent outside the University and then returned to go once again through the BU Mail Service. The mail service is only for Department and University business, and is not for personal mail. All mail must have a return address.

Telephones & FAX Machine

There is a telephone in the MCBB first-year graduate student office. After the first year, students have offices or desks within the faculty advisor's laboratory. You are expected to use that telephone unless your advisor has made other arrangements. You will need to check with your advisor as to his or her policy regarding use of laboratory phones. To make on-campus calls, first dial a 3 or 8 for offices, or a 2 for residences, followed by the last four digits of the phone number. To get an outside line for a local call you must dial '9' followed by the number you wish to reach. For toll-free 800-numbers, dial '9-1-800' and the number. For long-distance calls you must use a telephone code and must make arrangements with your advisor about using his or her telephone code to make these calls.

The Biology Department has FAX machines located in the main office (353-6340), and Room 307 at 2 Cummington Street (353-6041), which are available for first-year MCBB student use. FAX machines are available in other departments for work-related business only.

FAX Machines are quite simple to use; nevertheless, ask for assistance if you need any help. Since FAX machines operate over telephone wires, all charges associated with its use appear on a phone statement. The Biology Department covers the cost of all local Faxes. All long-distance Faxes must be charged to your professor's telephone code. As with long-distance telephone calls, you must make arrangements with your advisor to send long-distance faxes. Your incoming FAX messages are placed in your mailbox. You should have your faxes sent to your resident department FAX machine.

Photocopying

Each individual Department pays for photocopying needed for a course being taught by that Department, usually on that Department's photocopy machine. If the photocopying pertains to a grant, you should charge the grant. Students teaching a course will be given a copying code for the class they are teaching. Students must pay for any other copying.

There are two copying machines within the Biology Department that are available for MCBB student use. In 5 Cummington Mall there is a large, fast, high-resolution copier in Room 101C. This room can be accessed from the corridor at any time; the key that opens all common Biology Department space (KM-keys) also opens this room. This copier requires a copy-code, which can be purchased (see below). There is an ImageRunner 3500 copier located in Room 601 of the Life Science and Engineering Building at 24 Cummington Mall. For copying through the Chemistry Department the copier facilities are available in the Chemistry office (SCI 299). Students receive a copier access code from their research advisor. For use of machines in Biomedical Engineering, please see Rene Smith, the Academic Programs coordinator for Biomedical Engineering at 3-7609.

If you plan on using the Canon Machine in the Biology Department, it is recommended that you purchase a "copy-code". Payment may be in cash, but checks are preferred. Codes may be purchased in counts of 500 (\$30) or 1000 (\$60). Codes may be obtained between 9:00-5:00 Monday through Friday. If you wish to purchase a code please ask at the Front Desk, BRB 101.

Please keep in mind:

- large jobs should *not* be copied between the hours of 9 AM and 5 PM, Monday through Friday;

- faculty, staff, and copying related to teaching have priority at the copying machines;
- if you have questions about how to use either machine in the Biology Department please see the front desk in BRB 101.

Reimbursements & Travel

Reimbursements

Supplies, and other expenses incurred that are course or grant related, can be reimbursed if the proper procedures are followed. Reimbursements can be either cash or check depending upon the amount and the nature of the expense.

Petty Cash

A cash reimbursement can be made under the following conditions:

1. Supplies are needed the same day.
2. Supplies are not normally available through the Biology or Chemistry stockrooms.
3. An original receipt is given for each reimbursement.
4. The receipt is under \$15.00.

Policies

Petty cash is limited to two receipts per day for each account. Petty cash cannot be used for personal advances (IOU's) or entertainment purposes. University policy does not allow reimbursement for any sales tax paid.

If the expense incurred does not fit the above criteria, a reimbursement check may be issued. A reimbursement form must be filled out completely, otherwise there will be a delay in processing your check. It usually takes two to six weeks once the form is received for a check to be issued.

If the supplies have already been purchased and paid for, a check will be issued to you. If you have an invoice from the vendor, a check will be sent directly to the vendor. Only original receipts or invoices are accepted. Invoices must name Boston University and provide some detail of what goods and services were provided. Altered invoices or receipts cannot be processed.

Travel

A reimbursement form may also be used for travel advances and other travel-related expenses. In the Biology Department, see the Financial Administrator, Rich Rigolini, in BRB 101. In the Chemistry Department, see the Administrator, Charles Alongie in SCI 299. In the Physics Department, see the Business Manager, Rachel Meisel in SCI 201. In the Biomedical Engineering Department, see the Financial Administrator. In the Health Sciences Department, see the Departmental Administrator, Danka Charlind, in SAR 433.

Travel Advances

Advances cannot be issued more than two weeks prior to departure. If the requested advance exceeds \$1500, a detailed itinerary is required. Only one advance can be issued per trip. If registration or reservation fees must be paid in advance, request an Accounts Payable Request Voucher to make direct payment.

A travel advance will not be issued to the traveler for airline tickets. Requisitions are used for airfare advances and are paid directly to the travel agent. Advances cannot be issued for airfare from sources other than University travel agents. If you have received an award for travel and are not on the University's payroll system, the travel advance request must be accompanied by the award letter.

Clearing a Travel Advance and Travel Reports

A travel report must be submitted one week after the conclusion of a trip. Reports must have original receipts for all expenses. Copies of receipts are not accepted. Meal expenses must be reported per meal, per day. Registration and reservation fees paid directly to the vendor should not be included in the report.

A check or money order must accompany reports that result in a payment due to the University. Do not send cash. For example, if a travel advance was issued for \$500 and only \$300 was needed, a check must be made out to the University for the difference. Airfare advances paid directly to University travel agents must be included in the travel report. Airfare advances are considered to be the same as cash advances by the University. Passenger coupons (receipts), or unused tickets, must be submitted with a travel report.

The use of a personal car can only be reimbursed for the mileage at the University mileage reimbursement rate (currently 50 cents per mile). Receipts for gasoline purchase are accepted for car rentals or a University vehicle, but not for personal car use.